ASSESSMENT OF THE PERFORMANCE OF DETERMINISTIC DESIGN FLOOD ESTIMATION METHODS IN SOUTH AFRICA

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DECLARATION

I, the undersigned, declare that the dissertation hereby submitted by me for the degree *Master of Engineering (Civil Engineering)* at the Central University of Technology, Free State, is my own independent work and has not been submitted by me to another university and/or faculty in order to obtain a degree. I further cede copyright of this dissertation in favour of the Central University of Technology, Free State.

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ABSTRACT

A design flood may be defined as the peak discharge value that corresponds to an assigned non-exceedance probability, typically expressed in terms of a return period. The estimation of design floods focuses on the frequency analysis of peak flows and/or runoff volumes for the design of hydraulic structures and flood inundation delineation. Furthermore, realistic estimates are crucial to ensure an acceptable correlation between expected flood magnitudes and associated risk levels, not only to enable the planning and design of hydraulic structures, but more importantly, to preserve human life and infrastructure.

The primary aim of this research was to assess the performance of the event-based deterministic design flood estimation (DFE) methods currently used in South Africa in 396 gauged catchments scattered across South Africa. This assessment was intended to contribute to the development of best practice guidelines for the application of event-based deterministic DFE methods in South Africa, consistent with the objectives set out by the National Flood Studies Programme (NFSP). Recognising the practitioners' dilemma in selecting a single, justifiable event-based deterministic DFE method from the suite of DFE methods and alternative options available, the specific objectives of this research sought to establish a performance assessment and ranking system. This system was designed to guide practitioners in choosing the most appropriate event-based deterministic DFE method for application in specific primary drainage regions (PDRs) and return periods, thereby promoting the consistent adoption and application amongst engineering practitioners and hydrologists.

The methodology adopted to assess and compare the performance of the event-based deterministic and at-site probabilistic DFE methods was based on the core components of DFE, namely, input (observed and design rainfall), transfer functions (catchment characteristics), and output (runoff estimation). Event-based deterministic DFE was carried out using the Rational Method-Alternative 3 (RM3), Soil Conservation Services (SCS), Soil Conservation Services-South Africa (SCS-SA), Lag-routed Hydrograph (LRH) and Synthetic Unit Hydrograph (SUH) methods. Both the veld-type and time of concentration (T_C) approaches associated

with the LRH method were considered in this study. Apart from the SCS and SCS-SA methods, all other DFE methods incorporated the use of the areal reduction factor (ARF) estimation methods recommended for South Africa as developed by Alexander (2001) and Pietersen (2023), and designated as ARF (A) and ARF (P), respectively. The standard application procedures associated with each DFE method were followed by employing relevant software tools and acknowledging the relevant assumptions, limitations, and intended applications of each DFE method. Results from these methods were consolidated to facilitate the comparison of the deterministic (Q_{Ti}) flood peaks against the benchmark probabilistic (Q_{Pi}) flood peaks. The performance assessment was based on a ranking procedure to assess the relative accuracy and biases of each event-based deterministic DFE method across the 396 gauged catchments using an array of goodness-of-fit (GOF) criteria. The DFE method with the lowest composite ranking value was considered as the best performer. Additionally, graphical tools such as box plots and scatter plots were used to visualise discrepancies and identify areas for improvement. The combination of statistical rankings and visual assessments enabled a comprehensive evaluation of the various DFE methods.

Overall, when considering the different ranking and grouping procedures adopted, it was evident that the SCS and SCS-SA methods consistently emerged as the most reliable and robust event-based deterministic DFE methods across all catchments and return periods within the 20 PDRs distributed across South Africa. In contrast, the LRH-Veld-ARF (P) method was regarded as the least reliable. Both the LRH-T_C-ARF (A) and LRH-T_C-ARF (P) methods also demonstrated a consistent performance, frequently ranking amongst the top methods, while the SUH-ARF (A), SUH-ARF (P), LRH-Veld-ARF (A), and LRH-Veld-ARF (P) methods generally performed less satisfactorily. The RM demonstrated moderate performance, with RM3-ARF (P) often ranking better than RM3-ARF (A). However, both these methods demonstrated higher uncertainty at lower return periods.

Ultimately, the selection of hydrological input parameters and methods, along with the application of various DFE methods, can lead to significantly different estimates. This variability arises from factors such as differences in data quality and sources, uncertainties in input parameter values, variations in spatial and temporal resolution, distinct calibration and validation procedures, as well as methodological frameworks inherent to each DFE method. A comparison between literature, the results obtained in this study, and results from other studies revealed several key factors that may contribute to the observed discrepancies, including: (i) the deterioration of the current rainfall monitoring and flow-gauging networks, (ii) overall quality of rainfall, streamflow, and catchment parameter data sets, (iii) characteristics of the annual maximum series (AMS) data sets, particularly record lengths and outlier handling methods, (iv) selection of plotting positions and theoretical probability distributions, and (v) GOF criteria and employed ranking procedure(s).

The above-listed factors underscore the need for rigorous assessments and standardisation in DFE, all of which were achieved in this research at a national scale. Subsequently, the spatial and qualitative performance rankings of the event-based deterministic DFE methods across all PDRs and return periods can be incorporated for the development of a best practice guideline framework for DFE in South Africa.

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LIST OF ABBREVIATIONS

ACRU	Agricultural Catchments Research Unit
AEP	Annual exceedance probability
AIC	Akaike information criterion
AMS	Annual maximum series
ARC	Agricultural Research Council
ARF	Areal reduction factor
ARF (A)	Areal reduction factor (Alexander, 2001)
ARF (P)	Areal reduction factor (Pietersen, 2023)
CALC	Computer automated land cover
CAPA	Catchment parameter
CCKP	Climate Change Knowledge Portal
CN	Curve number
CSM	Continuous simulation model
CSIR	Council for Scientific and Industrial Research
DFE	Design flood estimation
DEA	Department of Environmental Affairs
DFET	Design flood estimation tool
DFFE	Department Forestry, Fisheries and the Environment
DRE	Design rainfall estimation
DRH	Direct runoff hydrograph
DWAF	Department of Water Affairs and Forestry
DWS	Department of Water and Sanitation
E/O	Estimated/Observed
FFA	Flood frequency analysis
GEV	Generalised extreme value
GIS	Geographical information system
GOF	Goodness-of-fit
GPA	Generalised Pareto
GTI	GeoTerraImage
GUI	Graphical user interface
HRU	Hydrological Research Unit
IPZA	Improved probability-model, South Africa
IQR	Interquartile range
JAM	Joint association method
JPA	Joint-probability approach
K-S	Kolmogorov-Smirnov
LC	Land cover
LM	Linear moments
LN	Log-Normal

LP3	Log-Pearson Type 3
LRH	Lag-routed Hydrograph
MAE	Mean absolute error
MARE	Mean absolute relative error
MAP	Mean annual precipitation
MCM	Median condition method
MIPI	Midgley and Pitman
MLE	Maximum likelihood estimation
MLS	Method of least squares
MM	Method of moments
MRE	Mean relative error
NASA	National Aeronautics and Space Administration
NASA-JPL	NASA - Jet Propulsion Laboratory
NFSP	National Flood Studies Programme
NLC	National Land Cover
NSE	Nash-Sutcliffe efficiency
PDF	Probability density function
PDR	Primary drainage region
PDS	Partial duration series
PP	Plotting position
POT	Peak over threshold
PWM	Probability-weighted moments
QDR	Quaternary drainage region
QGIS	Quantum geographic information system
RE	Relative error
RLMA-SAWS	Regional Linear Moment Algorithm – South African Weather Services
RLMA&SI	Regional Linear Moment Algorithm and Scale Invariance
RM	Rational Method
RM1	Rational Method Alternative 1
RM2	Rational Method Alternative 2
RM3	Rational Method Alternative 3
RMSE	Root mean square error
SABS	South African Bureau of Standards
SANLC	South African National Land Cover
SANRAL	South African National Roads Agency Limited
SANS	South African National Standards
SASA	South African Sugar Association
SAWB	South African Weather Bureau
SAWS	South African Weather Services
SBC	Schwarz Bayesian information criterion

SCS	Soil Conservation Service
SCS HSG	Soil Conservation Service Hydrological Soil Groups
SCS-SA	Soil Conservation Service – South Africa
SCWG	Soil Classification Working Group
SDR	Secondary drainage region
SE	Standard error of estimate
SDF	Standard design flood
SRTM	Shuttle Radar Topography Mission
SUH	Synthetic Unit Hydrograph
UH	Unit hydrograph
USA	United States of America
USACE	United States Army Corps of Engineers
USBR	United States Bureau of Reclamation
USDA	United States Department of Agriculture
WMA	Water Management Area

1. INTRODUCTION

This chapter provides some background on the estimation of design floods using event-based deterministic and probabilistic methods in South Africa. The problem statement, research objectives, and dissertation outline are also included in this chapter.

1.1 Background

A design flood may be defined as the peak discharge value that corresponds to an assigned non-exceedance probability, typically expressed in terms of a return period, which indicates the likelihood that a flood of a given magnitude will not be exceeded in any given year (*T*) (Di Baldassarre *et al.,* 2008). The estimation of design floods focuses on the frequency analysis of peak flows and/or runoff volumes for the design of hydraulic structures and flood inundation delineation. In other words, design flood estimation (DFE) is the first step in the design process of hydraulic infrastructure such as dam spillways, bridges, canals, and culverts (Pilgrim and Cordery, 1993). Moreover, realistic DFE is crucial to ensure an acceptable correlation between expected flood magnitudes and associated risk levels, not only to enable the planning and design of hydraulic structures, but more importantly, to preserve human life and infrastructure (Pegram and Parak, 2004; Smithers, 2012; Gericke, 2021).

Infrastructure which failed in South Africa because of flooding can mainly be attributed to the magnitude of a flood event. These flood magnitudes vary significantly due to the diverse responses of catchments to storm rainfall and the inherently variable nature of storm events. Therefore, it is expected that flood estimations for the purposes of engineering design will most probably display wide confidence bands of uncertainty pertaining to all estimates of the flood magnitude to flood frequency relationships, in combination with steep flood magnitude increases associated with increases in event return periods (Alexander, 2002; 2003). Consequently, the reliable estimation of flood frequencies in terms of peak flows and volumes remain challenging to practitioners (Cameron *et al*., 1999). The latter challenge is also supported by the statement made by Cordery and Pilgrim

(2000: 185–197): *'The demands for improved DFE have not been met with any increased understanding of the fundamental hydrological processes……..'*

Typically, statistical (probabilistic), deterministic, empirical, and probable maximum flood estimation methods are used for DFE (England, 2015). The University of the Witwatersrand Hydrological Research Unit (HRU, 1972) argued that DFE may be based on either a statistical or deterministic approach, where the statistical approach (often referred to as a 'probabilistic approach') employs accessible data and experience, while the deterministic approaches translate design or recorded rainfall events into runoff. Smithers and Schulze (2002) generally categorised these DFE procedures as methods based on the study of observed floods and the study of rainfall-based methods and classified DFE methods used in South Africa as shown in Figure 1.1.

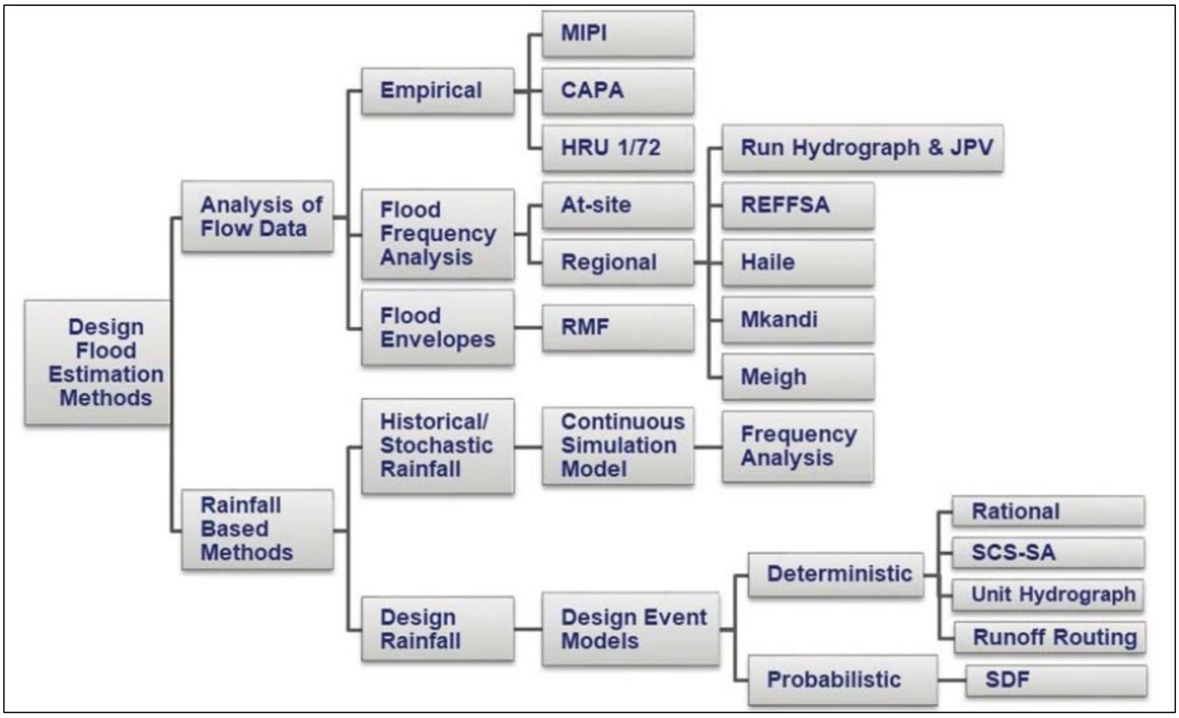


Figure 1.1: DFE methods used in South Africa (after Smithers and Schulze, 2002; after Smithers, 2012; Brooker *et al.,* 2023)

When considering the categorisation of DFE methods in South Africa, as presented in Figure 1.1, a survey by Van Vuuren *et al.* (2013) reported that 67% of practitioners predominantly use deterministic DFE methods, 17% apply statistical approaches, and 16% use empirical DFE methods.

1.2 Problem Statement

Internationally, the occurrence and frequency of floods, along with the uncertainty involved in their estimation, contribute to the practitioners' dilemma to make a single, justifiable decision when various DFE methods are used (Gericke, 2021). Despite the collection and availability of a vast amount of meteorological and hydrological data in South Africa, as well as elsewhere in the world, there is still no universally applicable method for DFE (Van der Spuy and Rademeyer, 2021).

South African DFE methods developed in the late 1960s and early 1970s need updating, with more than 50 years of additional data and new international approaches to be considered (Smithers *et al.*, 2014). Smithers (2012) recommended that new and up-to-date DFE methods are essential to: (i) learn from current and new international practices, (ii) improve design flood estimates based on longer periods of record, (iii) improve on the information currently available, and (iv) account for the influences of climate change on DFE. The revision of existing methods and if required, the development of new approaches for DFE in South Africa, were highlighted by Alexander (2002), Smithers and Schulze (2003), Görgens (2007), Smithers (2012), Gericke and Du Plessis (2013), Van Vuuren *et al.* (2013), and Gericke (2021). Additionally, all the recent DFE studies conducted in South Africa in an attempt to assess, update or improve the current methods, *e.g.*, studies by Alexander (2002), Görgens (2007), Gericke and Du Plessis (2012), Calitz and Smithers (2020), and others, were only applied at a local or regional level; hence, no assessments were conducted at a national level.

One of the most significant aspects when considering DFE is the need for consistency when the different methods are utilised by practitioners, *i.e.,* the requirement for similar results from practitioners when applying the same estimation method (Smithers and Schulze, 2002). Alexander (2003) also advocated for consistency in the application of DFE methods by different users. Smithers (2012) reiterated the same rationale in echoing that different practitioners ought to obtain similar results when applying similar DFE methods. The National Flood

Studies Programme (NFSP) (Smithers *et al.,* 2014) initiated research to improve existing, and develop reliable and consistent DFE methods in South Africa.

Van der Spuy and Rademeyer (2021) argued that different DFE methods will render different outcomes. Moreover, no single DFE method can be presumed to be more effective than any other method, resulting in the user's dependency on their own experience and knowledge to decide on the best DFE method in a particular situation. According to Görgens (1997), the practitioner must continuously strive to attain meaningful hydrological results through balancing the demand for extensive scientific analysis in recognition of the rainfall-runoff variability and the demand for sufficient and optimal DFE analysis methods that are accurate, data optimal, and consistent.

However, many practitioners currently active in South African flood hydrology are relatively inexperienced as revealed by the survey conducted by Van Vuuren *et al.* (2013). The survey highlighted that only 17% of the respondents had more than 20 years of experience and 46% of the respondents had less than five years of experience. A total of 66% of the respondents had less than 10 years of design flood experience, with the retirement of well-experienced hydrological practitioners contributing to a troublesome industry gap. Furthermore, there are also no national DFE guidelines available to practitioners in South Africa that guide and suggest the best practice method(s) relevant to different circumstances and locations in South Africa, while the expected accuracies and uncertainties when applying these methods are also unknown (Campbell *et al.,* 1986; Ward *et al.,* 1989; Gericke, 2021).

Considering the above discussion, the need to assess the performance of the current deterministic DFE methods used in South Africa is evident and the need for further investigations justified.

1.3 Purpose of the Study

The overall purpose is to contribute to the development of best practice guidelines relevant to the application of deterministic DFE methods in South Africa, as envisaged by the NFSP (Smithers *et al.,* 2014). Hence, guidance towards the refinement and/or updating of the deterministic DFE methods in South Africa is also envisaged. Given the practitioners' dilemma in selecting between various deterministic DFE methods (Gericke, 2021), the development of national practitioners' guidelines recommending appropriate deterministic DFE methods would promote consistency among engineering practitioners and hydrologists in South Africa.

1.3.1 Research aims and specific objectives

The primary research aim is to assess the performance of event-based deterministic DFE methods used in South Africa on a national scale. These methods include the Rational method (RM; Alternatives 1 – 3), Soil Conservation Service (SCS & SCS-SA), Synthetic Unit Hydrograph (SUH), and Lag-routed Hydrograph (LRH) methods. It is envisaged that the suggested ranking-based selection procedure and assessment of performance results will assist practitioners to apply best practices, *i.e.*, to develop guidelines on method selection for use by practitioners in different regions and/or under circumstances. The performance results will also provide practitioners with an idea of the accuracy of the various deterministic DFE methods. Furthermore, it would ensure that an acceptable correlation between expected flood magnitudes and associated risk levels can be established, particularly as the protection of human life and infrastructure remains of primary concern in flood risk management.

To achieve the research aim, the specific objectives are to:

(a) Assess the performance of deterministic DFE methods at a national level in South Africa. The deterministic DFE results will be compared to the at-site statistical (probabilistic) flood frequency analysis (FFA) in each catchment under consideration by considering a large set of quantitative goodness-of-fit (GOF) criteria.

(b) Develop a ranking-based selection procedure based on the GOF criteria in (a) to select the best performing event-based deterministic DFE method associated with different locations and climatological conditions in South Africa. Consequently, each deterministic DFE method will be ranked against the different assessment criteria and summed to provide the overall performance ranking at a national level.

(c) Contribute towards the development of best practice guidelines (as envisaged by the NFSP) for practitioners by providing guidance towards the refinement and/or updating of existing deterministic DFE methods.

(d) Compare the performance results (based on the steps followed in [c]) to establish an overall ranking of deterministic DFE methods in South Africa, taking cognisance of spatial trends in the recommendations for the best-performing methods.

1.3.2 Assumptions

This study is based on the following assumptions:

(a) Floods are the complex result of interactions amongst hydrological and meteorological processes; hence, no quantifiable upper limit related to the magnitude of a flood can be specified. This subsequently highlights the uncertainty involved.

(b) When utilising deterministic DFE methods, all complex and heterogeneous catchment processes are lumped into a single process to enable the estimation of individual design flood events in a simplistic and robust manner.

(c) The fundamental premise in deterministic methods of joint probability is that the return period of a rainfall event (1:T-year) will result in a corresponding return period of the flood event (1:T-year), provided the catchment remains in its average state.

(d) Practitioners in South Africa tend to use familiar and simplified DFE methods, with deterministic approaches, particularly the RM, being among the most commonly applied (Van Vuuren *et al*., 2013; Brooker *et al*., 2023).

1.4 Outline of Dissertation Structure

This dissertation describes the assessment of event-based deterministic DFE methods at a national level in South Africa.

Chapter 2 includes a review of event-based deterministic and probabilistic DFE methods in South Africa. Factors influencing DFE, the assumptions, limitations, and description of DFE methods, and GOF criteria to assess the performance of DFE methods are discussed. The chapter concludes with a summary focusing on the performance of event-based deterministic DFE methods applied to date in South Africa.

Chapter 3 provides an overview of the study area inclusive of the location, climate, rainfall, hydrological and meteorological monitoring network infrastructure, drainage network, soils, generalised veld types, and land cover.

Chapter 4 outlines the methodological framework adopted to assess the performance of event-based deterministic and probabilistic methods within the South African context. Building upon the comprehensive literature review presented in Chapter 2, this chapter also details the specific methods and data preparation processes undertaken.

Chapter 5 presents the results, including the data interpretation and discussions.

Chapter 6 presents the conclusions and recommendations.

Chapter 7 contains a detailed reference list.

2. LITERATURE REVIEW

This chapter provides a comprehensive review of DFE in South Africa, incorporating both event-based deterministic and probabilistic methods. Factors influencing DFE, the assumptions, limitations, and description of DFE methods, and GOF criteria to assess the performance of such methods are discussed. The chapter concludes with a summary of key findings, focusing on the performance of event-based deterministic DFE methods applied to date in South Africa.

2.1 Introduction

Runoff following storm rainfall events is influenced by a combination of catchment and climatological characteristics. Floods occur when rainfall-induced runoff accumulates in catchment areas, eventually draining as streamflow towards a single outlet point, resulting in water levels that exceed the normal channel capacity. In this process, storm rainfall acts as the primary input. The catchment characteristics define the nature of the transfer function, since storm rainfall losses occur as the catchment experiences a change in storage while it absorbs (infiltration), retains or attenuates (surface depressions) and loses some of the rainfall through groundwater seepage and evaporation. The excess rainfall that exits the catchment as streamflow is the output, the runoff contributing to flood peaks. However, runoff generation in catchments is highly variable both in time and space. It depends not only on the amount and intensity of rainfall but is also affected by the different or combination of physiographical parameters describing the catchment characteristics (Beven *et al.,* 1988; Pilgrim and Cordery, 1993; Alexander, 2001; McCuen, 2005). To fully grasp the interaction between the various factors affecting catchment response times and the resulting runoff, the entire catchment process should be conceptualised within a framework that includes the key elements of input, transfer functions, and the output. DFE methods depend on various catchment parameters such as soil type, slope, and land use, amongst others. Rainfall-based DFE methods typically use these parameters to determine runoff coefficients, representing the percentage of total rainfall that is converted into direct runoff.

There are three event-based DFE approaches used for at-site flood estimation in South Africa: (i) deterministic, (ii) probabilistic and (iii) empirical methods (Pilgrim and Cordery, 1993; Alexander, 2001; Rahman *et al*., 2002, Pegram and Parak, 2004; Smithers, 2012; Gericke and Du Plessis, 2013; SANRAL, 2013; Gericke, 2021; Van der Spuy and Rademeyer, 2021).

DFE is centred on the frequency analysis of peak flows and serves as the initial step in the design of hydraulic structures such as dam spillways, bridges, canals, and culverts (Pilgrim and Cordery, 1993). Accurate DFE is vital to establish a reliable correlation between anticipated flood magnitudes and associated risk levels, facilitating both infrastructure design and most importantly, the protection of human life (Pegram and Parak, 2004; Smithers, 2012; Gericke, 2021).

An overview of event-based deterministic and probabilistic DFE methods is provided in Section 2.2 and the different event-based DFE methods are discussed in the subsequent sections.

2.2 Overview of Event-based Deterministic and Probabilistic DFE Methods

Deterministic DFE methods attempt to reflect physical systems, i.e., catchments in a simplistic manner, with parameters either directly measurable or derived from the physical attributes of a catchment to provide reasonable flood estimation results (Brooker *et al.,* 2023). These methods are classified as either event-based (single-event) or continuous simulation model (CSM) methods. In utilising the event-based methods, all complex and heterogeneous catchment processes are lumped into a single process to enable the estimation of individual design flood events in a simplistic and robust manner (Institute of Hydrology, 1999; Gericke and Du Plessis, 2013). The design rainfall (causative factor) is transformed into design runoff (expected result), based on the assumption that the frequency of the estimated runoff and the input rainfall is equal for the user input catchment and model parameters. In other words, the T-year recurrence interval rainfall will produce the T-year flood event, given that the catchment is at an 'average condition' (Smithers, 2012). The stated assumption does consider the probabilistic nature of rainfall; however, the probabilistic behaviour of other relevant input parameters is ignored (Görgens, 1997; Alexander, 2001). By ignoring the direct implications of joint-probability, deterministic methods assume the catchment at an ‘average state’ to produce the T-year flood event from a T-year rainfall event (Pilgrim and Cordery, 1993; Alexander, 2001; Rahman *et al*., 2002). The CSM approach uses stochastic weather generators to simulate long-record synthetic time series of rainfall and temperature, which then serve as the primary input. Typically, the annual maximum series (AMS) is extracted from the time series and probabilistic analyses are used to assign return periods (Calver and Lamb, 1995; Camici *et al.,* 2011; Haberlandt and Radtke, 2014).

Time of concentration refers to the duration needed for runoff resulting from a rainfall event with a uniform spatial and temporal distribution to reach the catchment outlet. Flood-producing storms typically have durations that allow runoff from the entire catchment to contribute to the peak discharge simultaneously, at the end of the critical storm duration or time of concentration (T_C), thereby linking critical storm duration to T_C. In DFE, the critical storm duration is assumed to be equal to T_C, which results in the catchment effectively being drained by the peak runoff. It is the time a water particle requires to travel from the catchment's boundary, following the longest watercourse to the catchment outlet (Chow *et al.,* 1988; Rooseboom *et al.,* 1993; Smithers and Schulze, 2000a; SANRAL, 2013).

Design rainfall refers to a specific depth and duration of rainfall associated with a defined probability of exceedance or return period, with the return period (or recurrence interval) representing the average interval, in years, between events of that magnitude or greater. Irrespective whether a single-site or regional approach is applied, the design rainfall depth for DFE, especially in deterministic methods, is normally based on T_C (Gericke and Du Plessis, 2011). The estimation of areal design rainfall, also known as catchment design rainfall, involves a series of steps. First, Thiessen weighting (SANRAL, 2013) is applied to the design point rainfall depth or intensity to determine the average design point rainfall depth or intensity. This average is then multiplied with an areal reduction factor (ARF) (Alexander, 2001; Pietersen, 2023) to adjust for the spatial distribution of design point rainfall across the catchment. The resulting value represents the areal design or catchment design rainfall used in DFE (Alexander, 2001; SANRAL, 2013; Brooker *et al*., 2023). ARFs will be further discussed in Chapter 4.

Taking cognisance of all the complexities involved in catchment processes and biases introduced by ignoring the joint probability of rainfall and runoff, there is a preference to utilise simple deterministic DFE methods that are representative of the actual processes and that are recognised and applied in practice (Smithers, 2012).

Probabilistic DFE methods are used to assess and predict the occurrence and magnitude of floods based on the statistical analyses of historical data recorded at flow-gauging sites. These methods involve examining patterns, trends, and characteristics of past flood events to identify the statistical properties that can inform predictions about the likelihood and magnitude of future floods. Various statistical techniques, including frequency analyses, probability distributions, and regression models, are employed to quantify the uncertainty associated with flood occurrences. Probabilistic DFE methods provide a systematic and quantitative approach to understanding flood probabilities and characteristics, enabling the proper planning, design, and management of water resources and infrastructure to mitigate the impact of potential flooding events (Chow *et al.,* 1988; Alexander, 2001 and 2002). Brooker *et al.* (2023) contend that probabilistic DFE methods produce the best design flood estimates, provided that the data record is of sufficient length and accuracy.

Alexander (2001) describes probabilistic FFA as the relationship between peak discharge at a specific site and the probability of this value being exceeded in any one year, known as the annual exceedance probability (AEP). One of two approaches may be used for FFA: the single-site approach examines each flow-gauging site within the relevant catchment area in terms of the length and quality of the data record (Smithers and Schulze, 2000a; 2000b), or the regional approach, which combines multiple sites within a region to augment relatively short observed records at other sites by integrating spatial diversity (Schaefer, 1990; Nandakumar *et al.*, 1995).

Moreover, FFA typically employs two main approaches: the block maxima approach, which uses the AMS, and the peak-over-threshold (POT) approach, which uses the partial duration series (PDS). The AMS is the most commonly applied method in FFA, identifying only the maximum peak discharge recorded in each hydrological year. When using the AMS, flood peaks occurring outside the series within a given year are disregarded, even if they exceed the maximum values of other years (Brooker *et al.*, 2023). Although less commonly employed in DFE and FFA (Alexander, 2001), the PDS remains an available alternative for estimating flood frequencies. The PDS ranks flood peaks and selects a specified number of peaks based on available hydrological years, introducing a threshold exceedance value and influencing key assumptions, such as homogeneity, arrival times, and exceedance magnitudes (Madsen *et al.,* 1997). Brooker *et al.* (2023) recommend using the AMS for frequency analyses, ensuring independency of events in the series and drawing on the fact that only marginal differences exist between the AMS and PDS when used in frequency analyses for $T > 10$-year.

A fundamental assumption in both probabilistic and deterministic analyses is that the data used are stationary, meaning that their statistical properties remain constant over time. This implies that potential changes in climate and catchment conditions that may influence runoff are not taken into consideration. In contrast, non-stationary data has statistical properties such as mean and variance that change over time, rendering traditional methods that assume constant distributions less reliable for analysis or prediction. Several studies have underscored the need to identify trends in extreme rainfall events due to climate change and the importance of accounting for non-stationary data in developing new DFE methods for South Africa (Smithers, 2012; Smithers *et al.*, 2014; Johnson *et al.*, 2021; Brooker *et al.*, 2023).

For the detailed methodologies and computational procedures related to the various DFE methods, numerous guidelines are readily available. The *Drainage Manual* (SANRAL, 2013) is considered one of the most authoritative texts in South African flood hydrology and the recently published *Best Practice Guideline for DFE in Municipal Areas in South Africa* (Brooker *et al.,* 2023) provides comprehensive guidance. Consequently, these detailed methodologies are not repeated in this dissertation; however, certain equations are outlined with respect to their application in DFE. Empirical methods, which rely on regional parameters derived from comparisons between historical peak flows and other catchment characteristics, do not form part of this study.

2.3 Event-based Deterministic DFE Methods

This section focuses on the event-based deterministic DFE methods commonly used in South Africa and as applied in this study.

2.3.1 Rational method

The RM remains the most applied event-based deterministic DFE method across both urban and rural environments (Brooker *et al*., 2023). The method was developed by Thomas Mulvaney, an Irish engineer in 1851 (Xu, 2002; Beven, 2012). Currently, there are three alternatives for design point rainfall estimation used as input to the RM in South Africa. Alternative number one (RM1) is the original method that utilises a depth-duration-frequency (DDF) diagram (SANRAL, 2013). The second alternative (RM2) considers the Technical Report 102 (TR102) design rainfall database and modified Hershfield equation (SANRAL, 2013). Alternative number three (RM3) employs the design rainfall estimation (DRE) software as developed by Smithers and Schulze (2003) to determine design point rainfall depths based on a regional approach. The software incorporates the regional linear moment algorithm and scale invariance (RLMA&SI) approach (Smithers and Schulze, 2003) and is currently the preferred method for DRE in South Africa (Gericke and Du Plessis, 2011; SANRAL, 2013; Brooker *et al*., 2023).

As previously stated (*cf*. Chapter 1), the RM3 was considered in this study. Utilising this approach, the *T*-year flood peak (Q_T) is estimated by using Equation (2.1). The standard T_C-based approach for design rainfall estimation applies to the RM. Storm losses are represented by a weighted runoff coefficient (C_T) which can be estimated as a function of mean annual precipitation (MAP), slope, permeability, land use, vegetation, and urbanisation within a specific catchment. Return period adjustment factors may be used to decrease the runoff coefficient for events with *T* < 50-year (Alexander, 2001; SANRAL, 2013).

$$Q_T = 0.278 C_T I_{TAvg} A \tag{2.1}$$

Where:

Q_T = peak flow for *T*-year return period (m^3/s),

A = catchment area (km^2),

C_T = weighted runoff coefficient for *T*-year return period, and

I_{TAvg} = average areal design rainfall intensity (mm/h).

2.3.2 Soil Conservation Services methods

The original SCS method was developed by the United States Department of Agriculture (USDA) SCS in 1954 and is based on the widely accepted curve number (*CN*) approach (Michel *et al.,* 2005; Baltas *et al.*, 2007; Sahu *et al.*, 2007). In South Africa, the method was introduced by Reich (1962) and popularised after 1979 with the introduction of the first SCS User's Manual. The SCS method accounts for most factors that have an influence on runoff and includes the quantity and time distribution of rainfall, storm duration, land use, soil types, antecedent soil moisture conditions, catchment size, and other characteristics (Mishra and Singh, 2003). The SCS method estimates the *T-year* flood hydrograph parameters, specifically stormflow depth (Q_V) in mm and peak discharge (Q_T), using Equations (2.2) and (2.3). This estimation is based on the *T-year*, one-day rainfall event and employs a unit hydrograph of triangular shape to approximate runoff response. As highlighted before, the standard T_C-based approach used for design rainfall estimation when event-based deterministic DFE methods are used, also applies to the SCS. Storm losses are computed as a function of dimensionless *CN* values, which range between 30 and 100 (Schulze *et al.*, 1992). These calculations incorporate the potential maximum soil water retention (S_R), as well as initial abstraction (I_A), which represent the initial storm losses before runoff begins.

Schulze *et al*. (1992) systematically adapted the SCS method for the South African environment (SCS-SA) from the late 1970s. According to Schmidt and Schulze (1987), the SCS-SA method accounts for regional variations in the average antecedent soil moisture conditions preceding large storm events and for the joint association between rainfall events and subsequent runoff by using either the joint association method (JAM) and/or the median condition method (MCM), respectively. Schulze *et al*. (1992) developed a PC DOS-based software package, *SCS-SA* and an accompanying user manual. The DOS-based platform was subsequently converted into the *Visual SCS-SA* Version 1.03, a Windows-based software platform (Schulze *et al*., 2004). This conversion enabled quicker computation times in larger catchment areas up to 80 km².

The catchment response time, expressed as the lag time (T_L), is a key factor when using the SCS and SCS-SA methods. It represents one of the most important differences between these approaches. The SCS lag time method was developed by the USDA in 1962 (Reich, 1962) for the estimation of T_L for mixed overland flow conditions and catchments ≤ 8 km². In South Africa, Schmidt and Schulze (1984) estimated lag time by analysing rainfall and streamflow data from 12 agricultural catchments in both South Africa and the United States of America (USA), focusing on catchments with areas ≤ 3.5 km². The SCS-SA lag time equation is preferred to the original SCS lag time equation in South Africa, specifically when surface and sub-surface runoff are included in stormflow responses, observed in regions with high MAP values, or in natural catchments with sufficient land cover (Schulze *et al*., 1992; Brooker *et al*., 2023).

$$Q_V = \frac{(P_T - I_A)^2}{P_T - I_A + S_R} \tag{2.2}$$

$$Q_T = \frac{0.2083 A Q_v}{\frac{T_C}{2} + T_L} \tag{2.3}$$

Where:

Q_V = stormflow (runoff) depth (mm),
Q_T = peak discharge for *T-year* return period (m^3/s),
A = catchment area (km^2),
C_N = runoff curve number,
I_A = initial losses/abstractions, normally 0.1S (mm),
P_T = 1-day design rainfall depth for *T-year* return period (mm),
S_R = potential maximum soil water retention (mm),
T_C = time of concentration (hours), and
T_L = lag time (hours).

In addition to the SCS and SCS-SA versions, the recently developed Agricultural Catchments Research Unit model (ACRU) SCS-SA CSM (Rowe, 2019) and Ensemble SCS-SA DFE (Dlamini, 2019) methods are outlined:

SCS-SA CSM: A comprehensive CSM system for DFE was developed using the ACRU model (Rowe, 2019). Based on similarities identified between the ACRU CSM (Schulze, 1995) and event-based SCS-SA (Schmidt and Schulze, 1987; Schulze *et al.,* 2004) models and the fact that the SCS-SA model is relatively simple and widely applied in practice, a CSM system was adapted to be consistent with the land cover classification used in the SCS-SA model. In principle, a simple system similar to and based on the event-based SCS-SA model by incorporating the ACRU CSM concepts was used to facilitate the migration to the SCS-SA CSM approach. The same input information was used and a performance assessment of the ACRU CSM and the SCS-SA results was conducted by including both the SCS single unit hydrograph (UH) and incremental UH approaches. New knowledge on the performance of the SCS-SA model and its associated approaches compared to the comprehensive CSM system developed for South Africa were confirmed.

Ensemble SCS-SA: An ensemble event-based joint-probability approach (JPA) was developed for DFE in South Africa (Dlamini, 2019). Studies by Caballero *et al.* (2011) and Loveridge *et al.* (2013) confirmed the significance of utilising a JPA in DFE. The JPA was applied within the SCS-SA model framework to derive flood frequency curves by considering: (i) defined key model input variables, (ii) a stochastic model to synthesise sequences of the selected input variables, and (iii) an appropriate deterministic DFE model. The Ensemble SCS-SA method also utilises Equations (2.2) and (2.3) to estimate the runoff volume and peak discharge, respectively. The application of a JPA using ensemble event simulations in combination with the event-based SCS-SA model in South Africa was confirmed. The Ensemble SCS-SA model demonstrates the ability to reproduce observed design flood estimates with reasonable accuracy over a wide range of return periods and for larger than anticipated catchment areas.

2.3.3 Synthetic unit hydrograph method

The SUH method involves using a hydrograph, which is a graph that represents the flow rate or stage versus time at a specific intersection point in a catchment. Each hydrograph is unique, reflecting the specific characteristics of the catchment and rainfall event. The concept underpinning this method, the unit hydrograph (UH), was introduced by Sherman in 1932. The UH method assumes that the discharge from a catchment at any point in time is proportional to the runoff volume, while the time factors which affect the hydrograph shape are regarded as being constant (USDA, 2007). In simplistic terms, a UH could be defined as a hydrograph of 1 mm runoff owing to uniform rainfall in terms of areal and time extent, with duration equal to unity. The duration of the hydrograph is related to the storm duration while the volume is related to the rainfall intensity (Subramanya, 2008).

In South Africa, the standard UHs used in the derivation of the SUH method are associated with effective rainfall of 1 mm occurring in one hour. Pullen (1969) derived UHs from observed data at 96 river flow-gauging stations in South Africa and these derived UHs were updated by Bauer and Midgley (1974). Data from the river flow-gauging stations with catchment areas ranging from 21 km² to 22 163 km² were used in the analyses. Nine veld-type regions with similar rainfall and catchment characteristics (*e.g.*, topography, soil type, and vegetation) were identified in South Africa and dimensionless one-hour SUHs were derived for each region.

The SUH method estimates the T-year flood hydrograph based on the T-year rainfall for the critical storm duration, as previously highlighted, by using a typical unit volume storm runoff hydrograph with storm losses based on regional trends in catchment areas ranging between 15 km² and 10 000 km². According to SANRAL (2013), the SUH method renders reliable results for catchment areas up to 5 000 km²; nonetheless, some natural variability in the hydrological occurrences is lost through the broad regional divisions and the averaged form of the UHs (HRU, 1972; SANRAL, 2013).

N-hour UHs are used to estimate the peak discharge and are converted to direct runoff hydrographs by multiplying their values by effective average design rainfall. However, the rising and falling limbs of the dimensionless UHs can be unequal, leading to fluctuations in the constructed S-curve, especially in small catchments. These inconsistencies may arise from large time intervals or long UH durations relative to the catchment's T_L, resulting in an uneven S-curve when the peak flow ratio is less than one. To address this, computed values are adjusted by dividing them by the maximum dimensionless UH ratio from relevant tables. This conservative method may overestimate direct runoff volume; nevertheless, it should yield a conceptually accurate peak discharge estimate (SANRAL, 2013). The adjusted peak discharge is calculated with Equation (2.4).

$$Q_{TA} = Q_T\left[\left(\frac{Q}{Q_P}\right)_{Max}\right] \tag{2.4}$$

Where:

Q_{TA} = adjusted peak discharge for T-year return period (m^3/s),
$(Q/Q_P)_{Max}$ = reciprocal of the maximum Q/Q_P 1-hour UH ratio, and
Q_T = peak discharge for T-year return period (m^3/s).

2.3.4 Lag-routed hydrograph method

The LRH method, which is also known as the direct runoff hydrograph (DRH) method, was developed by Bauer and Midgley (1974). This method follows the same T_C-based design rainfall estimation approach used by other event-based deterministic DFE methods. Characteristically, the method assumes that direct runoff from a catchment can be conveniently simulated by Muskingum routing as shown in Equation (2.5). The inflow is assumed as effective rainfall, and the outflow is runoff with the catchment storage represented by one or more reservoir-type storages. Thus, the runoff is subjected to a time lag; owing to the temporary storage in the system, the runoff is released at an attenuated and lagged rate compared to the rainfall input. Rainfall distribution over time is the driving mechanism of this method.

The rainfall distribution is expressed as the effective rainfall divided into time segments with each segment being sequentially routed through the system. The hydrograph shape is determined by the rainfall distribution over time and the T_C. This method can be used in catchment areas up to 10 000 km², provided the catchment shape is not too unusual or complex (Alexander, 2001). Bauer and Midgley (1974) established that the Muskingum storage constant (*K*) is primarily dependent on the catchment area and vegetation cover, but relatively independent of the catchment shape. Additionally, the storage constant (*K*) and weighing constant (*l*) used in this routing technique were determined by analysing the standard UHs developed by Pullen (1969). These *K*-values were then regionalised based on the nine (9) representative veld-type regions as used in the SUH method.

$$Q_{out(N)} = C_0 Q_{in(N)} + C_1 Q_{in(N-1)} + C_2 Q_{out(N-1)} \tag{2.5}$$

Where:

$Q_{out(N)}$ = routed peak outflow at current time interval (m³/s),
$C_{0,\,1,\,2}$ = Muskingum routing coefficients,
$Q_{in(N)}$ = routed peak inflow at current time interval (m³/s),
$Q_{in(N-1)}$ = routed peak inflow at previous time interval (m³/s), and
$Q_{out(N-1)}$= routed peak outflow at previous time interval (m³/s).

2.4 Event-based Probabilistic DFE Methods

This section provides a detailed discussion of probabilistic DFE methods. The approach typically conducts at-site probabilistic FFA of the AMS, followed by ranking the values in descending order of magnitude, applying a plotting position formula to assign return periods and estimating parameters for distribution fitting. The most suitable probability distribution is selected based on the AMS's statistical properties and visual inspection of plotted values, whereupon goodness-of-fit (GOF) criteria are used to assess the performance (Hosking and Wallis, 1997; Alexander, 2001; SANRAL, 2013; Gericke, 2021).

2.4.1 Plotting positions

The probability value or return period assigned to each plotted data point is referred to as the plotting position (PP) (Chow *et al*., 1988). A PP is calculated by assuming that if *n* values are distributed uniformly between 0% and 100% probability, there must be (*n* + 1) intervals, (*n* − 1) intervals between the data points and two intervals at the ends (Chow *et al*., 1988; SANRAL, 2013). Each data point is then plotted on probability paper or on a scale that linearises the probability density function (PDF). A straight line is fitted to the plotted data, facilitating interpolation and extrapolation. Several methods, mostly empirical, have been proposed for determining PPs. According to Chow et al. (1988), PP estimations assume that the sample frequency distribution approximates the population frequency distribution.

PPs available include those of Weibull (1939), Blom (1958), Beard (1962), Gringorten (1963), Cunnane (1978), and Greenwood (1979). The Cunnane (1978) PP recommended by the Department of Water and Sanitation (DWS; Van der Spuy and Rademeyer, 2021) is generally used in South Africa. However, the Weibull PP is considered more conservative, offering unbiased estimates of *T*-values across all distributions and is therefore recommended as the preferred PP (Stedinger *et al.*, 1993). The simplicity, efficiency, and consistency of the Weibull PP is beneficial for large hydrological data sets and is less sensitive to data quality issues, making it reliable for regions with incomplete or variable data sets. Moreover, Brooker *et al*. (2023) also proposed the use of the Weibull PP to fit the AMS, as it provides a visual overview of the data and assists in identifying anomalies.

Van der Spuy and Du Plessis (2022b) introduced the Z-set PP approach, which offers a more precise and realistic depiction of theoretical probability distributions. This method demonstrates robustness across varying record lengths and effectively captures data outliers. The Z-set PPs align closely with the general trends of established PPs, however, provide a smoother curve, eliminating significant discrepancies in probability assignments for flood peaks of similar magnitude. This results in a more accurate representation of the distribution's shape. Furthermore, the PPs exhibit minimal variation across different record lengths, facilitating a more consistent selection of suitable distributions. Although initially proposed as a complementary tool to well-established PPs (Van der Spuy and Du Plessis, 2022b), this study adopted the Z-set PP approach, utilising Equation (2.6), due to its superior performance and enhanced accuracy.

$$Z_{m.Z\text{-}set} = 0.0902 \text{ x } Z_{m.W} + 0.1564 \text{ x } Z_{Q_m} + 0.8083 \text{ x } Z_{logQ_m} \tag{2.6}$$

Where:

$Z_{m.Z\text{-}set}$ = *Z*-set PP,

Z_{logQm} = *Z*-score of the log-transformed AMS flood peak data,

Z_{Qm} = *Z*-score of the AMS flood peak data, and

$Z_{m.W}$ = Weibull PP.

2.4.2 Parameter estimation

Several parameter estimation methods, including the method of linear moments (LM), maximum likelihood estimation (MLE), method of moments (MM), probability-weighted moments (PWM) and the method of least squares (LS) are available for defining a probability distribution's characteristics and behaviour. These methods, outlined by Yevjevich (1972), Chow *et al*. (1988), Kite (1988) and Stedinger *et al.* (1993), fit theoretical probability distributions effectively, though each within certain limitations (Kite, 1988). The LM method, commonly used internationally, has been criticised for its insensitivity to outliers (Alexander, 2001); Smithers (2012) suggested that the method requires further evaluation. Alexander (2001) recommended the use of MM and PWM for a single-site or regional approach. The *Drainage Manual* (SANRAL, 2013) utilises the MM to fit probability distributions in single-site, direct probabilistic analyses. Van der Spuy and Rademeyer (2021) recommended the MM particularly for its sensitivity to data outliers while the study by Gericke (2021) utilised the LM and MM for distribution fitting. Brooker *et al*. (2023) also recommended using the MM, while suggesting the consideration of PWM and

LM for data outliers. The MM, widely supported in the literature and used in this study, was developed by Pearson in 1902. It suggests that the moments of a probability density function (PDF), when the distribution has well-defined parameters, should match the moments of the observed data. This method relies on the first three moments: mean, standard deviation (the second moment, which measures variability), and skewness (the third moment, which reflects asymmetry). As the moment order increases, the method becomes more sensitive to high and low values in the data. However, since hydrological data is often asymmetrical, the MM can suffer from efficiency losses in estimation.

2.4.3 Probability distributions

Fitting an appropriate theoretical probability distribution to a data set offers a concise and smoothed representation of the observed frequency distribution derived from limited data. This approach facilitates methodical extrapolation of frequencies beyond the available data range (Smithers and Schulze, 2000a). Alexander (2001) argued that statistical analyses of observed flow data through various probability distributions rely on the following fundamental assumptions:

- Independency of observation implies that one event's occurrence and magnitude do not influence others;
- Presumption of error-free data makes accuracy crucial, especially with significant measurement influences;
- Data originates from a single population with a consistent weather event causing rainfall; and
- Data originates from a single population with a uniform distribution, indicating one type of rainfall event.

Practitioners in South Africa and internationally tend to prefer specific probability distributions, selecting them based on their theoretical foundations and the context of the analysis. Hosking (1990) recommended the generalised extreme value (GEV) distribution, fitted with the LM. Alexander (1990) proposed using the GEV, log-Normal (LN) and log-Pearson Type 3 (LP3), fitted with the MM or PWM. Alexander (2001) recommended the LP3 distribution for DFE, while Görgens (2007), along with

Van der Spuy and Du Plessis (2022a), recommended both the GEV and LP3 distributions. Calitz and Smithers (2020) argued that the generalised Pareto (GPA) distribution, when fitted using LMs, is the most suitable probability distribution for FFA in South Africa. Van der Spuy and Rademeyer (2021) suggested that for a single-site analysis, the GEV, LN, and LP3 distributions are better suited for FFA in South Africa. Brooker *et al.* (2023) recommended the GEV and LP3 probability distributions, as the GPA fitted with LMs has not been widely adopted in practice. Regardless of the probability distribution applied, Brooker *et al*. (2023) recommend visually comparing the GOF between different probability distributions and AMS data. When choosing a probability distribution, it is important to account for all relevant factors; if a single distribution does not adequately fit the data, considering alternative or multiple distributions may offer a more accurate representation.

The GEV distribution offers significant flexibility by unifying three families of extreme value distributions, namely the Gumbel, Fréchet and Weibull, in order to model data set extremes effectively. This adaptability makes it especially valuable for predicting rare events, such as floods, in regions with extensive historical data, with applications extending to the analysis of extremes in both river discharge and rainfall (De Paola *et al.,* 2018). In South Africa, it has been widely utilised in flood studies owing to its robust capacity to account for the variability and uncertainty characteristic of extreme hydrological conditions (Kovács, 1988).

The GPA distribution is commonly used in modelling extreme hydrological events and has been proved ideal to fit the Peak Over Threshold (POT) series in flood hydrology (Zhou *et al*., 2017). The POT series is an alternative to the AMS when studying extreme event characteristics. The distribution of data exceeding a specific threshold can often be approximated by a suitably scaled GPA (Balkema and De Haan, 1974; Pickands, 1975), since the threshold value converges to the endpoint of the distribution.

In the LN distribution, the data series is normally distributed, whilst the mean, standard deviation, and coefficient of skewness is assumed to be zero (Das and Qureshi, 2014). In hydrology, the LN distribution is advantageous because it is bounded, and the log transformation helps reduce the positive skewness often observed in hydrological data. Logarithms disproportionately reduce large numbers more than small ones (Yevjevich, 1972; Chow *et al*., 1988). The LN distribution is widely employed in South Africa and relies on long and established theoretical frequency distributions of flood peak records (Kovács, 1988).

In South Africa, the LP3 distribution is often one of the preferred choices for flood frequency analysis, particularly in regions where skewed data is common. Nathanael *et al*. (2018) utilised the LP3 distribution, among others, to evaluate the performance of regional flood frequency analysis methods by analysing data from 407 flow stations across the country. This distribution may be valuable in offering more accurate representation of the distribution's tail, especially for rare, high-magnitude events, and it is instrumental in estimating extreme flow or rainfall probabilities.

Van der Spuy and Du Plessis (2024) recently developed the Improved Probability-Model for South Africa (IPZA), a simplistic and reliable approach that enhances data management robustness, while removing the need for moment adjustments. Compared to the GEV and LP3 distributions, the IPZA method delivers more stable and consistent flood quantile estimates. It offers practical benefits, including ease of use with a uniform set of frequency factors applicable to all parameters, irrespective of skewness and a more rational treatment of outliers. Though still in its early stages, the IPZA method represents a significant advancement. However, the authors caution that further research is needed to validate and refine it, proposing that IPZA could become a valuable complement to established methods for flood frequency analysis (Van der Spuy and Du Plessis, 2024).

In summary, the IPZA was incorporated into this study based on its superior performance, as evidenced by research conducted by Van der Spuy and Du Plessis (2024). The method, calculated with Equation (2.7), has already shown promise as a preferable distribution approach within the South African context.

$$Q_{AEP} = (K_{\mathrm{P-Q}} \times Q_{\mathrm{avg}}) + (K_{\mathrm{P-SD}} \times \mathrm{SD}) + (K_{\mathrm{P-SD^*}} \times \mathrm{SD^*}) \qquad (2.7)$$

Where:

Q_{AEP} = peak discharge associated with a specific AEP or *T*-year (m³/s),
$K_{\mathrm{P-Q,P-SD,P-SD^*}}$ = frequency factors as listed in Table 2.1.
Q_{avg} = average of the AMS (m³/s),
SD = standard deviation of the AMS (m^3/s), and
SD^* = standard deviation of the AMS (m^3/s), excluding the largest flood peak (Q_{max}) from the AMS.

Table 2.1: Frequency factors for IPZA (Van der Spuy and Du Plessis, 2024)

AEP (%)	**50**	**20**	**10**	**5**	**2**	**1**	**0.5**	**0.2**	**0.1**	**0.05**	**0.02**	**0.01**
W_P	0.3665	1.4999	2.2504	2.9702	3.9019	4.6001	5.2958	6.2136	6.9073	7.6007	8.5171	9.2103
Frequency factors												
$K_{\mathrm{P-Q}}$	1.1035	1.4673	1.5258	1.4791	1.3099	1.1296	0.9249	0.6444	0.4429	0.2641	0.0803	−0.0082
$K_{\mathrm{P-SD}}$	−0.1216	−0.1320	−0.0286	0.1838	0.6317	1.0865	1.6253	2.4345	3.0952	3.7787	4.6980	5.4022
$K_{\mathrm{P-SD^*}}$	−0.3379	0.1553	0.7155	1.3020	2.0310	2.5124	2.9205	3.3465	3.5892	3.7695	3.9131	3.9379

2.5 Goodness-of-Fit Statistics: Numerical Descriptors

Willmott (1982) and Schulze (1995) identified three major categories of GOF statistics applicable to hydrological analyses: (i) conservation, (ii) descriptive, and (iii) regression statistics. Roberts (1987) indicated that GOF criteria are objective mathematical functions which highlight the key features of the relationship between a model/method's simulated/estimated output and the observed data. In FFA, GOF criteria are either used:

(a) to establish the suitability of a probabilistic curve fitted against ranked AMS data points; and/or
(b) to assess the performance of deterministic and/or empirical design flood estimation results (Q_{Ti}) in comparison to at-site probabilistic FFAs (Q_{Pi}).

In the case of (a), visual comparisons based on graphical plots are often used. However, visual comparisons can be subjective; subsequently, statistical performance metrics are generally employed to ensure objectivity. Typically, GOF criteria are indicative of whether any poor fit issues are due to sample variability or a significant mismatch between the data and the simulated/estimated values (Stedinger *et al*., 1993; Smithers and Schulze, 2000a). In contrast, Gericke (2021) questioned the use of GOF tests when probabilistic design floods are used as a benchmark in FFA to assess the performance of any deterministic and/or empirical DFE method. Typically, it was argued by Gericke (2021) that the plotting positions of the AMS data against which the probability distributions are fitted are merely estimates of the AEP and dependant on the ranking of the AMS events and the record length. The latter is evident in AMS data sets having different plotting positions for flood events of equal magnitude. Consequently, it was recommended that only the statistical properties of each AMS data set and the visual inspection of the probability distribution fittings are used to identify the most suitable probability distribution.

In terms of (b), various quantitative GOF criteria are suggested in literature. For example, Zhong and Dutta (2015) suggested performance indicators including the standard error of estimate (*SE*), mean absolute relative error (*MARE*), root mean square error (*RMSE*), coefficient of determination (r^2), and Nash-Sutcliffe coefficient (*NSE*). In considering the latter performance indicators, Gericke (2021) developed a ranking-based selection procedure to assess the performance (accuracy and potential bias) of DFE methods across 48 catchments in South Africa. Typically, the DFE methods were ranked against the different GOF criteria and summed to provide the overall performance ranking, with the lowest ranking method deemed the best performer. A similar approach was adopted in this study. Subsequently, the GOF criteria used in this study are summarised below:

Coefficient of determination (r^2): The r^2 statistic (Eq. 2.8) is widely used to evaluate the GOF of hydrological models, assessing the degree of association between observed data and simulated/estimated values, particularly in linear regression analyses (Schulze, 1995). It represents the proportion of variance in the observed data that is explained by the model, ranging from 0 to 1, with higher values indicating less error variance (Legates and McCabe, 1999). The key advantage of r^2 is its well-defined statistical distribution, which simplifies the evaluation of statistical significance and facilitates the assessment of model correlation. However, r^2 is highly sensitive to outliers and does not effectively capture additive or proportional differences between model predictions and observed data (Legates and McCabe, 1999).

Mean absolute relative error (*MARE*): The *MARE* statistic (Eq. 2.9) quantifies the error between observed and simulated/estimated values, with an optimal value of zero (Aichouri *et al.*, 2015). *MARE* is an adaptation of the mean absolute error (*MAE*). While *MAE* calculates the average of absolute errors in a data series, *MARE* reflects the average of absolute errors relative to the observed data (Ferreira *et al.*, 2020). Moreover, MARE provides an unbiased error estimate by assigning appropriate weights to all magnitudes of the simulated/estimated variable (Parasuraman *et al.*, 2007). According to Aytek *et al.* (2014), *MARE* also provides a more balanced evaluation of GOF criteria at moderate levels, whereas low *MARE* values suggest difficulties in accurately simulating lower magnitudes (Zaherpour *et al.*, 2018).

Nash-Sutcliffe efficiency (*NSE*): Nash and Sutcliffe (1970) introduced this coefficient of efficiency to quantify the relative difference between observed and simulated/estimated values, while providing a measurable indicator of how accurately a model replicates the actual data. The *NSE* coefficient (Eq. 2.10) is an improvement of the r^2 coefficient (Legates and McCabe, 1999). Typically, the objective function is to obtain *NSE* values close to 1, with negative *NSE* values indicating unacceptable model performance (Zhong and Dutta, 2015). The sum of the absolute squared differences between the simulated/estimated and observed values are subtracted from one another and normalised by the variance of the observed values (Krause *et al.*, 2005).

Root mean square error (*RMSE*): The *RMSE* statistic (Eq. 2.11) is a commonly used metric to quantify the difference between observed and simulated/estimated values, emphasising the magnitude of prediction errors. However, the *RMSE* does not indicate the source or type of error. The objective function is to minimise the *RMSE* to zero. According to Chai and Draxler (2014), the *RMSE* is sensitive to outliers, but has the advantage of being easier to work with mathematically given it ignores absolute values.

Standard error of estimate (*SE*): The *SE* statistic (Eq. 2.12) approximates the variation of observed values around the regression line. It can be used to establish a margin of error or prediction interval around a predicted value, and to provide insight into the model's accuracy and reliability (Jarman, 2013). The error or residual is the difference between the actual value and the simulated/estimated value in a regression model. The *SE* measures the average vertical distance between the points on the scatter plot and the regression line, representing the standard deviation of the residuals. A smaller standard error indicates a better fit of the regression model to the data (Watts, 2022).

$$r^2 = \sqrt{\left(\frac{\sum_{i=1}^{N}(Q_{Ti} - Q_{Pi})^2}{\sum_{i=1}^{N}(Q_{Ti} - Q_T)^2}\right)} \tag{2.8}$$

$$MARE = \frac{100}{N}\sum_{i=1}^{N}\frac{|Q_{Ti} - Q_{Pi}|}{Q_{Pi}} \tag{2.9}$$

$$NSE = 1 - \frac{\sum_{i=1}^{N}(Q_{Ti} - Q_{Pi})^2}{\sum_{i=1}^{N}(Q_{Ti} - Q_T)^2} \tag{2.10}$$

$$RMSE = \sqrt{\frac{\sum_{i=1}^{N}(Q_{Pi} - Q_{Ti})^2}{N}} \tag{2.11}$$

$$SE = \sqrt{\frac{1}{N-2}\sum_{i=1}^{N}(Q_{Ti} - Q_T)^2 - \left(\frac{\sum_{i=1}^{N}(Q_{Pi} - Q_P)(Q_{Ti} - Q_T)}{\sum_{i=1}^{N}(Q_{Pi} - Q_P)^2}\right)^2} \tag{2.12}$$

Where:

N = size of data sample,

Q_P = mean of the at-site probabilistic design flood peaks (m³/s),

Q_{Pi} = at-site probabilistic design flood peak (m³/s),

Q_T = mean of the deterministic design flood peaks (m³/s), and

Q_{Ti} = estimated design flood peak using a deterministic method (m³/s).

2.6 Goodness-of-Fit Statistics: Graphical Descriptors

Various graphical descriptors are used in hydrology to assess model performance, and include, but are not limited to, box-and-whisker, estimated/observed ratio, relative error and scatter plots. Typically, these graphical plots, as summarised below, support model calibration and parameter adjustments for improved accuracy.

Scatter plots: Scatter plots have been widely employed in South African research to explore relationships between variables. In terms of hydrology, Kovács (1988) utilised scatter plots for comparing observed and estimated flood frequencies, identifying patterns, and improving model accuracy. Naidoo (2020) used scatter plots to illustrate the correlation between estimated and observed FFA values. Although scatter plots effectively visualise relationships between two variables on a Cartesian plane, challenges such as non-random patterns, variable variation, and outliers require careful analysis to ensure accurate interpretation, as association does not imply causation (NIST, 2012). Interpreting scatter plots involves examining the distribution of data points to understand the relationship between two variables. The trend direction reveals the type of correlation, i.e., an upward slope indicates a positive correlation, a downward slope signifies a negative correlation, and a random scattering of points suggests no correlation (Kovács, 1988). Moore *et al.* (2013) reasoned that the strength of a relationship can be evaluated based on the clustering of points, with closely clustered points indicating strong correlations and widely dispersed points suggesting a weak or no correlation. Outliers may highlight anomalies or errors in the data (Kovács, 1988), while the incorporation of trendlines can further reveal key patterns, interdependencies, and potential outliers (Van der Spuy & Rademeyer, 2021).

Box-and-whisker plots: Box-and-whisker plots (or boxplots) are specifically useful for comparing different DFE methods and allow for easy visual comparisons of the accuracy and reliability of the estimations. In South Africa, boxplots have been used extensively to compare hydrological modelling and FFA results (Gwate *et al*., 2015; Naidoo, 2020; Rivers-Moore *et al.,* 2020). Boxplots are valuable tools in hydrology for visualising and interpreting relative errors, notably in flood and runoff modelling. These plots summarise data by displaying key statistical measures, including the minimum, first quartile (Q_1), median (Q_2), third (Q_3), and maximum. The central box represents the interquartile range (IQR), i.e., the middle 50% of the data, while the whiskers extend to the minimum and maximum values within 1.5 times the IQR (Banacos, 2011). Points outside this range are identified as outliers. These statistical measures are described below:

- Median (Q_2) indicates the central tendency, providing insight into the typical value of relative error.
- IQR (box width) represents the variability of relative errors, with a narrow box suggesting low variability and a wider box indicating larger variability/errors.
- For outliers, the data points outside the whiskers highlight extreme values, signalling possible issues with estimations or data anomalies.
- Skewness relates to the position of the median within the box which can indicate whether the data is skewed, highlighting whether a method tends to overestimate or underestimate errors.

Relative error (*RE*): The *RE* statistic (Eq. 2.13) is used to evaluate the accuracy of an estimated value (Q_{Ti}) by comparing it to a benchmark value. It is expressed as a fraction or percentage of the benchmark (Q_{Pi}) values (Van der Spuy and Rademeyer, 2021).

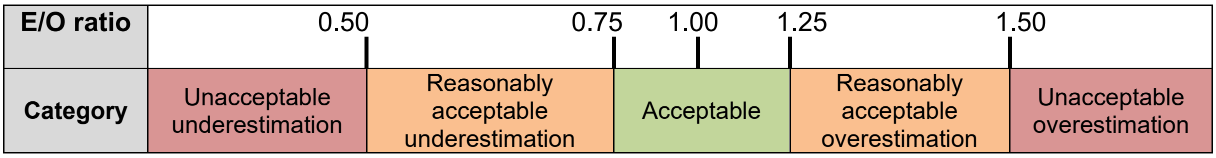
$$RE = 100\left|\frac{Q_{Ti} - Q_{Pi}}{Q_{Pi}}\right| \qquad (2.13)$$

Typically, Naidoo (2020) used *RE* estimates as input for box-and-whisker plots, effectively illustrating the distribution of relative error across different methods. This visualisation provides a clear comparison of variability and central tendencies within the data. Understanding the *RE* statistic involves assessing both its magnitude and pattern. Smaller errors indicate higher accuracy, while larger errors are indicative of model or measurement limitations. Consistent errors suggest systematic biases, while varying errors may reflect random discrepancies or data variability.

Estimated/Observed (E/O) ratios: According to Naidoo (2020), E/O ratios (Eq. 2.14) can be graphically classified as shown in Table 2.2.

$$Ratio = \frac{Estimated\ value}{Observed\ value} \tag{2.14}$$

Table 2.2: Range of plausible E/O ratios (Naidoo, 2020)



E/O ratio	0.50	0.75	1.00	1.25	1.50
Category	Unacceptable underestimation	Reasonably acceptable underestimation	Acceptable	Reasonably acceptable overestimation	Unacceptable overestimation

E/O ratios in the range 0.75 ≤ E/O ≤ 1.25 are regarded as ‘acceptable’, while the ranges 0.5 ≤ E/O ≤ 0.75 and 1.25 ≤ E/O ≤ 1.5 are classified as 'reasonably acceptable'. Any E/O ratio exceeding 50% is regarded as ‘unacceptable’.

2.7 Performance of Event-based Deterministic DFE Methods

Currently, there are no best practice guidelines available for the application of event-based deterministic DFE methods at a national level in South Africa. This is primarily ascribed to the fact that most studies to date focused on or were limited to pilot case studies in localised areas. A summary of these pilot case studies and the subsequent performance of the DFE methods, is listed below:

- Gericke and Du Plessis (2013) assessed the performance of event-based DFE methods in gauged catchments ranging from 100 km² to 10 000 km² in the C5 secondary drainage region in South Africa. The results showed that the simplified ‘small catchment’ (A ≤ 15 km²) deterministic DFE methods, *e.g.*, RM and original SCS method, provided acceptable results when compared to the probabilistic analyses applicable to all the catchment sizes and return periods under consideration, except for the two-year return period. Less acceptable results were demonstrated by the ‘medium catchment’

($15\ \text{km}^2 < A \leq 000\ \text{km}^2$) deterministic, *e.g.,* SUH and LRH, and 'large catchment' ($> 5\ 000\ \text{km}^2$) empirical DFE methods.

- Naidoo (2020) assessed the performance of event-based deterministic and empirical DFE methods at 157 DWS dam sites across South Africa with catchment areas ranging from 10 to 108 360 km². The study concluded that all the event-based deterministic and empirical DFE methods generally tend to underestimate design floods, except for the standard design flood (SDF) and empirical Midgley and Pitman (MIPI) methods. In terms of the *MARE* values, the RM, SUH and the empirical catchment parameter (CAPA) method ranked amongst the top three best performing methods, with the average *MARE* values ranging between 56% and 82%. The poorest performance was demonstrated by the SDF method (average *MARE* = 294%). However, these 'acceptable' estimates using the top three DFE methods were only evident at approximately 40% of the sites under consideration. Spatial mapping of the methods' performance resulted in no identifiable regional trends.
- Gericke (2021) used a ranking-based selection procedure to assess the performance of all the event-based DFE methods used in South Africa by considering 48 gauged catchments ($22\ \text{km}^2 \leq A \leq 31\ 283\ \text{km}^2$) located in four climatological regions. The SCS, RM3 and CAPA methods provided the best estimates of the at-site probabilistic flood peaks, while the SDF method proved to be the least appropriate.
- More recently, the performance of the SCS-SA method has been assessed using the *CN*s as published in the literature (Dlamini, 2019; Maharaj, 2020; Smithers *et al*., 2021). The results highlighted that the published *CN*s are not representative and should be updated accordingly.

This study evaluates deterministic DFE methods across South Africa by comparing them to statistical flood analyses using various GOF criteria. The research will support the refinement and updating of existing deterministic DFE methods by contributing to best practice guidelines for practitioners, as envisioned by the NFSP. The next chapter provides an overview of the study area inclusive of the location, climate, rainfall, hydrological and meteorological infrastructure, drainage network, soils, generalised veld types, and land cover.

3. STUDY AREA

This chapter provides an overview of the study area (South Africa), focusing on location, climate, rainfall, and the hydrological and meteorological monitoring network infrastructure. This is followed by discussions on the national drainage network, soils, generalised veld types, and national land cover.

3.1 Geographical Location

South Africa, located at the southern tip of Africa, extends from 22°S to 35°S latitudinally and 17°E to 33°E longitudinally, covering approximately 1 219 602 km². It shares about 4 900 km of borders with Namibia, Botswana, Zimbabwe, Mozambique, and Eswatini, while entirely surrounding Lesotho. The 2 881 km coastline borders the Atlantic Ocean to the west and the Indian Ocean to the south and east. The central plateau is drained by the Limpopo and Orange Rivers, with variable flow from east to west into the Atlantic Ocean. Coastal regions are drained by numerous shorter rivers, with few found along the arid west coast north of 31°30′S.

3.2 Climate and Rainfall

South Africa's climate is largely subtropical, with a mean annual temperature of approximately 17°C, having warmer temperatures in the east and cooler temperatures in the west (Archer *et al.,* 2010). The country's climate is influenced by factors such as geography, altitude, and the type of rainfall (*e.g.,* convective, frontal, and/or orographic), leading to a wide variety of climate zones. The Western and Southern Cape regions experience winter rainfall from June to August, accompanied by warm summers, while the rest of the country experiences summer rainfall from December to February (Climate Change Knowledge Portal [CCKP], 2021). The Karoo, a semi-desert region, is characterised by highly variable, non-seasonal rainfall and extreme temperatures. In contrast, the Highveld is marked by hot, stormy summers and cold winters, while the KwaZulu-Natal coast enjoys mesic-subtropical conditions (Davies and Day, 1998). Figure 3.1 shows the Köppen-Geiger climate classification map of South Africa (Council for Scientific and Industrial

Research [CSIR], 2021), which illustrates the various climate zones across the country.

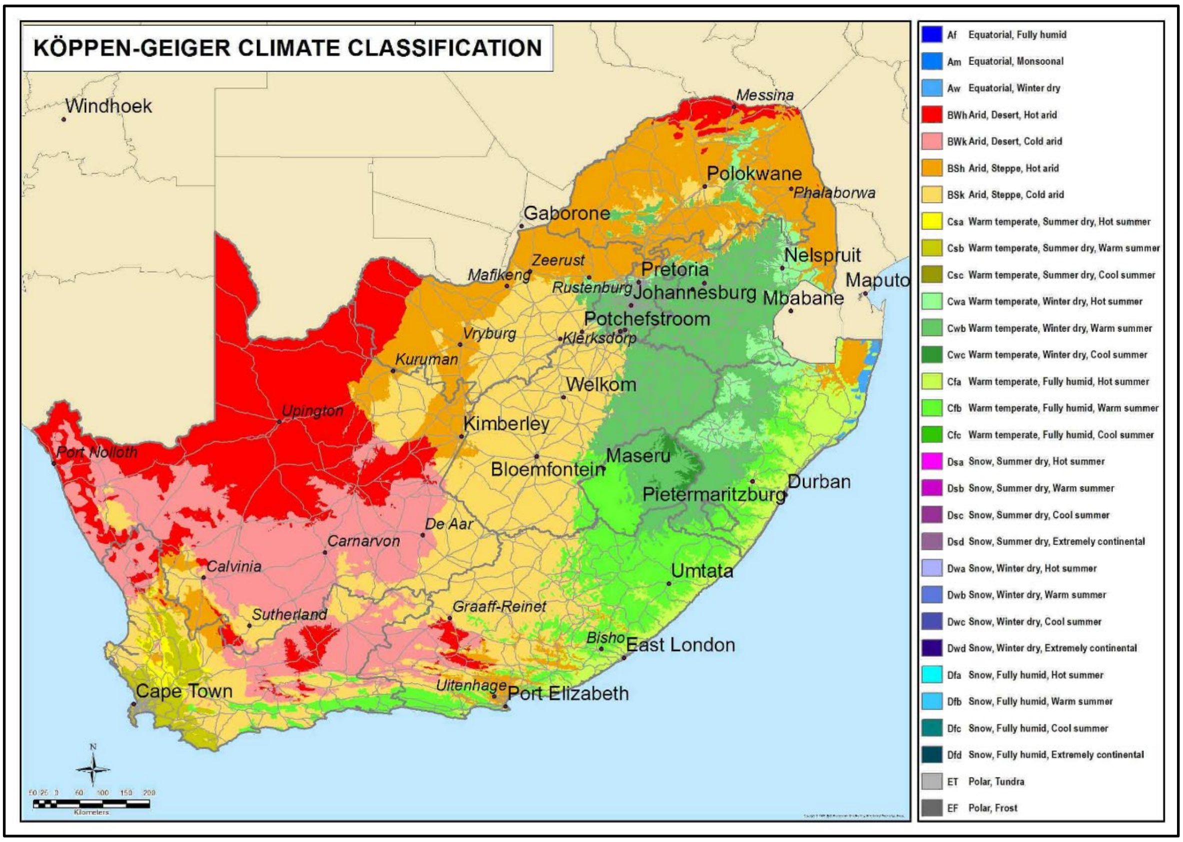


Figure 3.1: Köppen-Geiger climate classification map (CSIR, 2021)

Rainfall patterns exhibit significant temporal and spatial variability, influenced by seasonal fluctuations, with different weather systems generating rainfall across various regions, and at different times of the year. During the winter months, dominant north-westerly winds bring substantial rainfall to the western parts of the country, while the southern interior and Karoo regions remain dry. Conversely, summer rainfall is more common in the northern and eastern areas, though persistent high-pressure air masses over the western regions restrict rainfall (Davies and Day, 1998). South Africa's mean annual precipitation (MAP) is approximately 465 mm (Pitman, 2011), which is significantly lower than the global MAP of 860 mm (Tibane and Vermeulen, 2014). Annual precipitation decreases moving westward, while evaporation rates increase, often surpassing rainfall except in mountainous regions (Pitman, 2011). Only 9% of South Africa receives a MAP of over 800 mm, and 20% of the country receives less than 200 mm of rainfall (Lynch, 2004). On average, evaporation exceeds rainfall in most regions, particularly in the central and western parts, where evaporation can exceed rainfall by a factor of ten (Davies and Day, 1998). Figure 3.2 contains the average monthly precipitation for the period 1901–2020 (CCKP, 2021).

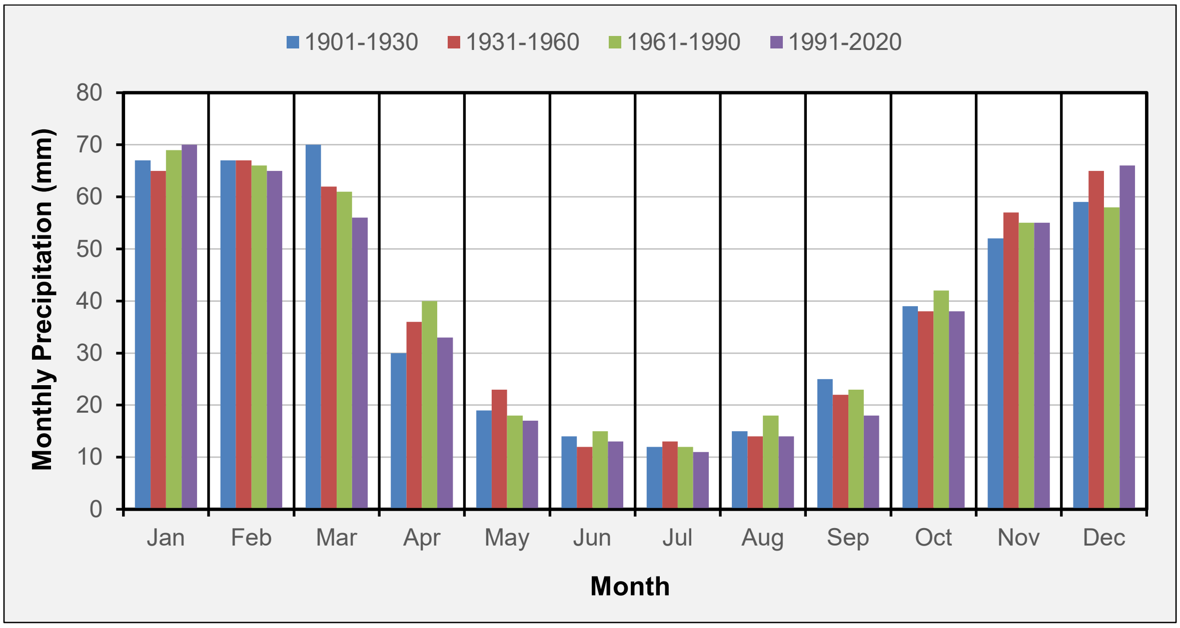


Figure 3.2: Average monthly precipitation for South Africa: Period 1901 to 2020 (after CCKP, 2021)

3.3 Hydrological and Meteorological Monitoring Network Infrastructure

Hydrological and meteorological infrastructure, along with associated data collection, are the primary responsibility of the Directorate of Hydrological Services in the Department of Water and Sanitation (DWS) and the South African Weather Services (SAWS), respectively. The earliest gauging structures built expressly for measuring river flow in South Africa were completed in 1904 in the then Transvaal Province (Menné, 1960). The number of active flow-gauging stations increased rapidly until the early 1970s and stabilised between 780 and 880 from the beginning of 1975, with streamflow data continuously recorded at 782 operational flow-gauging sites since 2007 (Wessels and Rooseboom, 2009).These sites include sharp-crested weirs (55%), crump weirs (35%), and the remaining 10% comprising broad-crested weirs, dam spillways, and velocity-area gauging stations. However, the number of active DWS flow-gauging stations operational each year has exhibited a steady decline since the late 1980s, as noted by Pitman (2011) and illustrated in Figure 3.3. This figure also depicts the cumulative growth of gauging stations from the 1920s. Rainfall stations established in South Africa over time include those managed by SAWS, the Agricultural Research Council (ARC), the South African Sugar Association (SASA), as well as privately owned stations. Lynch (2004) compiled one of the most comprehensive rainfall station databases in South Africa, with a total of 12 153 stations from various institutions as summarised in Table 3.1. Pitman (2011) also highlighted the increase, and subsequent steady decline in the number of operational rainfall stations in South Africa, as shown in Figure 3.4.

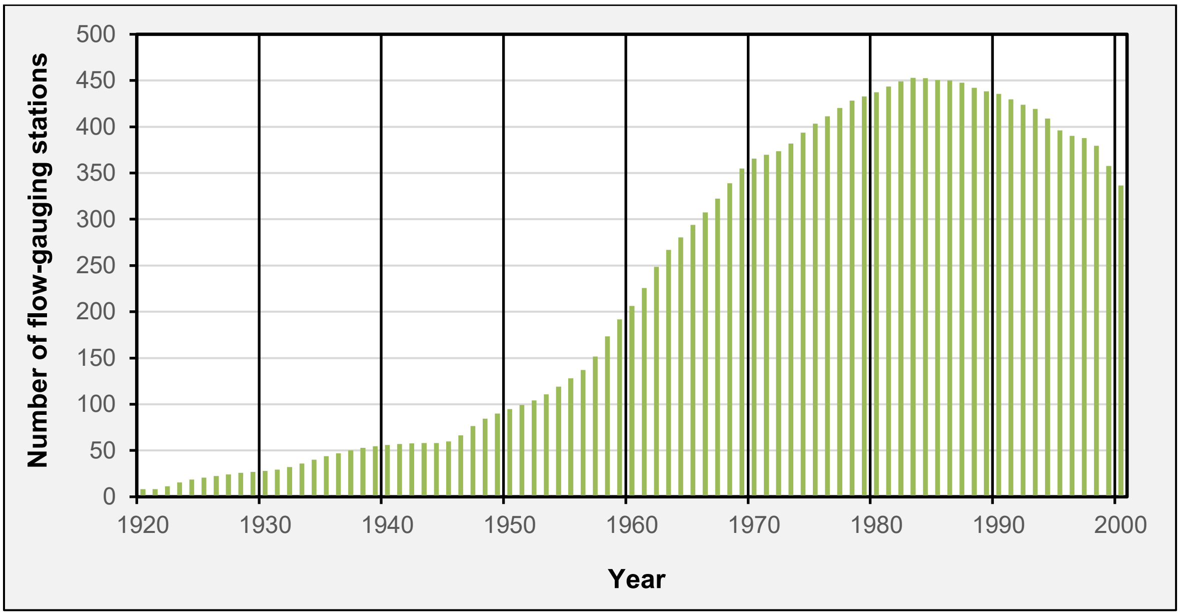


Figure 3.3: Trend in operational flow-gauging stations in South Africa (after Pitman, 2011)

Table 3.1: Distribution of rainfall stations used by Lynch (2004)

Organisation	Stations	% of Total	Organisation	Stations	% of Total
SAWS	8 281	68.14	SASA	161	1.32
ARC	2 661	21.90	Private	1050	8.64

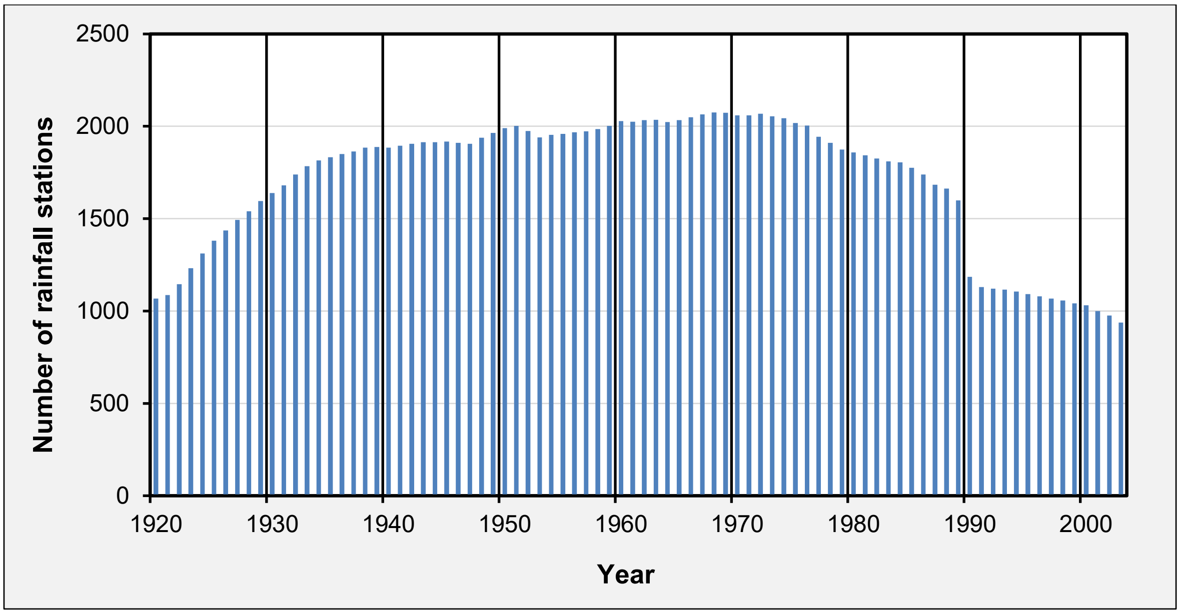


Figure 3.4: Trend in operational rainfall stations in South Africa
(after Pitman, 2011)

Based on the observations of Pitman (2011), and as clearly depicted in Figures 3.3 and 3.4, it is reasonable to conclude that the apparent trend of a steady decline in the operational flow-gauging and rainfall infrastructure would most likely continue. This persistent reduction in the number of operational stations will present significant challenges for effective hydrological monitoring and reliable data collection across South Africa.

3.4 Drainage Regions

Bonetti *et al*. (2018) define a drainage region as a land area that regulates both surface and sub-surface hydrological fluctuations, playing a critical role in various ecohydrological and geomorphological processes. South Africa is divided into six established water management areas (WMAs), or major drainage regions (DWS, 2023), including the Limpopo-Olifants, Inkomati-Usuthu, Pongola-Mtamvuna, Vaal-Orange, Mzimvubu-Tsitsikamma, and Breede-Olifants. South Africa is further delineated into 22 primary drainage regions (PDRs), labelled A to X, which are further subdivided into 148 secondary drainage regions (SDRs), 278 tertiary drainage regions (TDRs) and 1950 quaternary drainage regions (QDRs) (Midgley *et al.,* 1994; DWS, 2017). Within these 22 PDRs, 411 continuous flow-gauging stations were identified by the DWS as suitable for this study based on the data quality and record length. Figure 3.5 shows the locations of the 326 river and 85 reservoir flow-gauging stations (Department of Water Affairs and Forestry [DWAF], 1995; Calitz and Smithers, 2020) assessed in this study.

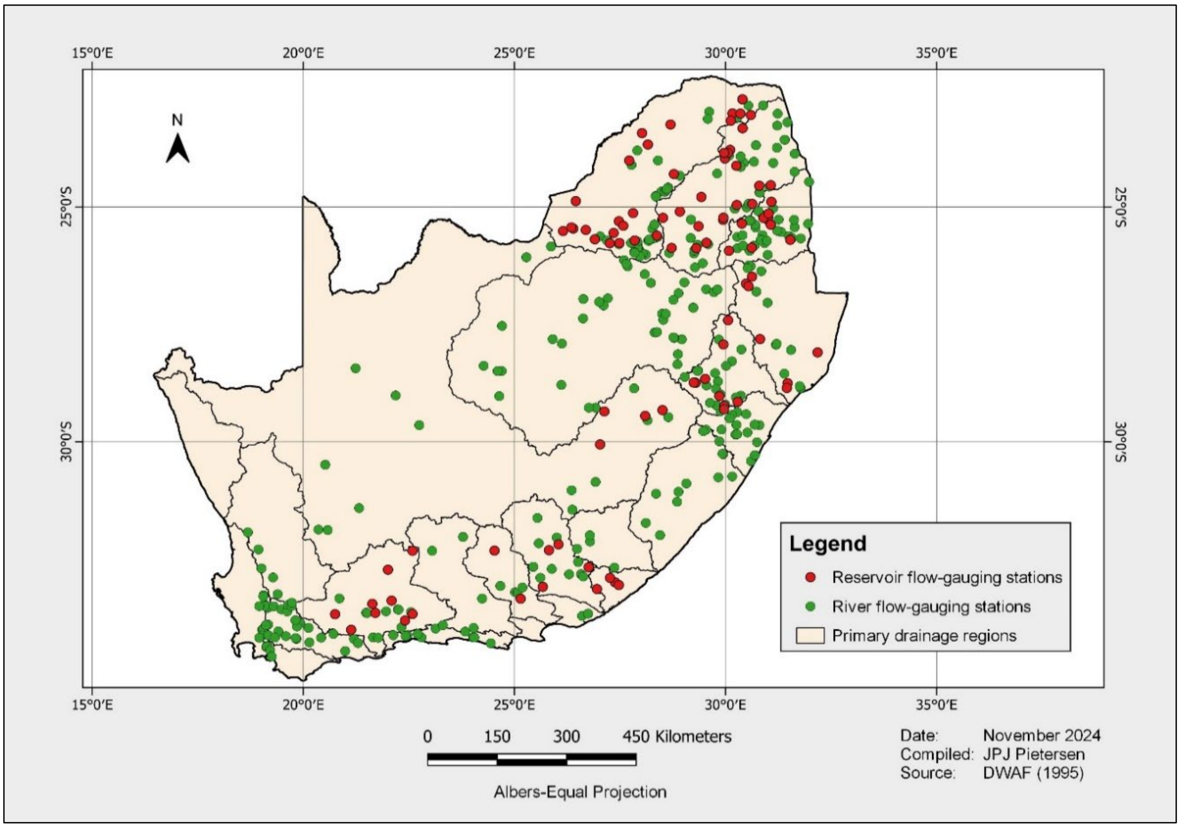


Figure 3.5: Location of the 326 river and 85 reservoir flow-gauging stations in South Africa (DWAF, 1995)

These 411 catchments in Figure 3.5 represent the diverse variations in climate, catchment geomorphology, channel geomorphology, geographical location and altitude across South Africa.

3.5 River Drainage Network

South Africa's river drainage network is defined by three major horse-shoe-shaped divides concentric to the coastline. The outer arc follows the Great Escarpment, separating coastal rivers from inland plateau drainages. The central arc divides the Orange River basin from the Limpopo and the inner arc separates the Limpopo and Zambezi basins in Zimbabwe from fossil endorheic rivers in Botswana

(Moore *et al*., 2009). Key river basins include the Nkomati, Limpopo, Maputo, Orange-Senqu, Thukela, and Umbeluzi, shared with neighbouring countries (Ashton *et al.,* 2008). South Africa shares four international river basins, which are the Inkomati, Limpopo, Maputo and Orange/Senqu, with six neighbouring countries, namely Botswana, Eswatini, Lesotho, Mozambique, Namibia, and Zimbabwe (DWS, 2022). The major rivers in South Africa in relation to the PDRs are listed in Table 3.2 (DWS, 2016).

Table 3.2: Major rivers located within the PDRs (DWS, 2016)

PDRs	Major rivers
A	Limpopo, Matlabas, Mokolo, Lephalala, Mogalakwena, Sans, Nzhelele, Mutale and Luvuvhu.
B	Olifants, Elands, Wilge, Steelpoort and Letaba.
C	Vaal, Modder, Riet, Makwasie, Leeu, Sandspruit, Palmietspruit and Harts.
D	Orange, Kraai, Molopo, Kuruman, Vis, Brak, Ongers, Hartbees, Carnavornleegte, Mohaweng, Plepane and Mareetsane.
E	Olifants, Berg, Steenbras and Diep, Doorn, Krom, Sand and Sout.
F	Modder, Riet, Caledon, Ongers, Kraai, Hartbees and Orange.
G	Berg, Diep, Eerste, Verlorevlei, Bot River, Klein and Uilkraal.
H	Breede, Sonderend, Sout, Bot, Palmiet, Gouritz, Olifants, Kamanassie, Buffels, Touws, Gamka, Goukou and Duiwenhoks.
J	
K	Little Brak, Great Brak, Karatara, Knysna, Keurbooms, Bloukrans, Lottering, Storms, Sandrif, Groot, Tsitsikamma, Klippedrift, Kromme, Seekoei and Kabelkous.
L, M, N, P, Q, R & S	Mzimvubu, Mtata, Mbashe, Buffalo, Nahoon, Groot Kei and Keiskamma, Kowie, Fish, Boesmans, Gamtoos, Sundays, Kromme, Goukou and Duiwenhoks.
T	Slang, Xuka, Mtata above Mtata dam), Tsitsa, Pot, Mooi, Inxu, Wildebees and Gatberg.
U	Pongola, Mhlatuze, Mfolozi, Mkuze, Thukela, Mvoti, Umgeni, Umkomazi, Umzimkulu and Mtamvuna.
V	
W	Umfolozi River, White Umfolozi River, Black Umfolozi River, Pongola River and Mkuze River.
X	Crocodile (east), Nwanedzi, Sabie, Komati and Usuthu.

3.6 Soils

In South Africa, two primary soil classification systems are used. The binomial classification system, developed by Macvicar *et al.* (1977), includes soil forms and series, generally referred to as the 'Red Book' in practice. The taxonomic classification system, established by the Soil Classification Working Group (SCWG), (1991), comprises 73 soil forms, families, and series, generally known as the 'Blue Book'. Hydrological interrelationships between soil forms, families, and series were detailed by Schulze *et al*. (1991). Each soil family is linked to a corresponding soil series and the 501 identified soil series are assigned to SCS hydrological soil groups (SCS HSG), namely A, B, C, or D, as well as intermediate groups (A/B, B/C, and C/D) (Schulze *et al.,* 2004). Figure 3.6 shows the SCS-SA soil groupings across South Africa utilised for weighted hydrological soil group calculations (Schulze and Schütte, 2018).

3.7 Generalised Veld-type Regions

South Africa is categorised in nine (9) generalised veld-type regions as listed in Table 3.3 (SANRAL, 2013).

Table 3.3: Generalised veld type regions (after SANRAL, 2013)

No.	Generalised veld type	No.	Generalised veld type
1	Coastal tropical forest	5a	Weakly developed zone 5 soils
2	Schlerophyllous bush	6	Karoo
3	Mountain sourveld	7	False karoo
4	Grasslands of interior plateau	8	Bushveld
5	Highland sourveld and Dohne sourveld	9	Tall sourveld

The generalised veld-type map (HRU, 1972) and proposed by SANRAL (2013), is shown in Figure 3.7. Typically, Figure 3.7 was used to determine the weighted veld type regions associated with each catchment under consideration when the SUH and LRH methods were applied. The distribution of dolomitic areas is also shown.

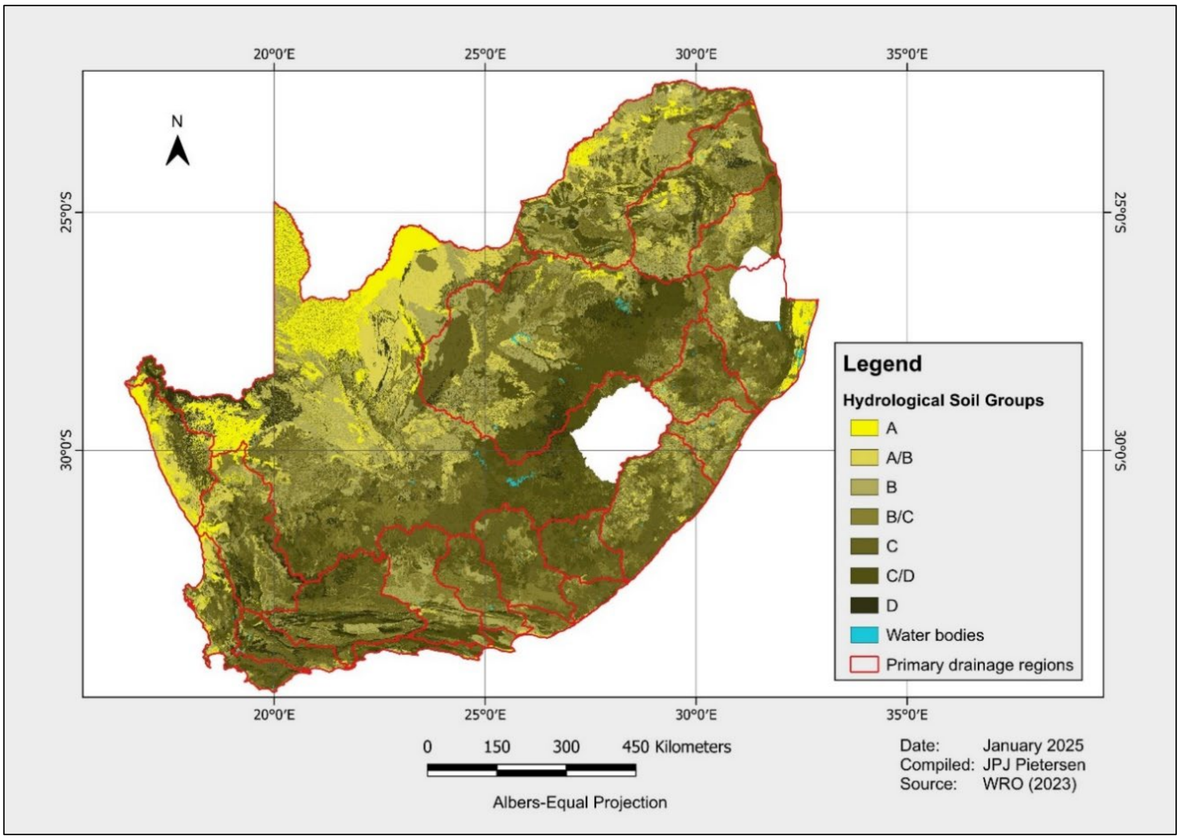


Figure 3.6: SCS-SA soil groupings across South Africa (after Schulze and Schütte, 2018)

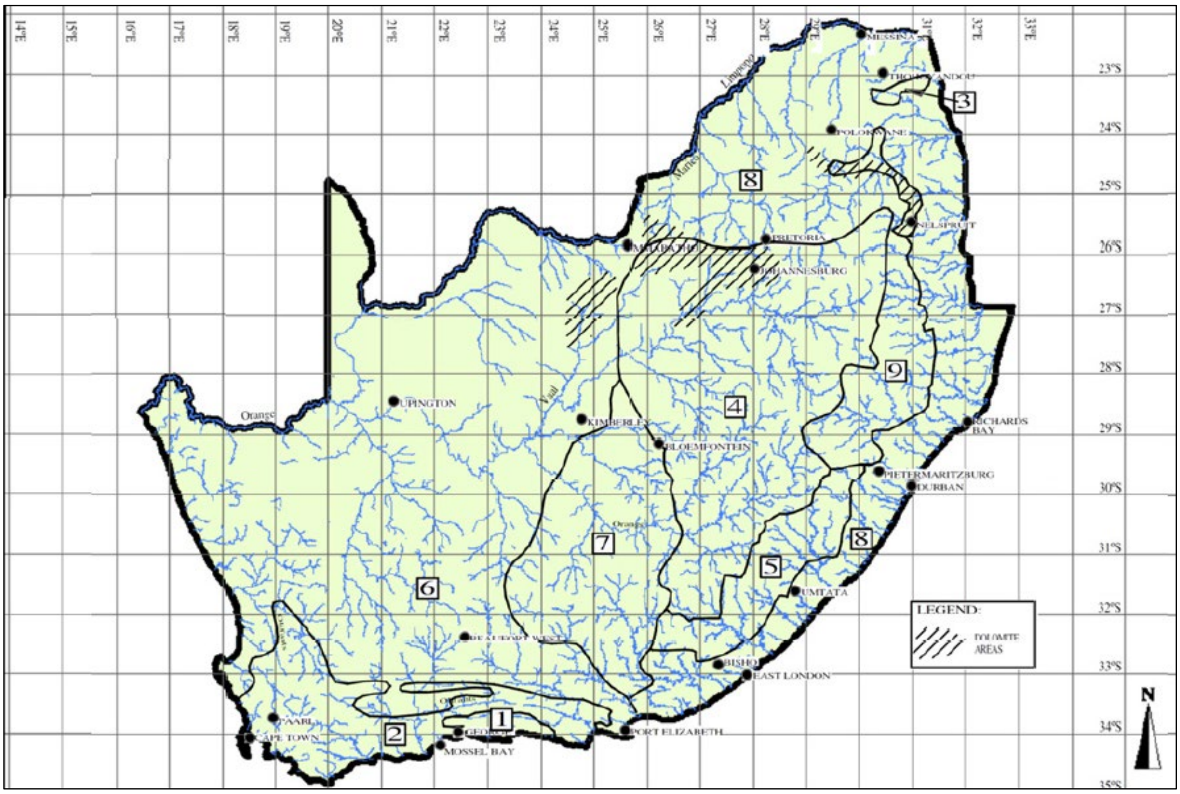


Figure 3.7: Generalised veld type regions in South Africa (SANRAL, 2013)

3.8 Land Cover

Numerous resources related to land cover (LC) at a national level are available in South Africa. Over the years, the South African National Land Cover (SANLC) data sets have been compiled and are accessible for this purpose. The most recent and commonly used data sets available from the Department Forestry, Fisheries, and the Environment (DFFE) are categorised as follows:

(a) **SANLC 2013/2014:** Actual land cover/use classes in the 2013/2014 NLC data set (Department of Environmental Affairs (DEA), 2015; GeoTerraImage (GTI), 2015).

(b) **SANLC 2018:** Actual land cover/use classes in the 2018 NLC data set (DEA, 2019; GTI, 2019).

(c) **SANLC 2020:** Actual land cover/use classes in the 2020 NLC data set (DEA, 2021; GTI, 2021), which were adopted in this study.

The SANLC 2013/2014 data set comprises 72-LC classes, aligned with the South African National Standards (SANS) 1877, the then South African Bureau of Standards (SABS) National Land Cover (NLC) classification standard for South Africa (DEA, 2016; GTI, 2016). In addition, the SANLC 1990 data set was produced, complementary to the SANLC 2013/2014 data set, containing the same 72-LC classes. The 2018 SANLC data set that adheres to gazetted LC classification standard (SANS 19144-2) consists of 73-LC classes, including natural estuaries, lagoons, lakes, rivers, and artificial dams, with individual classes more hydrologically focused than the SANLC 2013/2014 data set. Moreover, the 2018 data set includes more detailed coastal land, fallow land road and rail, as well as mine classes with no equivalent classes in the SANLC 1990 or 2013/2014 data sets (DEA, 2016; GTI, 2016). The SANLC 2020 data set, derived from 20-meter Sentinel-2 satellite imagery, is an updated national land cover product succeeding the SANLC 2018. It follows the SANS 19144-2 classification system, continuing with the 73-LC classes, aggregated into nine Level 1 categories: waterbodies, forest land, grassland, wetlands, cultivated land, shrubland, built-up areas, barren land, mining and quarrying areas. The SANLC 2020 dataset represents a major consolidation and refinement of the 2018 system, focusing on standardisation, automated processing, harmonised class definitions, and improved spatial accuracy. The change assessment between 2018 and 2020 confirms measurable national increases in urbanisation, cultivation, forestry, and mining activity (DFFE, 2024). Furthermore, the DFFE developed the Computer Automated Land Cover (CALC) system to generate land cover data sets automatically, conduct accuracy assessments, and perform change detection between comparable land cover data sets. Brooker *et al*. (2023) recommended that Google Earth imagery should also be used to validate the NLC/hydrological conditions for corresponding time periods.

Figure 3.8 shows the additional imagery source used in this study, namely the National Aeronautics and Space Administration - Jet Propulsion Laboratory (NASA-JPL, 2013; Calitz, 2020).

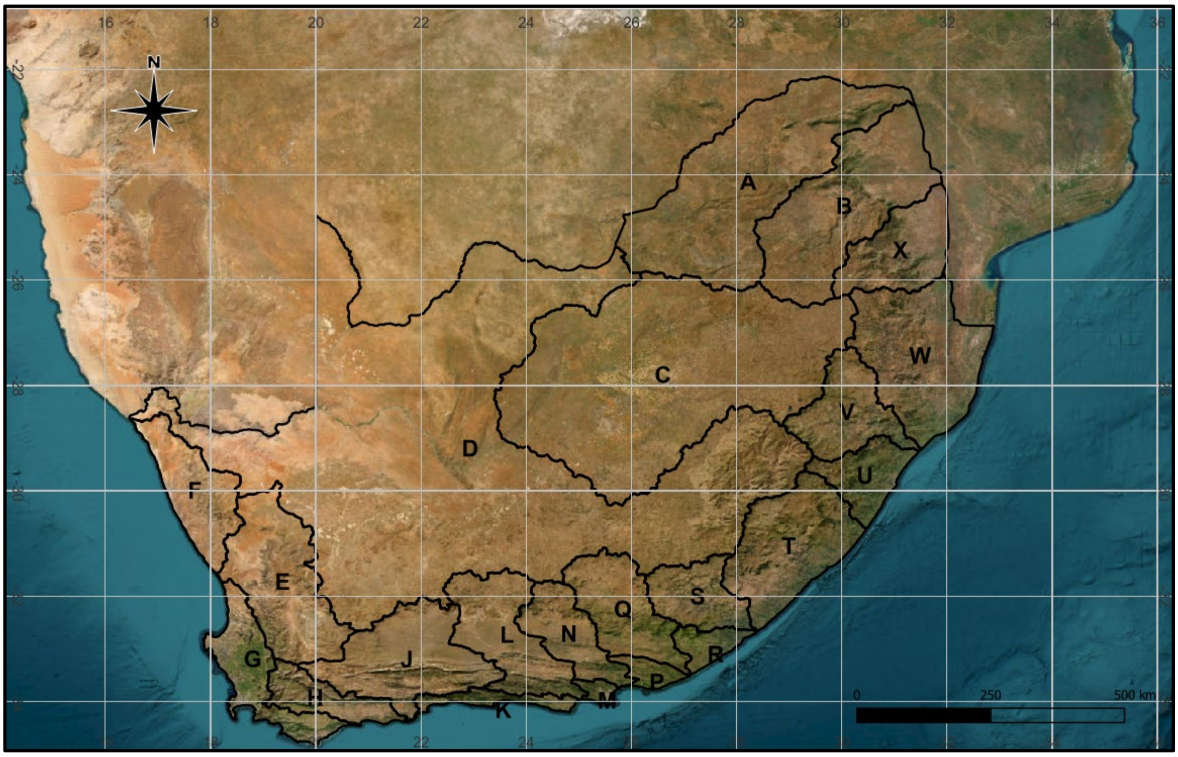


Figure 3.8: NASA-JPL (30 x 30 m high resolution imagery) combined with the 22 PDRs in South Africa (NASA-JPL, 2013; Calitz, 2020)

The next chapter outlines the methodological framework adopted to assess the performance of event-based deterministic and probabilistic methods within the South African context.

4. METHODOLOGY

This chapter outlines the methodology adopted to assess the performance of event-based deterministic and at-site probabilistic DFE methods in South Africa, building on the comprehensive literature review presented in Chapter 2. The methodology incorporates the fundamental components required for DFE, *i.e.*, the input, transfer function, and output. Subsequently, the approaches taken to: (i) estimate the input (design rainfall and associated parameters), (ii) define the transfer function (estimation of catchment characteristics), (iii) acquire, prepare and manage all required data sets, and (iv) estimate the deterministic and probabilistic design floods using appropriate software tools, are described in detail. Figure 4.1 provides an overview of the methodology adopted.

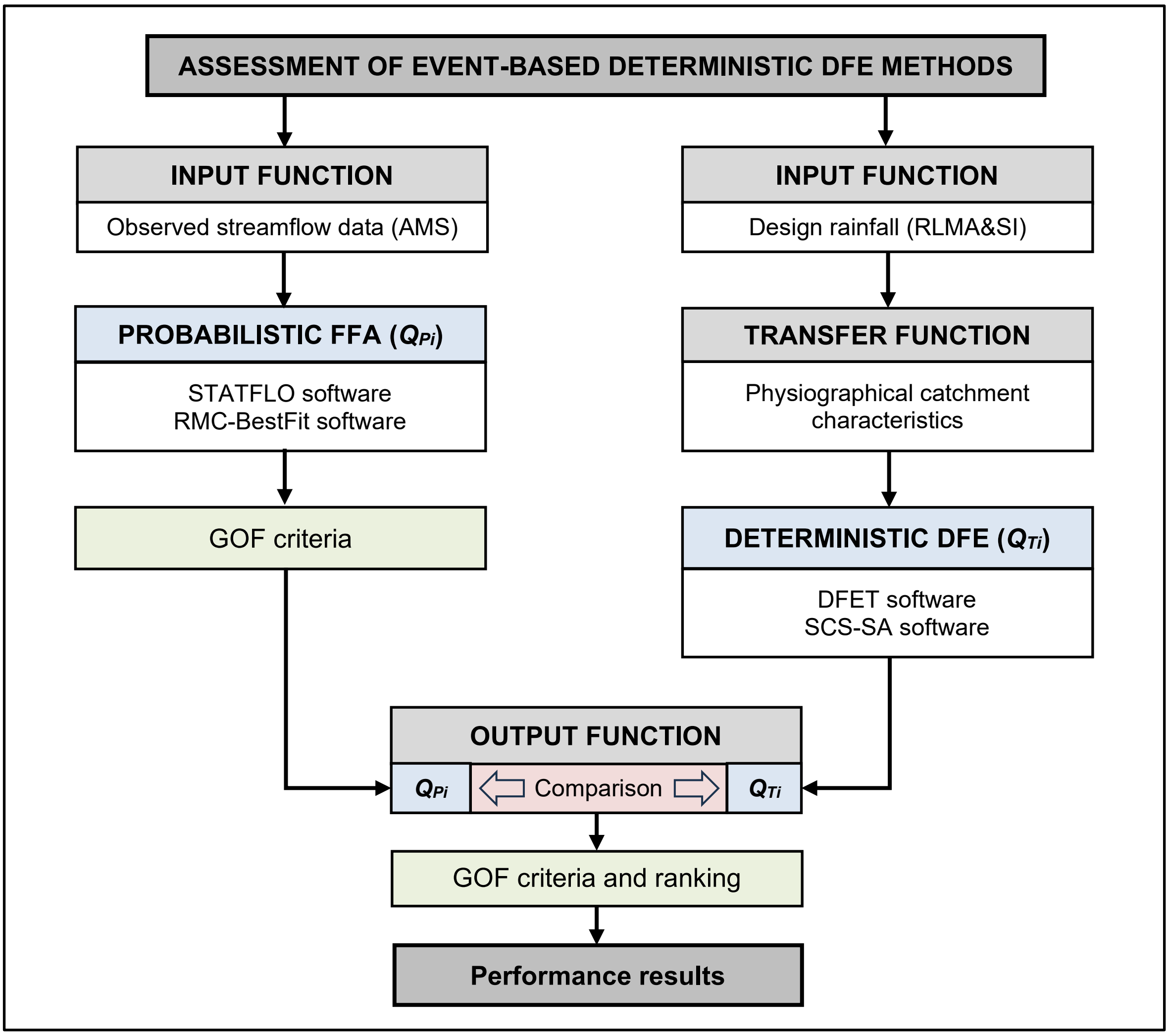


Figure 4.1: Research methodology flow diagram

4.1 Input Function: Observed and Design Rainfall

As the primary input function to DFE, rainfall of various intensities and duration largely determines the amount of surface runoff contributing to streamflow and flood events within a catchment area. Hence, the accurate conversion of observed rainfall to design rainfall is required to ensure that the most appropriate frequency interval (return period) is associated with rainfall of a specific depth and duration.

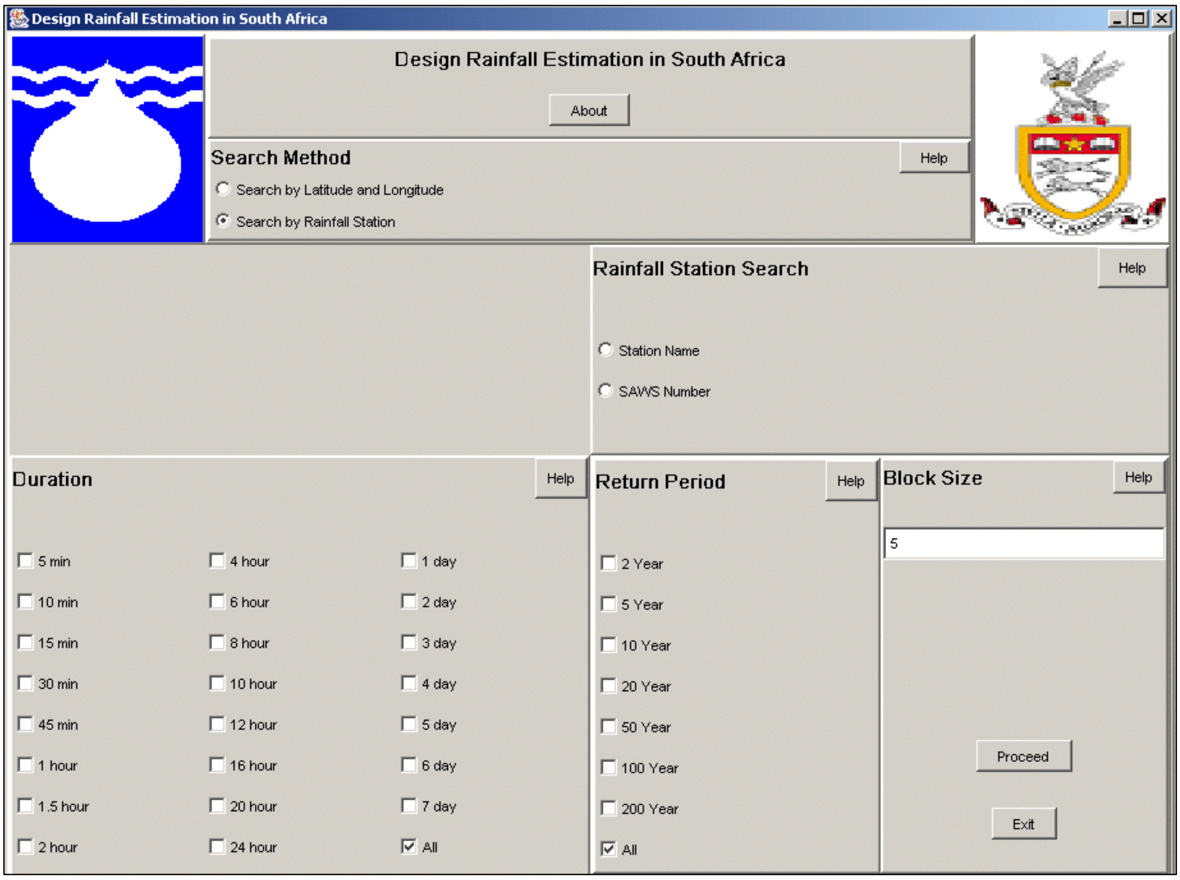
4.1.1 Design rainfall estimation (DRE)

As highlighted in Chapter 2, a regional rainfall approach is the preferred method for DRE in South Africa (Gericke and Du Plessis, 2011; SANRAL, 2013). Hence, the DRE software, based on the RLMA&SI approach (Smithers and Schulze, 2003), was used to estimate design point rainfall depths in this study. In comparison to a single site approach, the regional approach is more efficient and accurate for rainfall quantile estimation, given that statistical homogeneity within regions and heterogeneity between regions are appropriately considered (Hosking and Wallis, 1997; Smithers and Schulze, 2003). Typically, the RLMA&SI approach allows DRE calculations at any 1’x1’ grid point in South Africa, covering storm durations from five minutes to seven days and for return periods from two to 200 years, while the MAP is also estimated.

The graphical user interface (GUI) of the RLMA&SI approach is shown in Figure 4.2, while an example of a typical rainfall grid generated across a catchment (*e.g.*, X2H013) is shown in Figure 4.3.

4.1.2 Time of concentration

The time of concentration (T_C) associated with the most critical storm duration in a catchment was estimated using Equation 4.1, which is recommended by the United States Bureau of Reclamation (USBR, 1973) and SANRAL (2013) for defined watercourses. The average main watercourse slope was estimated using the 10-85 method (Eq. 4.2) as developed by the United States Geological Survey (USGS) and recommended by SANRAL (2013).



Design Rainfall Estimation in South Africa

Design Rainfall Estimation in South Africa

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Figure 4.2: RLMA&SI DRE GUI in South Africa (Smithers and Schulze, 2003)

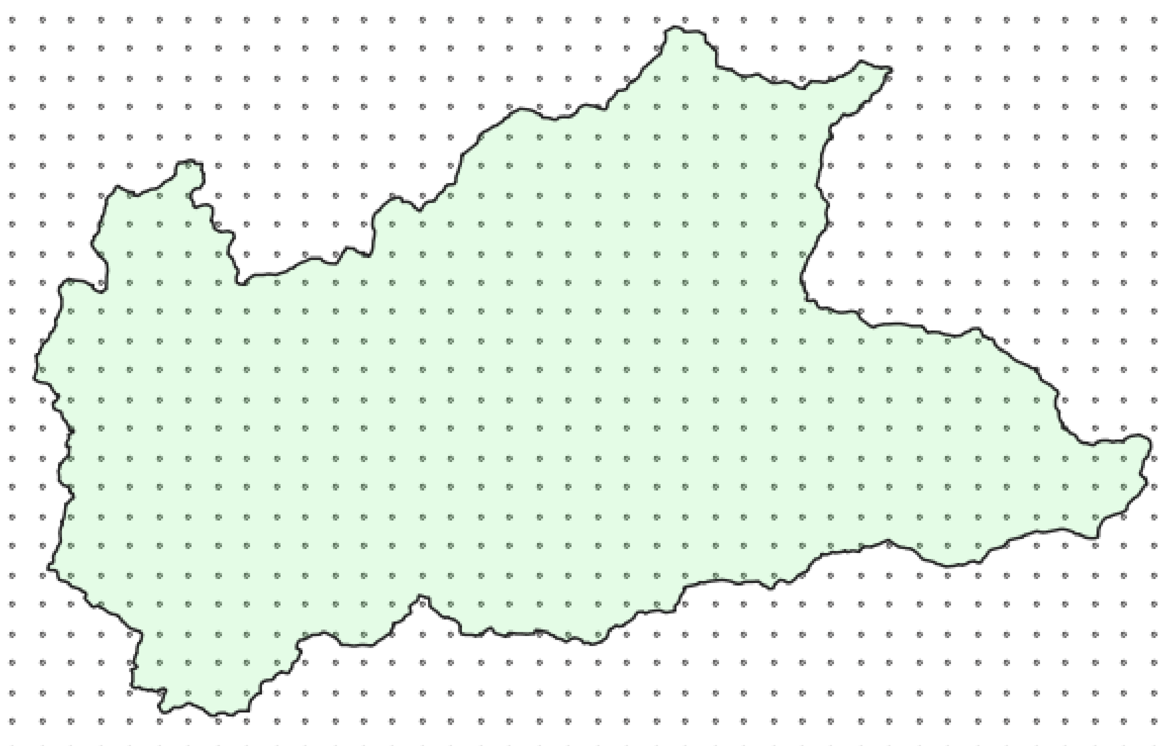


Figure 4.3: Typical example of a RLMA&SI rainfall grid in catchment X2H013

$$T_C = \left(\frac{0.87L_C^{\;2}}{1000S_{CH}}\right)^{0.385} \tag{4.1}$$

$$S_{CH} = \frac{\left(H_{0.85L_{CH}} - H_{0.10L_{CH}}\right)}{(0.75L_{CH})} \tag{4.2}$$

Where:

T_C = time of concentration (hours),
S_{CH} = average main watercourse slope (m/m),
$H_{0.85L}$ = height of main watercourse at length $0.85L_{CH}$ (m),
$H_{0.10L}$ = height of main watercourse at length $0.10L_{CH}$ (m), and
L_{CH} = length of main watercourse (m).

4.1.3 Areal reduction factors

The only two geographically-centred ARF methods available in South Africa were used to estimate and compare the ARFs required to convert average design point rainfall into average areal design rainfall within the bounds of a fixed catchment area, i.e., Equation 4.3 (Alexander, 2001) and Equations 4.4 and 4.5 (Pietersen, 2023). Equation 4.3 was transposed and developed from the UK Flood Study Report (FSR) ARF diagrams as initially developed and proposed by the Centre for Ecology and Hydrology (CEH; NERC 1975; Faulkner 1999). Hence, limited local rainfall data was used during the calibration and verification of Equation 4.3 in South Africa, while the ARF estimates remain constant for all return periods. In contrast, Equation 4.4 is based on a regionalised approach to estimate long duration (≥ 24-hour), geographically-centred ARFs which vary with return period and are based on daily rainfall data from 1 779 daily rainfall stations distributed throughout South Africa in five distinctive ARF regions. The latter methodology is not only new to the South African flood hydrology research community and practice, but it was subjected to extensive calibration and verification processes to result in the stand-alone ARF software interface as reported and further evaluated by Pietersen *et al.* (2024a; 2024b) in a range of default and actual catchment areas, storm durations, and return periods. The ARF software GUI is shown in Figure 4.4, while the regional calibration coefficients are listed in Table 4.1.

$$ARF_1 = [90000 - 12800Ln(A) + 9830Ln(60T_C)]^{0.4} \tag{4.3}$$

$$ARF_2 = aX^2 + bX - c \tag{4.4}$$

$$\begin{aligned} X &= x_1 log\left(\frac{Tc}{24}\right)^2 + x_2 log\left(\frac{Tc}{24}\right) - x_3 log(T)^2 + x_4 log(T) \\ &\quad - x_5 log(A)^2 - \; x_6 log(A) + x_7 \end{aligned} \tag{4.5}$$

Where:

ARF = areal reduction factor (%),

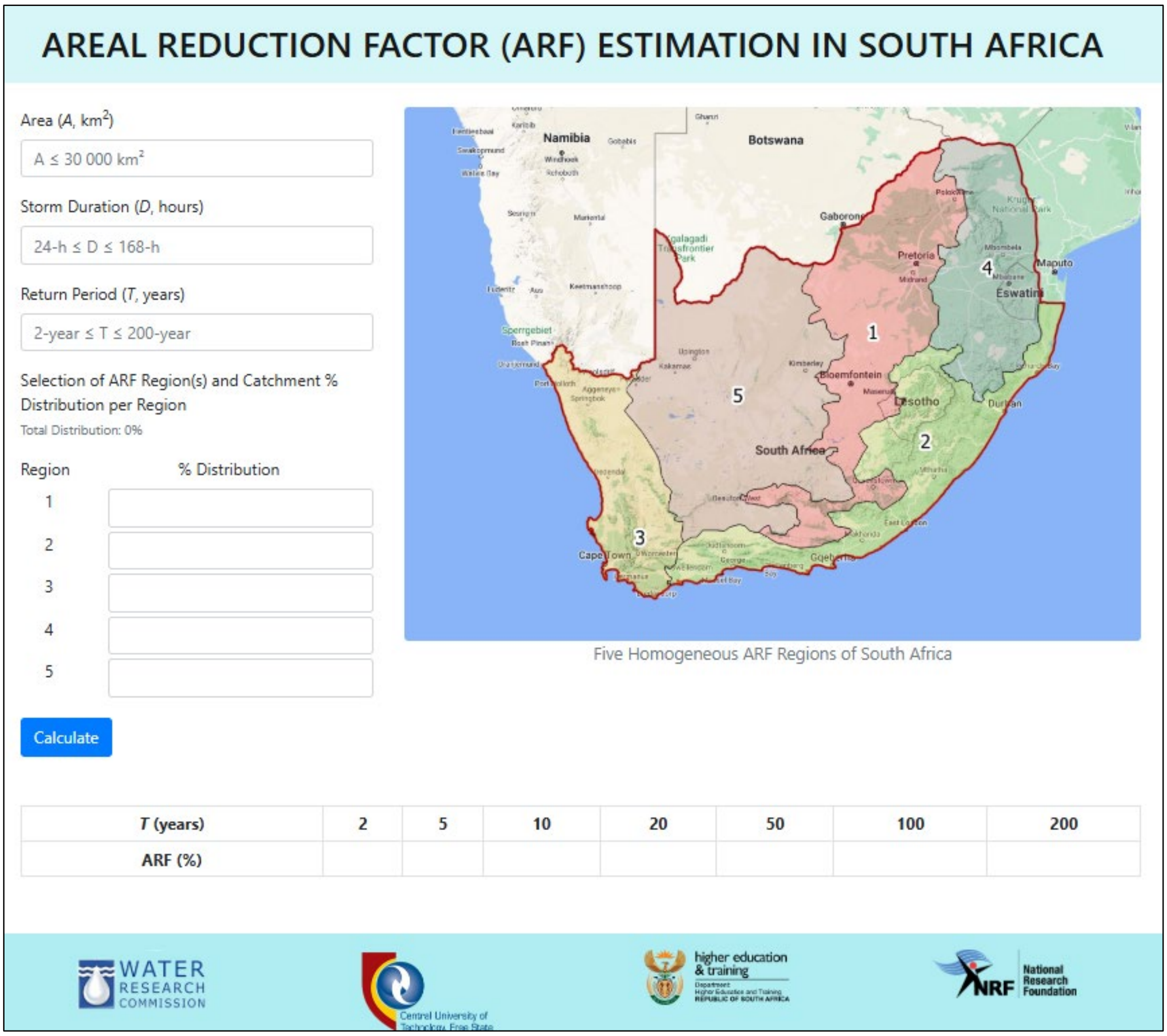
A = catchment area (km²),

a to c = major expression constants,

T = return period (years),

Tc = time of concentration (hours),

X = major expression variable and x_1 - x_7 is the regional calibration coefficients (Table 4.1).



AREAL REDUCTION FACTOR (ARF) ESTIMATION IN SOUTH AFRICA

Area (A, km^2)

A ≤ 30 000 km²

Storm Duration (D, hours)

24-h ≤ D ≤ 168-h

Return Period (T, years)

2-year ≤ T ≤ 200-year

Selection of ARF Region(s) and Catchment % Distribution per Region

Total Distribution: 0%

Region	% Distribution
1	
2	
3	
4	
5	

Five Homogeneous ARF Regions of South Africa

T (years)	2	5	10	20	50	100	200
ARF (%)							

Figure 4.4: ARF design software GUI (Pietersen *et al.*, 2024a)

Table 4.1: Calibration coefficients for the five (5) ARF regions (Pietersen, 2023)

Region	*a*	*b*	*c*	x_1	x_2	x_3	x_4	x_5	x_6	x_7
1	-0.034	7.286	287.648	-9.415	19.494	1.164	7.666	0.754	1.081	86.067
2	-0.037	7.896	319.770	-9.527	18.229	1.042	6.816	0.629	1.058	88.019
3	-0.055	11.395	487.770	-7.608	15.724	0.330	4.562	0.330	1.216	89.190
4	-0.024	5.391	196.710	-12.363	24.372	0.817	7.660	0.540	2.436	85.056
5	-0.025	5.502	200.890	-11.957	23.453	0.896	7.037	0.953	0.129	84.444

4.1.4 Rainfall regions

The summer and winter rainfall regions in South Africa have been classified in various studies, with Weddepohl (1988) introducing a key regional rainfall map, while Gericke (2010) overlayed the latter map on the SAWS rainfall station reference grid (SANRAL, 2013) to distinguish between the Type 1 (Winter/coastal) and Type 2 (Inland/summer/all year) rainfall regions as required when the RM is applied (*cf*. Figure 4.5).

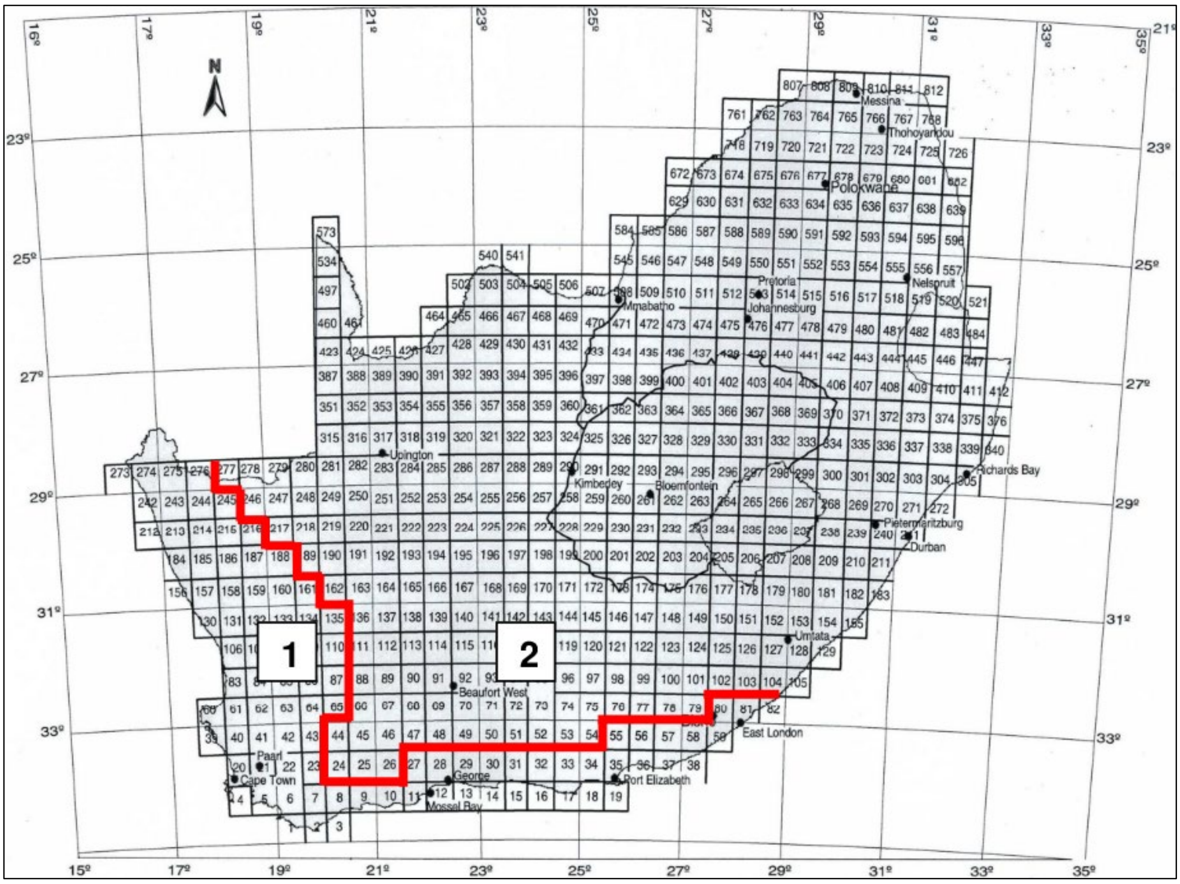


Figure 4.5: Type 1 and 2 rainfall regions in South Africa (after Gericke, 2010)

4.2 Transfer Function: Catchment Characteristics

The catchment characteristics which need to be considered in DFE significantly shape the transfer function, as these characteristics influence storm rainfall losses due to variations in storage capacity. This process includes water absorption through infiltration, retention in surface depressions, groundwater seepage, and evaporation. Runoff generation is highly variable in both time and space, influenced not only by rainfall volume and intensity, but also primarily by various physiographical parameters that define the characteristics of a catchment.

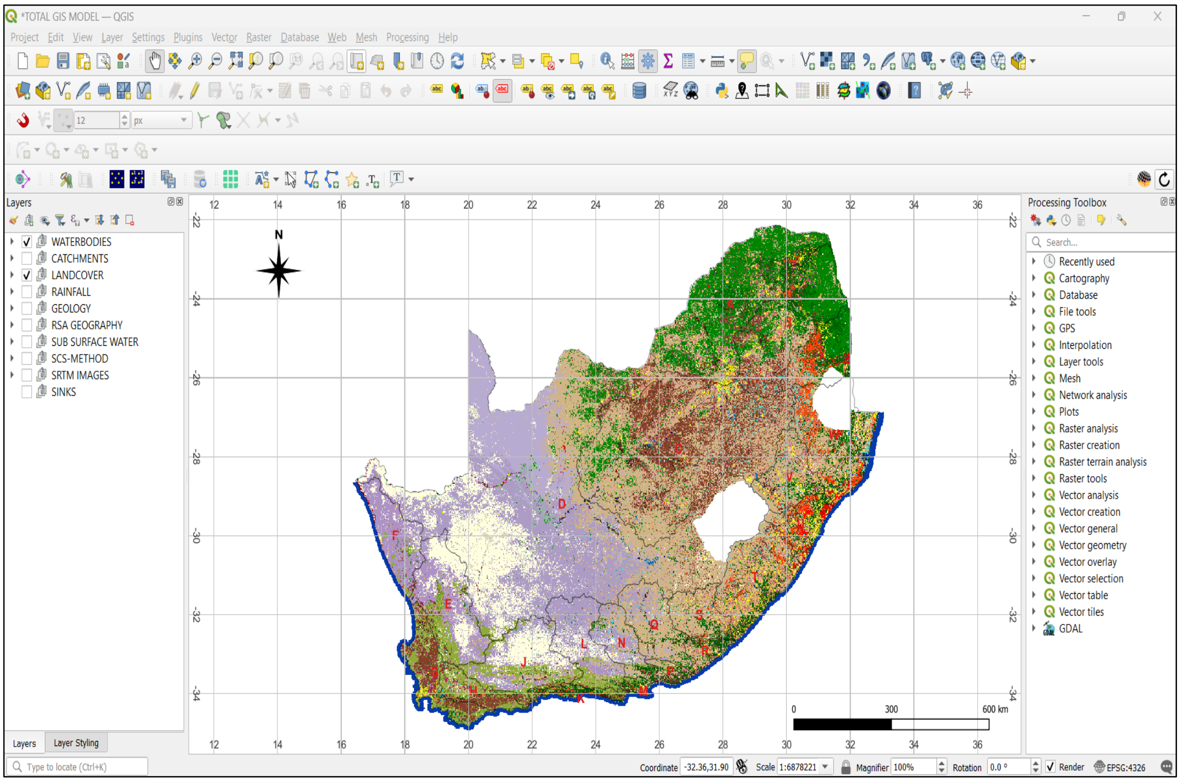
4.2.1 National hydrological database

The National Flood Studies Programme (NFSP; Smithers *et al.,* 2014) identified the need for an integrated catchment parameter database for hydrological studies across South Africa. Such a database would enhance flood research and assist in advancing DFE methods in the country through promoting collaboration, efficiency, and informed decision-making amongst practitioners. Key benefits include data standardisation, improved data quality, centralised access to data, reduced duplication, long-term monitoring, transparency, accountability, and controlled scrutiny of data. Calitz (2020) developed a hydrological catchment parameter database, which the NFSP accepted as their primary unified hydrological database, pending quality control validations when utilised. In this study, the following parameters were extracted from the Calitz (2020) database:

- Gauged catchment area (A, km²);
- Distribution of rural, urban, and lake areas (%) ;
- Longest main watercourse (L_{CH}, km);
- Average main watercourse slope (S_{CH}, m/m);
- Distance to the catchment centroid (L_c, km); and
- Average catchment slope (S, %).

4.2.2 Additional catchment parameters

All the other catchment parameters, such as generalised veld-type regions, hydrological soil groups, land cover classes, and urbanised areas and homogeneous ARF regions. were obtained through geographic information system (GIS) technology, which facilitated efficient data extraction and analysis. The Quantum Geographical Information System (QGIS) Version 3.26.2, as shown in Figure 4.6, was primarily used. QGIS is open-source software which supports raster, vector, and mesh layers for spatial data analysis, editing, and map creation. It stores vector data as point, line, or polygon features and supports multiple raster formats, including georeferencing images (QGIS, 2022).



☑ WATERBODIES
☐ CATCHMENTS
☑ LANDCOVER
☐ RAINFALL
☐ GEOLOGY
☐ RSA GEOGRAPHY
☐ SUB SURFACE WATER
☐ SCS-METHOD
☐ SRTM IMAGES
☐ SINKS

Coordinate -32.36,31.90 Scale 1:6878221 Magnifier 100% Rotation 0.0 ° ☑ Render EPSG:4326

Figure 4.6: QGIS version 3.26.2 GUI (QGIS.org, 2022)

The following spatial data files were used in QGIS to extract supplementary data sets (HRU, 1972; NASA-JPL, 2013; SANRAL, 2013; Beukes, 2018; Calitz, 2020; DEA & GTI, 2020; Schulze and Schütte, 2020 and Pietersen, 2023):

- Generalised veld-type regions including dolomite areas (HRU, 1972; SANRAL, 2013);
- Shuttle Radar Topography Mission (SRTM) data from NASA-JPL in 30x30 m resolution (NASA-JPL, 2013);

- Agricultural Research Council (ARC) terrain unit data set (SCS-TU shapefile) (Beukes, 2018);
- PDRs and continuous-flow gauging stations (Calitz, 2020);
- Actual land cover/use classes in the 2020 NLC data set (SA-NLC-2020-GEO shapefile) (DEA, 2021; GTI, 2021);
- SCS-SA soil groupings across South Africa (Schulze and Schütte, 2020); and
- Five homogeneous ARF regions of South Africa (Pietersen, 2023).

The procedures outlined in the subsequent sections were used to extract all the necessary data from the specified spatial data files to determine the required catchment parameters. A weighted approach was crucial to ensure that the data utilised for determining curve numbers (*CN*s) for the SCS methods, as well as rural and urban runoff coefficient values (*C*) for RM3, accurately represents the unique characteristics of each catchment.

4.2.3 Curve numbers and rural runoff coefficients

The SA-NLC-2020-GEO shapefile, which includes 73 land cover (LC) classes, along with the SCS-TU shapefile containing the average hydrological soil values associated with terrain units, and the delineated catchment spatial data files, was used for data extraction. By applying reclassification, the process of calculating the required weighted *CN* and rural runoff coefficient (*C*) values was streamlined. The LC classes were reclassified into general *CN* categories for use in the SCS methods, which include: (i) agriculture, (ii) open space, (iii) forest, (iv) disturbed land, (v) residential, (vi) paved, and (vii) commercial/industrial areas (Schulze *et al*., 1992). Moreover, the SCS-HSG were assigned numerical identifiers (A–1, A/B–2, B–3, B/C–4, C–5, C/D–6, and D–7) to enhance processing efficiency and simplifying data referencing during the computational analyses. Furthermore, the LC classes were also reclassified into five primary land use/vegetation categories: (i) thick bush and plantations, (ii) light bush and farmlands, (iii) grasslands, (iv) cultivated land merged with contoured cultivated land, and (v) no vegetation (CSIR, 2001) for use in the RM3.

The data extraction approach involved integrating land cover and hydrological soil group (HSG) data to generate a single composite data set. This data set was then extracted according to the delineated catchments to identify specific land cover–soil group combinations for subsequent analyses. This process commenced by ensuring that all data sets, including the SA-NLC-2020-GEO raster layer, the SCS-TU vector shapefile, and the delineated catchment shapefiles, are loaded into QGIS and do share a common coordinate reference/projection system. To ensure the integrity of the input data, the *Fix Geometries* tool was applied to the SCS-TU and catchment shapefiles to resolve any geometric errors and border leakages.

Next, the *Zonal Statistics* tool was used to integrate (union) land cover data with hydrological soil group zones. The SCS-TU shapefile was specified as the input layer and the SA-NLC-2020-GEO raster was selected as the raster layer. Relevant statistics were calculated to describe the land cover distribution within each HSG zone. The resulting statistics were added as new attributes to the SCS-TU shapefile. Subsequently, the *Clip* tool was employed to extract data specific to each delineated catchment. The updated SCS-TU shapefile containing the zonal statistics was used as the input layer, while the delineated catchment shapefile served as the overlay layer. The output was a series of polygons representing the delineated catchments, each with attributes summarising land cover and HSG information.

Finally, the attribute tables from the resulting data set were exported to Microsoft Excel for reclassification, standardisation, and further analyses. In Excel, land cover counts for each catchment were summarised using pivot tables, percentages were calculated, HSG-based *CN* values were assigned, and weighted *CN* values for each catchment were computed. This facilitated the calculation of land cover percentage distributions within each catchment, incorporating the corresponding HSG data.

A similar process was employed to extract the data required for reclassifying and calculating the rural runoff coefficients required as input to the RM3.

4.2.4 Urban runoff coefficients

The impact of urbanisation was evaluated by incorporating urban influences into the DFE for catchments where urban areas constitute at least 10% of the total catchment area. The threshold was set at 10% based on the premise that urbanisation affecting less than this proportion of a catchment has minimal influence on hydrological processes, such as runoff generation and peak flow rates, often indistinguishable from natural variability. By adopting this threshold, the analysis ensures that urban-induced hydrological changes are significant enough to be reliably quantified, enhancing the relevance and robustness of the study's findings. Oudin *et al*., (2018) identified a 10% impervious surface threshold beyond which high, low, and mean flows are noticeably altered, marking a critical point where urbanisation impacts hydrology.

Data necessary for calculating urban runoff coefficients was extracted from the high-resolution 30 x 30 m NASA-JPL imagery, which served as the base layer, providing comprehensive topographical and land cover information. Catchment shapefiles were overlaid on the imagery to ensure that the analysis of urban categories was conducted within the boundaries of each catchment. The *Polygon* tool in QGIS was used to manually delineate different urban categories, creating separate shapefiles for each category within the catchments. The attribute tables of these shapefiles were then used to calculate the percentage distribution of each category, enabling accurate identification, delineation, and quantification of the following urban categories:

- Lawns (sandy or heavy soil types);
- Residential areas (houses and flats);
- Industry (light, average, and heavy industry); and
- Business (city centres, suburban areas, and streets).

4.2.5 Generalised veld-type regions

The HRU (1972) generalised veld-type regional map, as referenced by SANRAL (2013), was used to determine the weighted veld-type values for each catchment, supporting their application in the DFE methods. In using the *Overlap*

Analysis tool in QGIS, the proportional distribution of various regions across each catchment area was established. Spatial associations amongst the features within the input layers were established by identifying overlapping regions, providing a comprehensive understanding of their interactions. The resulting layer delineated the extent of overlap, offering a clear visual representation of the intersections between the catchment boundaries and the veld-type regions. To quantify this overlap, the information was transformed into a weighted mean, reflecting the proportion of each veld-type region relative to the total catchment area. This weighted mean was then used to allocate the corresponding veld-type region accurately to each catchment, ensuring that the analyses accounted for the spatial distribution of the veld-type regions as required in the SUH and LRH methods.

4.2.6 Overland flow and artificial flow paths

Given the extent of the catchment sizes under consideration, both overland flows and artificial flow paths were regarded as 'main watercourse flow' and the associated T_C values were estimated using Equation 4.1 as outlined in Section 4.1.2. The afore-mentioned omission of overland/artificial flow paths is justified given that surface properties which govern overland flow conditions become irrelevant during high (flood) flows and are limited to approximately 110 m on flat slopes (Gericke and Smithers, 2014). Similarly, the influence of artificial flow paths, such as street and canal flows, is also insignificant under these circumstances in large catchments.

4.3 Output: Probabilistic and Deterministic Design Flood Estimation

The transformation of design rainfall and catchment characteristics into actionable flood estimations constitutes the output function of DFE. The at-site probabilistic FFAs and event-based deterministic DFE methods used in this study are presented in the subsequent sections. Thereafter, the relevant software tools used to execute the FFA, DFE, and associated analyses are discussed. The chapter concludes with the performance measures used to assess the event-based deterministic DFE results.

4.3.1 At-site probabilistic flood frequency analyses

At-site probabilistic (statistical) FFAs were performed at each flow-gauging station to summarise the data, estimate parameters, and identify suitable theoretical probability distributions. The statistical flood estimation tool (STATFLO; Van der Spuy and Du Plessis, 2022; *cf*. Section 4.3.3) was used to the perform computations. The hydrological data were summarised by ranking the AMS in descending order of magnitude. The Z-set PP was applied to assign probabilities to the data points, while the MM was used to estimate parameters for fitting probability distributions. The statistical properties of each AMS data set, including the coefficient of variation, mean, skewness, and standard deviation were calculated. The most suitable probability distribution was typically selected based on these statistical properties, visual inspection of the plotted data, and GOF statistics. Based on the literature review in Chapter 2, the IPZA probability distribution was selected as the primary probability distribution, while the selection thereof was validated using a ranking-based procedure as outlined in Section 4.3.4.

AMS data management:

Only the AMS data sets were used in this research and obtained from the following data sources:

(a) DWS hydrological database https://www.dws.gov.za/Hydrology/Default.aspx (DWS, 2024);
(b) Latest processed dam (reservoir) and river flow data records obtained from the DWS Flood Studies Unit (Rademeyer, 2024);
(c) AMS data sets used by Van der Spuy and Du Plessis (2022); and
(d) AMS data sets used by Calitz (2020).

The data sets supplied by Calitz (2020) were designated to serve as the main/primary data source and were cross-verified with information obtained from the DWS hydrological database (DWS, 2024). Upon reviewing the data sets from the DWS hydrological database, it was found that most, if not all, records were accompanied by cautionary notes regarding data accuracy, in excess of 90%.

Consequently, these data sets were not integrated into the primary records. Moreover, it was established that the Calitz (2020) data set should be replaced by the later data sets from Van der Spuy and Du Plessis (2022) and the DWS Flood Studies Unit (Rademeyer, 2024), to serve as the primary AMS data sources.

Furthermore, 12 flow-gauging sites: A9H006, C2H027, D1H033, D2H034, E2H010, G1H015, J2H005, N1H002, V2R002, V2R003, W1R002, and Q4R001, contained unverified data accompanied by cautionary notes regarding accuracy. Subsequently, these sites were excluded from the analyses to mitigate potential uncertainties. In addition, A2H063, B7H020 and D1R003 were also excluded from the analyses owing to having less than 20 years of continuous records. A summary of the final AMS data sources applicable to the 411 gauged catchments ($0.6 \leq A \leq 361\ 995\text{km}^2$) is presented in Table 4.2.

Table 4.2: Summary of AMS data sources

AMS data source	Number of sites (%)
Van der Spuy and Du Plessis (2022)	320 (77.9%)
DWS processed dam (reservoir) records (2024)	45 (10.9%)
DWS processed river records (2024)	28 (6.8%)
Calitz (2020)	3 (0.8%)
Unverified/short data records (excluded)	15 (3.6%)
Total	**411**

Probability distributions:

The ranking-based selection procedure discussed in Chapter 2 (*cf.* Section 2.5) was employed to assess the performance (accuracy and potential bias) of the GEV, GPA, IPZA, LN and LP3 probability distributions. In addition, the GOF metrics outlined below (Equations 4.6 – 4.9) were also used to identify the most suitable probability distributions. The methodology involved the GOF-based ranking of the probability distributions based on their performance across all AMS data sets and return periods. The ranks of each distribution were summed to assess the overall performance, with the distribution achieving the lowest total rank identified as the best performer.

$$AIC \quad = -2k - 2\ log\ (L) \tag{4.6}$$

$$KS \quad = max|F_n(x) - F(x)| \tag{4.7}$$

$$R^2 \quad = 1 - \left(\frac{(1-r^2)(n-1)}{(n-k-1)}\right) \tag{4.8}$$

$$SBC \quad = -2Log(L) - k\ ln\ (n) \tag{4.9}$$

Where:

AIC = Akaike information criterion which evaluates model fit subjected to imposing a penalty for added complexity. It favours models offering the best balance between accuracy and simplicity (Akaike, 1974),

KS = Kolmogorov-Smirnov test which assess whether a sample conforms to a specific reference distribution, or it determines whether two samples originate from the same distribution by comparing their cumulative distribution functions (Massey, 1951),

R^2 = adjusted coefficient of determination, which accounts for the inclusion of variables that do not significantly improve the model by adjusting the r^2 value based on the number of predictors (Montgomery and Runger, 2011),

SBC = Schwarz Bayesian information criterion is comparable to the AIC; however, it imposes a stricter penalty for models with a greater number of parameters (Schwarz, 1978),

$F(x)$ = cumulative distribution function of the reference distribution,

$Fn(x)$ = empirical cumulative distribution function of the sample,

k = number of parameters in the model,

L = likelihood of the model, and

n = total number of observations.

The STATFLO Tool (*cf.* Section 4.3.3) used for the FFAs inherently only supports the GEV, IPZA, LN and LP3 probability distributions. However, modifications were made to also incorporate the GPA distribution.

4.3.2 Event-based deterministic flood estimation

Event-based deterministic DFE was performed using the RM3, SCS, SCS-SA, LRH, and SUH methods as outlined in Chapter 2. The standard procedures associated with each method were executed by default in using the different software tools listed in Section 4.3.3. In all cases, the relevant assumptions, limitations, and intended use of each DFE method were recognised and applied accordingly.

4.3.3 Software tools

Specialised software tools were utilised to execute the DFE, offering advanced computational capabilities for precise modelling and simulation of flood events across various hydrological scenarios. The detailed functionalities and operational instructions applicable to these tools are available in the literature (user manuals) and are therefore not included.

Microsoft Excel:

The creation of the comprehensive databases required in this study was carried out using the Microsoft Excel (MS Excel) platform (Microsoft Cooperation, 2018), a versatile and widely-used tool in data management. Various mathematical, statistical, logical, filtering, and sorting functions were used for effective data manipulation and analyses, while macros were used to automate tasks to ensure consistency and enhanced productivity when dealing with large data sets.

Python:

Python Version 3.13 (Python, 2024) is a programming language known for its simplicity. It was used to manipulate MS Excel spreadsheets and process the substantially large data sets. The integration of NumPy with MS Excel through libraries such as pandas enabled the efficient reading, manipulation, and analyses of data stored in Excel files. This combination harnessed the strengths of both tools, *i.e.*, Excel's user-friendly interface for data entry and visualisation, as well as NumPy's powerful numerical capabilities for data analysis.

STATFLO:

Van der Spuy and Du Plessis (2022) provided a comprehensive framework for applying probabilistic (statistical) methods to conduct FFAs. The STATFLO GUI, as shown in Figure 4.7, simplified data selection, analyses and plot generation; thereby eliminating the need for manual procedures. Typically, probability plots and regression lines were generated to assess and visualise the distribution of data points and their associated AEPs.

RMC-BestFit:

The RMC-BestFit 1.0 software (USACE, 2020), which is a Bayesian estimation and fitting tool, was used as a control measure to quality-assure outputs obtained with STATFLO (Van der Spuy and Du Plessis, 2022). The GUI (*cf.* Figure 4.8) is a menu-driven tool that performs distribution fitting and Bayesian estimation from a selection of probability distributions, offering an integrated modelling platform with data entry capabilities and quality report charts. Typically, the results of the applied GOF metrics (to select the most appropriate probability distribution) were verified using RMC-Bestfit to ensure both accuracy and consistency.

The flow diagram in Figure 4.9 summarises the modifications applied to STATFLO to incorporate the GPA distribution and to consolidate the outputs obtained from using the different software tools, *e.g.,* Excel, Python, and RMC-BestFit. Such modifications and/or consolidation were required to result in the most appropriate probabilistic flood peaks to be used as benchmark values when compared to the event-based deterministic flood peaks.

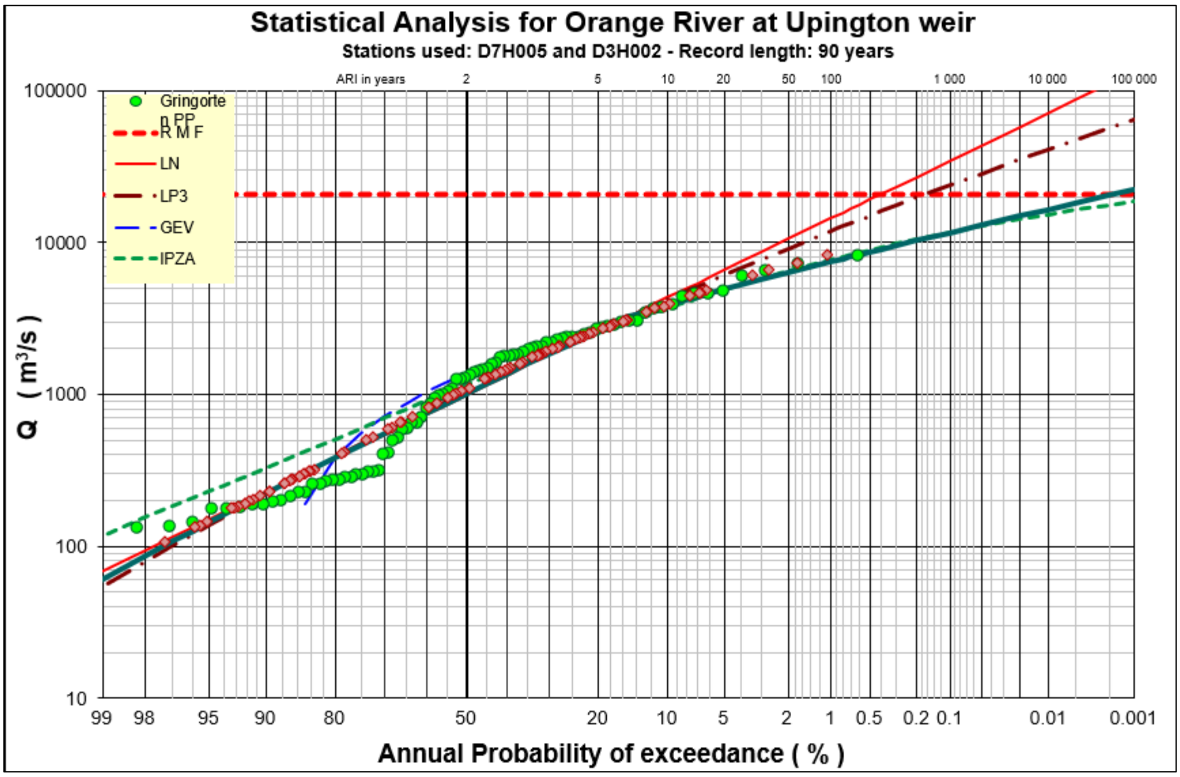
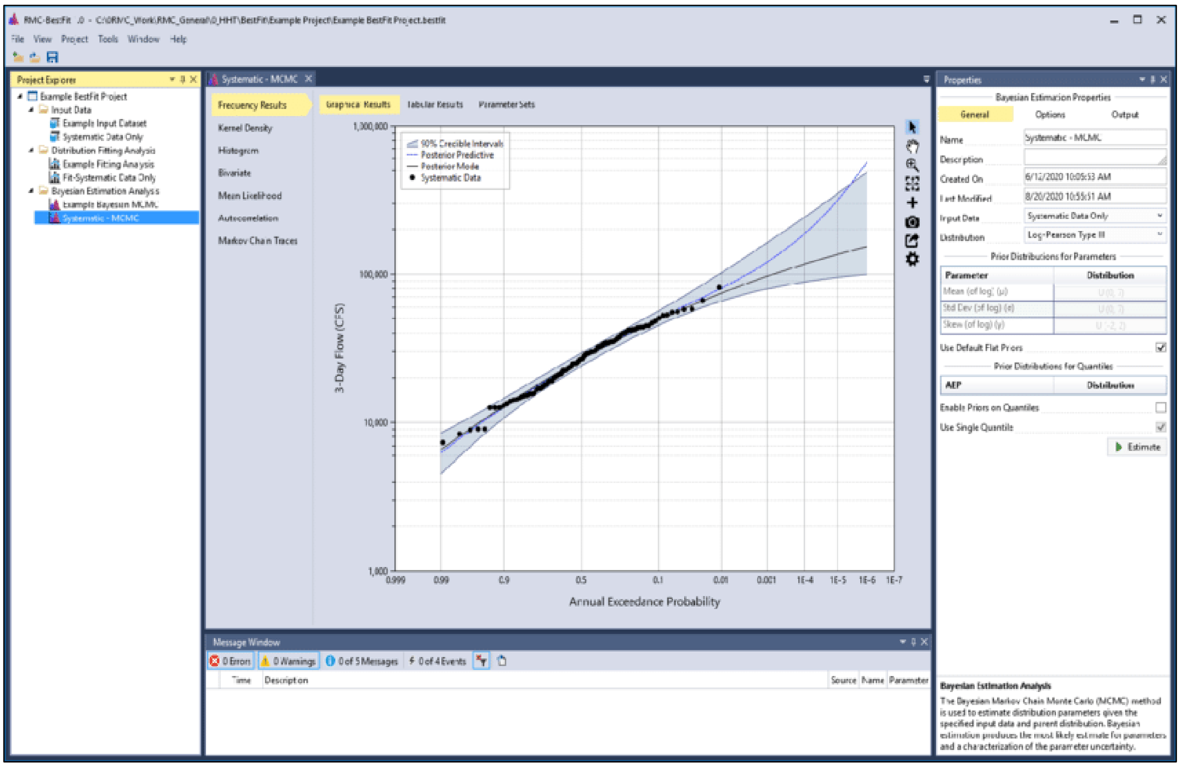


Figure 4.7: STATFLO GUI (Van der Spuy and Du Plessis, 2022)



Name: Systematic - MCMC
Description:
Created On: 6/12/2020 10:05:53 AM
Last Modified: 8/20/2020 10:55:51 AM
Input Data: Systematic Data Only
Distribution: Log-Pearson Type III

Parameter	Distribution
Mean (of log) (μ)	U(0, 7)
Std Dev (of log) (σ)	U(0, 7)
Skew (of log) (γ)	U(-2, 2)

Use Default Flat Priors ☑

AEP	Distribution

Enable Priors on Quantiles ☐
Use Single Quantile ☑

Bayesian Estimation Analysis

The Bayesian Markov Chain Monte Carlo (MCMC) method is used to estimate distribution parameters given the specified input data and parent distribution. Bayesian estimation produces the most likely estimate for parameters and a characterization of the parameter uncertainty.

Figure 4.8: RMC-BestFit 1.0 software GUI (USACE, 2020)

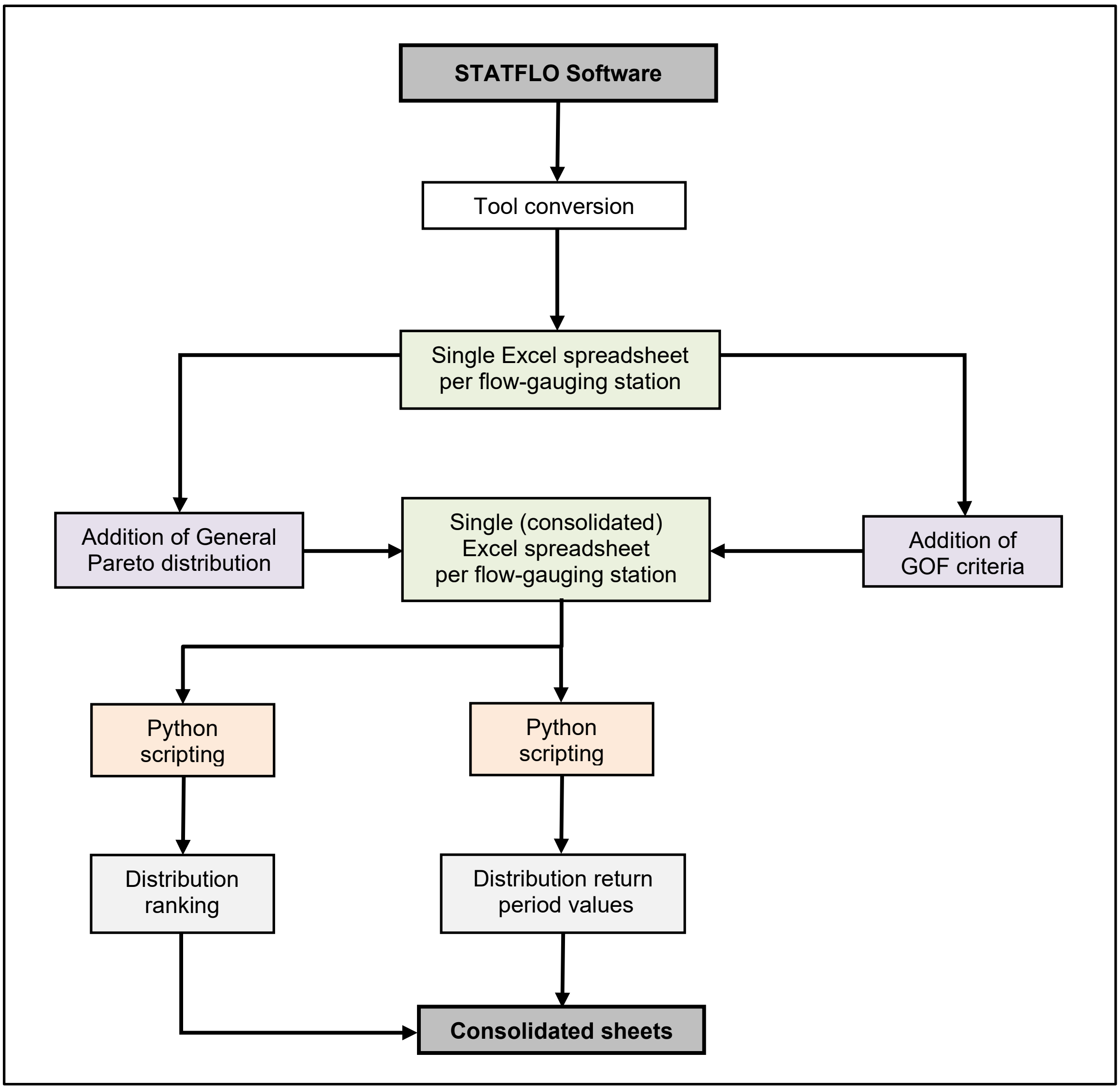
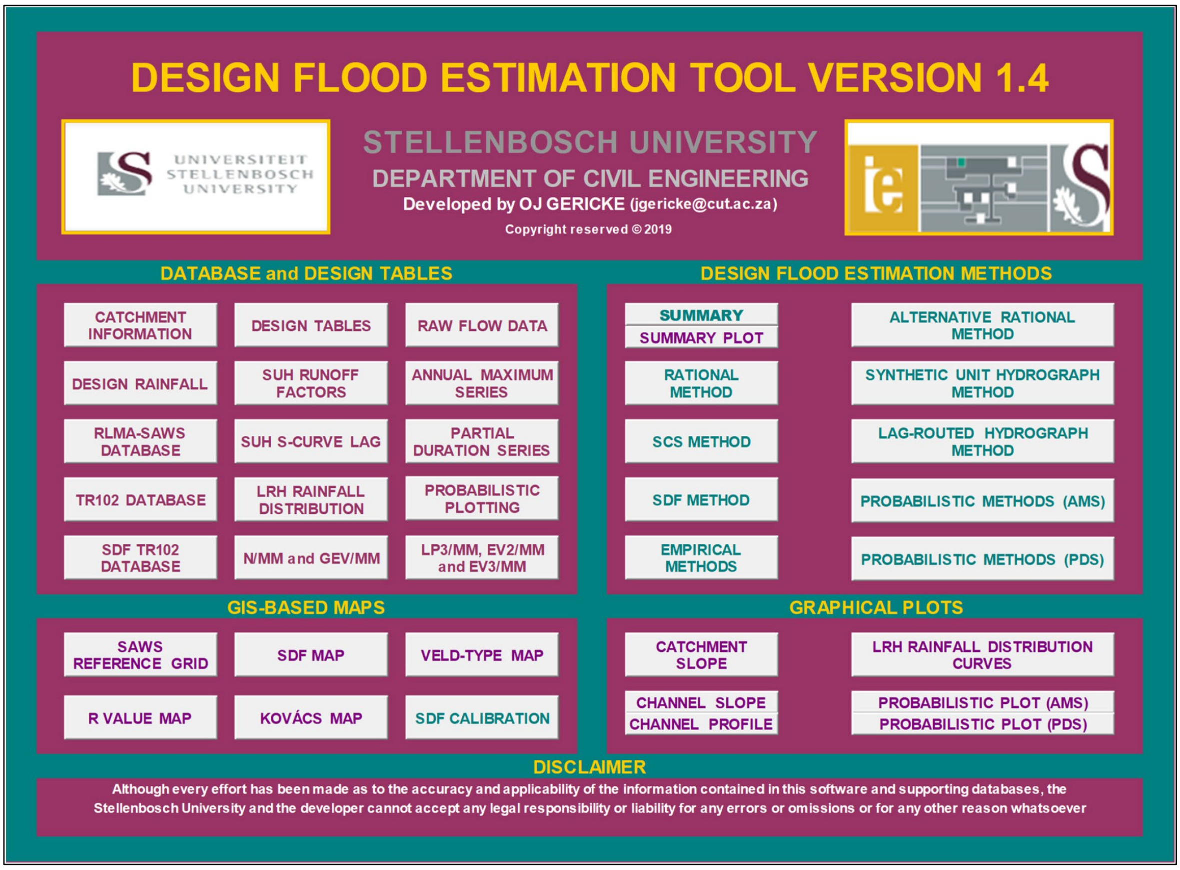


Figure 4.9: STATFLO conversion methodology flow chart

Design Flood Estimation Tool (DFET):

The DFET Version 1.4 (Gericke, 2021; Gericke and Du Plessis, 2013) as illustrated in Figure 4.10 was used for all the event-based deterministic DFEs. All the catchment parameters and design rainfall information input required for the various event-based deterministic DFE methods were processed using the DFET, while all other DFE procedures are fully automated and incorporate the standard procedures associated with each method by default. The assumptions, limitations, and intended field of application relevant to each method were acknowledged and applied accordingly.



DESIGN FLOOD ESTIMATION TOOL VERSION 1.4

STELLENBOSCH UNIVERSITY
DEPARTMENT OF CIVIL ENGINEERING
Developed by OJ GERICKE (jgericke@cut.ac.za)
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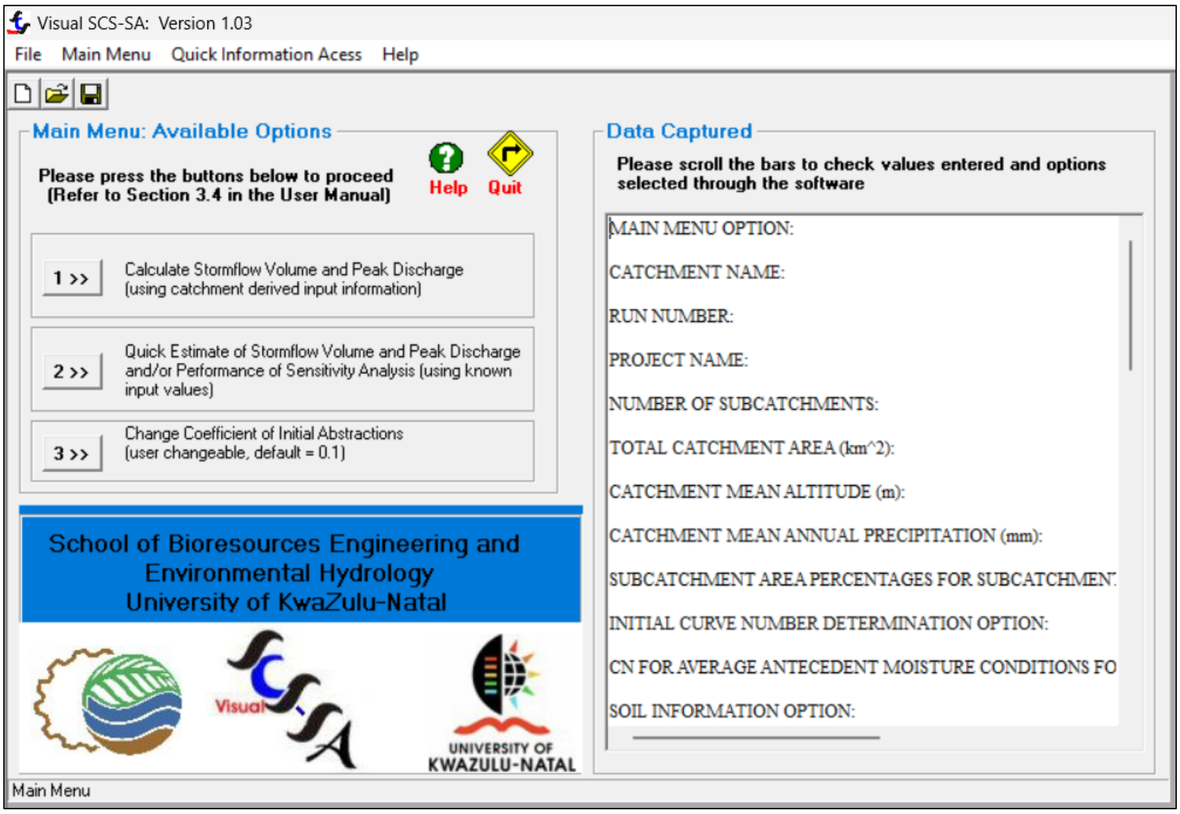
DISCLAIMER
Although every effort has been made as to the accuracy and applicability of the information contained in this software and supporting databases, the Stellenbosch University and the developer cannot accept any legal responsibility or liability for any errors or omissions or for any other reason whatsoever

Figure 4.10: DFET Version 1.4 GUI homepage (Gericke, 2021)

Visual SCS-SA:

The Visual SCS-SA Version 1.03 software (Schulze *et al.,* 2004) transitioned from a DOS-based system to a GUI-driven platform compatible with Windows as shown in Figure 4.11. The SCS-SA method was applied using Option 2 of the Visual SCS-SA software, ensuring a consistent input data set for both the SCS and SCS-SA methods, with weighted *CN* values and SCS-SA lag times calculated using the DFET. This approach enabled a fair comparison and thorough evaluation of the various versions of the SCS methods under identical conditions, effectively eliminating biases and enhancing the reliability and validity of the results.



Please press the buttons below to proceed
(Refer to Section 3.4 in the User Manual)

1 >> Calculate Stormflow Volume and Peak Discharge (using catchment derived input information)

2 >> Quick Estimate of Stormflow Volume and Peak Discharge and/or Performance of Sensitivity Analysis (using known input values)

3 >> Change Coefficient of Initial Abstractions (user changeable, default = 0.1)

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Please scroll the bars to check values entered and options selected through the software

MAIN MENU OPTION:
CATCHMENT NAME:
RUN NUMBER:
PROJECT NAME:
NUMBER OF SUBCATCHMENTS:
TOTAL CATCHMENT AREA (km^2):
CATCHMENT MEAN ALTITUDE (m):
CATCHMENT MEAN ANNUAL PRECIPITATION (mm):
SUBCATCHMENT AREA PERCENTAGES FOR SUBCATCHMEN
INITIAL CURVE NUMBER DETERMINATION OPTION:
CN FOR AVERAGE ANTECEDENT MOISTURE CONDITIONS FO
SOIL INFORMATION OPTION:

Figure 4.11: Visual SCS-SA software GUI (Schulze *et al*., 2004)

4.3.4 Performance assessment

The results based on the various event-based deterministic DFE methods were consolidated into a single analysis sheet to simplify the comparison of results, *i.e.,* event-based deterministic flood peaks (Q_{Ti}) versus the benchmark probabilistic flood peaks (Q_{Pi}). By aggregating the information in this manner, the assessment process was streamlined, allowing for a clearer identification of the relative strengths and weaknesses associated with each deterministic DFE method.

To assess the performance of the event-based deterministic DFE methods, the ranking-based selection procedure developed by Gericke (2021) was implemented. This systematic approach evaluated the accuracy and potential bias of the DFE methods across the 396 catchments considered. In this procedure, each DFE method was ranked based on a series of quantitative GOF criteria (*e.g*., *r², MARE, NSE, RMSE,* and *SE)* as outlined in Chapter 2 (*cf.* Section 2.5). The overall performance ranking was derived by summing the individual rankings across the selected GOF criteria, with the method achieving the lowest total ranking deemed the best performer, either as the most accurate and/or least biased event-based deterministic DFE method. The ranking system not only identified the most appropriate event-based deterministic DFE methods but also offered insights into the comparative performance of less appropriate methods.

In addition to the GOF criteria, various graphical descriptors were employed to support the assessment process and provide deeper insights into model performance. Graphical measures such as box-and-whisker plots, estimated/ observed ratio plots, relative error plots, and scatter plots were used to visualise discrepancies between the estimated Q_{Ti} and probabilistic Q_{Pi} values. These graphical representations were invaluable for identifying patterns or trends signalling areas needing improvement or refinement.

In summary, the comprehensive analysis of the DFE methods, supported by both quantitative rankings and graphical assessments, provided a thorough understanding of their performance results as presented and discussed in Chapter 5.

5. RESULTS AND DISCUSSION

This chapter presents the results and discussion thereof by focusing on the performance of probabilistic and event-based deterministic DFE methods, using a series of quantitative GOF criteria and ranking procedures. Anomalies observed during the DFE assessments are reported, and all pertinent results are presented in both tabular and graphical formats, with some cross-referenced in, or included in, the relevant appendices.

5.1 Event-based Deterministic DFE Input and Transfer Functions

As highlighted in Chapter 4 (*cf.* Sections 4.1 and 4.2), the associated methodologies used to derive all the required input for the selected event-based deterministic DFE methods (*e.g.*, veld-type and T_C approaches associated with the LRH method), incorporated both ARF methodologies (*e.g.*, Alexander ,2001, Eq. 4.3; Pietersen, 2023; Eq. 4.4) to ensure a consistent and comprehensive assessment across all return periods (*e.g.*, 2-year ≤ T ≤ 200-year). As previously highlighted, the ARF methods proposed by Alexander (2001) and Pietersen (2023) are referred to as ARF (A) and ARF (P), respectively.

In approximately 20% (78) of the 396 catchments with associated T_C durations ≤ 3-hour, the ARF (P) method yielded negative ARF values when applied to the RM3 and LRH methods. Furthermore, ARF (P) also yielded negative ARF values for 3-hour < T_C ≤ 12-hour in 8.6% (34) of the 396 catchments when applying the SUH method. This is to be expected, since the ARF (P) methodology considered only long duration storms (D ≥ 24-hour) during the calibration process. In such cases, the ARF (A) method was used to estimate representative ARFs, even if ARF (A) does not vary with return period. On the other hand, no negative ARF values were estimated for T_C durations ≤ 3-hour in PDRs D, E, N, P, S, and T when the RM3 and LRH methods were applied. The SUH method similarly produced no negative ARF values in these PDRs.

5.2 Ranking of Probability Distributions

As a result of inadequate data quality and insufficient record lengths, 15 flow-gauging stations were excluded from the continuous flow data analyses (*cf*. Section 4.3.1), which resulted in a total of 396 gauged catchments being considered for further analyses. The probability distributions, as discussed in Section 2.4.3, were assessed and ranked, as shown in Table 5.1, from 1 (best performance) to 5 (weakest performance). The latter was achieved by applying a selection of GOF metrics, as discussed in Section 4.3.1, across all catchments and return periods, *i.e.*, 2-year ≤ T ≤ 200-year.

Table 5.1: Summary of probability distribution rankings analysed for the 396 gauged catchments using GOF metrics

GOF criteria	Probability distribution ranking				
	LN	**LP3**	**GEV**	**IPZA**	**GPA**
RMSE ranking, Equation (2.11)	5	4	2	1	3
AIC ranking, Equation (4.6)	5	4	2	1	3
KS ranking, Equation (4.7)	5	4	2	1	3
R^2 ranking, Equation (4.8)	1	3	4	5	2
SBC ranking, Equation (4.9)	5	4	2	1	3
Sum of rankings	**21**	**19**	**12**	**9**	**14**
Final ranking	**5**	**4**	**2**	**1**	**3**

It is evident from Table 5.1 that the IPZA probability distribution achieved the highest overall ranking, securing first place with a ranking sum of nine for all criteria except for R^2, where it ranked fifth. This strong and consistent performance positioned IPZA as the most suitable distribution, effectively balancing accuracy and model complexity. The GEV probability distribution ranked second overall with a total ranking sum of 12, ranked fourth in the R^2 metric and second in the *RMSE*, *AIC, KS,* and *SBC* metrics. The GPA probability distribution followed closely, ranking third with a rank total of 14. The latter probability distribution performed well with the R^2 metric ranking in the second position, although securing no number one ranking. The LP3 probability distribution ranked fourth with a sum of 19, demonstrating moderate performance without achieving a 1st place ranking in any criterion. The LN distribution consistently underperformed, ranking last across most metrics with a total ranking sum of 21, however, it achieved first place in the R^2 metric. This highlights that while LN excelled in capturing overall data trend R^2, it did not provide the best fit across criteria measuring absolute and likelihood-based performance. Moreover, in recognition of the IPZA distribution as the newly recommended probability distribution in South Africa, and its justification as the top performer in this study based on the GOF ranking procedure outlined in Table 5.1, it was deemed necessary to evaluate its performance at the PDR level, as presented in Table 5.2 and Figure 5.1, respectively.

Table 5.2: GOF-based ranking of probability distributions for all return periods in all the PDRs

PDR	**Probability distribution ranking**				
	LN	**LP3**	**GEV**	**IPZA**	**GPA**
A	5	4	2	1	3
B	5	4	2	1	3
C	5	4	2	1	3
D	5	4	2	1	3
E	2	2	5	1	2
G	5	4	2	1	3
H	5	4	2	1	3
J	5	4	2	1	3
K	5	4	2	1	3
L	5	4	3	1	2
N	4	4	2	1	3
P	4	4	2	1	3
Q	5	3	2	1	4
R	5	3	1	2	4
S	5	1	3	2	3
T	5	4	2	1	3
U	4	4	3	1	2
V	4	5	3	1	2
W	5	4	3	1	2
X	5	4	2	1	3
Sum of rankings	**93**	**74**	**47**	**22**	**57**
Final ranking	**5**	**4**	**2**	**1**	**3**

It is clear from Table 5.2 that the IPZA probability distribution outperformed almost all other probability distributions by achieving the lowest total ranking score of 22. As a result, it secured the first place in South Africa, performing the best in 90% of the PDRs. The GEV ranked second with a ranking total of 47, earning first place in PDR R and second place in 12 other PDRs (A, B, C, D, G, H, J, K, N, P, Q, and T), confirming a consistent performance across diverse catchments. The GPA followed in third place, with a ranking total of 57, achieving second place in regions E, L, U, V, and W, with third place in most of the other regions, indicating a reliable, but less dominant performance. The LP3 ranked fourth with a ranking total of 74, securing first place in PDR S and second in PDR E, but generally ranking third or fourth, suggesting moderate effectiveness. Lastly, the LN performed the worst, with a total ranking score of 93, consistently ranking fourth or fifth across all regions and failing to achieve any first-place rankings; however, it shared second place with LP3 in PDR E, further highlighting its poor suitability for the dataset. Overall, as previously highlighted, IPZA proved to be the most suitable probability distribution to be used in this research, while the LN was regarded as the least appropriate.

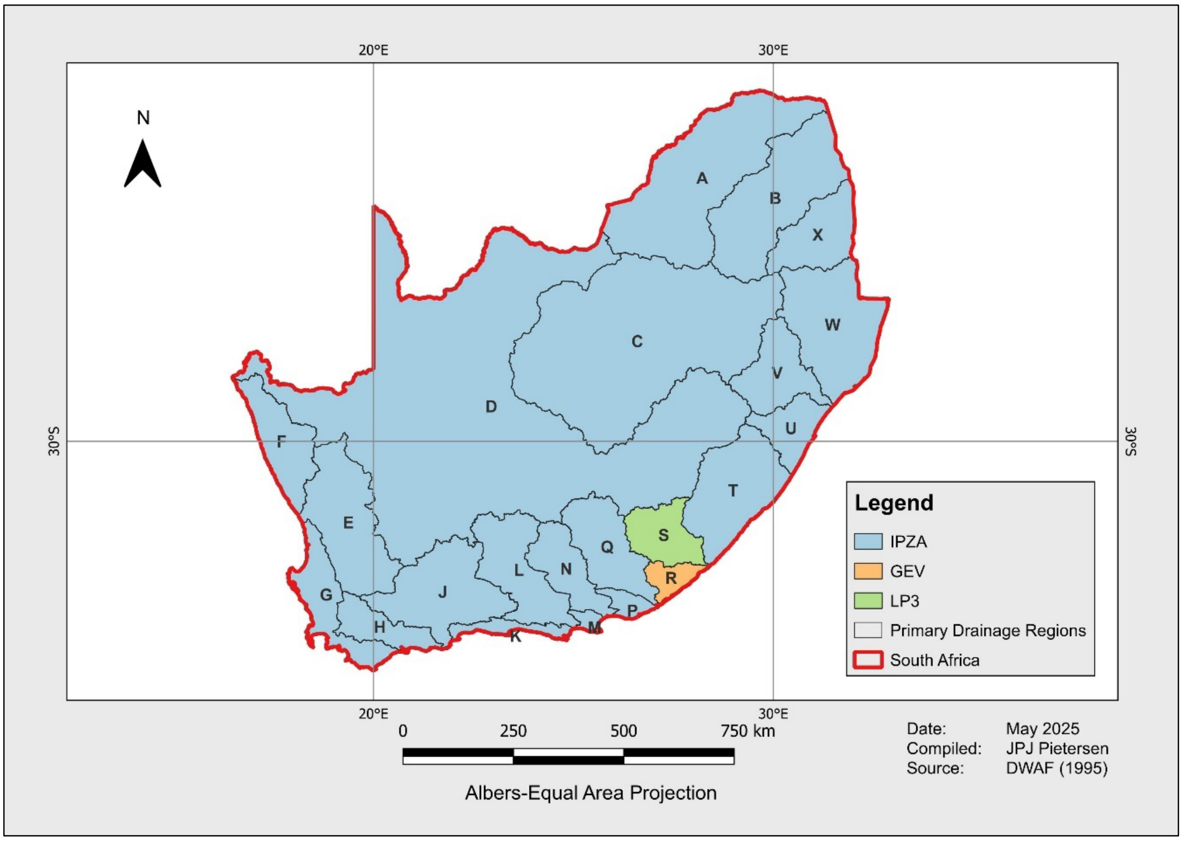

Figure 5.1: Spatial distribution of the probability distribution rankings for all return periods in the PDRs

Besides the overall performance of the five selected probability distributions within the PDRs, it is also evident from Figure 5.1 that the IPZA probability distribution is the best performer in more than 90% of South Africa. Based on the overall performance of the IPZA probability distribution as outlined in this section, it was concluded that the IPZA distribution is the preferred probability distribution for further analyses of the streamflow data in this research.

5.3 Ranking of Event-based Deterministic DFE Methods

FFA were conducted in each catchment using the methodologies outlined in Chapter 4 by employing customised Excel spreadsheets designed for bulk processing. The comparative analyses were used to assess the estimated peak flows (Q_{Ti}, m³/s) obtained from each event-based deterministic DFE method against the corresponding observed (probabilistic) peak flows (Q_{Pi}, m³/s) associated with return periods 2-year $\leq T \leq$ 200-year.

In certain cases, the Q_{Ti} values exhibited a high degree of association in comparison to the Q_{Pi} values, while in other cases, the degree of association was less favourable. Both overestimations and underestimations were observed across all DFE methods and return periods, while in some instances, no estimates were possible when applying the LRH and SUH methods in catchments where $T_C < 1$ hour and/or $T_C > 250$ hours, respectively. Notably, the LRH method failed to produce Q_{Ti} values in 12.6% (50) of the catchments under consideration. Similarly, the SUH method yielded no results for the six largest catchments ($A \geq 120\ 000$ km^2), which represent approximately 1.5% (6) of the 396 catchments under consideration. In the case of the LRH method, following the estimation of effective average design rainfall, the rainfall distribution over time is determined, focusing on excess rainfall as a percentage of the critical storm duration. However, the Bauer and Midgley (1974) rainfall curves used in the LRH method only apply to durations 2-hour $\leq T_C \leq$ 240-hour. Hence, the reason for not applying the LRH in these larger catchments where T_C exceeded 240 hours. In the case of the SUH method, flood runoff factors are derived to represent the average storm losses as obtained from a chart (SANRAL, 2013), where the catchment area (km²) and area distribution (%) correspond to the different veld-type regions. This chart typically applies to catchment areas up to 100 000 km²; hence, the SUH could therefore not be applied in catchments beyond this range.

As highlighted before, all deterministic DFE methods, except the SCS and SCS-SA methods, calculated peak flood estimates using both Alexander and Pietersen ARF values, with the ARF (P) variant generally outperforming the ARF (A). Moreover, estimation differences between the SCS and SCS-SA mainly arose from variations in estimated lag times and the more conservative estimation approach of the Visual SCS-SA software/method. The generally shorter lag times in SCS-SA produced faster runoff concentration times and higher peak flows compared to the more attenuated SCS lag times. Additionally, the SCS-SA software applies one-day design rainfall depths with four synthetic time distribution curves (Weddepohl, 1988) developed conservatively from regional intensity-duration relationships to address discrepancies between actual and design rainfall intensities by slightly overestimating flood peaks (Schmidt & Schulze, 1987a). This tendency to produce higher flood peaks was more pronounced in large to extremely large catchments.

The ranking-based approach, as discussed in Chapter 4 (*cf*. Section 4.3.4), was based on the GOF criteria inclusive of Equations 2.8 to 2.12 (r^2, *MARE, NSE, RMSE,* and *SE*). The overall performance and subsequent ranking of each DFE method within each PDR are listed in Table 5.3. Detailed results at catchment and PDR levels are provided in Appendix A.

Table 5.3: Ranking of event-based deterministic DFE methods for all return periods in the PDRs

PDR	RM3-ARF (A)	RM3-ARF (P)	SCS	SCS-SA	SUH-ARF (A)	SUH-ARF (P)	LRH-Veld-ARF (A)	LRH-Veld-ARF (P)	LRH-T_C-ARF (A)	LRH-T_C-ARF (P)
A	5	7	1	4	6	8	9	10	2	2
B	6	6	3	8	5	4	9	10	2	1
C	1	3	2	4	6	8	9	10	5	6
D	1	4	8	3	10	8	6	6	4	2
E	1	2	3	4	7	9	8	10	5	6
G	5	7	4	3	1	2	6	8	10	8
H	4	5	5	3	1	2	5	8	9	10
J	4	8	2	1	9	10	3	6	5	7
K	3	1	5	2	4	6	9	10	7	8
L	9	8	7	10	3	1	4	2	6	4
N	4	5	7	9	9	3	2	8	5	1
P	1	2	6	7	3	4	10	9	4	7
Q	9	10	1	4	7	8	5	6	2	3
R	7	6	7	2	3	1	5	4	10	9
S	10	9	3	3	2	1	6	8	6	5

PDR	RM3-ARF (A)	RM3-ARF (P)	SCS	SCS-SA	SUH-ARF (A)	SUH-ARF (P)	LRH-Veld-ARF (A)	LRH-Veld-ARF (P)	LRH-T_C-ARF (A)	LRH-T_C-ARF (P)
T	9	10	5	6	7	3	1	8	2	4
U	9	10	3	4	6	7	5	7	1	2
V	10	8	2	1	6	9	3	7	4	5
W	3	1	1	3	6	5	9	10	7	8
X	9	10	1	2	7	8	5	6	4	3
Sum of rankings	**110**	**122**	**76**	**83**	**108**	**107**	**119**	**153**	**100**	**101**
Final ranking	**7**	**9**	**1**	**2**	**6**	**5**	**8**	**10**	**3**	**4**

It is evident from Table 5.3 that the SCS method achieved the lowest ranking sum of 76, while securing the best ranking with strong performances in regions A, Q, W, and X. The SCS-SA method followed closely with a sum of 83, with a second-place ranking showing good consistency and excelling as first ranked in regions J and V. The SCS-SA method was also shown to be robust by performing sufficiently, with lower rankings, across multiple PDRs. The LRH-T_C-ARF (A) was placed third with a sum of 100, showing strength in PDR U with the best ranking. The LRH-T_C-ARF (P) came fourth with a sum of 101, achieving the best ranking in PDRs B and N. The SUH-ARF (A) ranked fifth with a sum of 108, demonstrating regional strengths such as the best ranking in PDRs G and H, while the SUH-ARF (P) secured fifth place with a ranking sum of 107, with the best associated performances in PDRs L, R, and S. The RM3-ARF (A) was seventh with a total ranking of 110, followed by the LRH-Veld-ARF (A) in eighth place with a total ranking of 119. The RM3-ARF (P) ranked ninth with a total ranking score of 122, despite being the strongest performer in PDRs K and W. The LRH-Veld-ARF (P) was placed tenth with a total ranking of 153, performing poorly with no first-place rankings. Based on the rankings in Table 5.3, the best to third-best performing event-based deterministic DFE methods are shown in Figures 5.2 to 5.4.

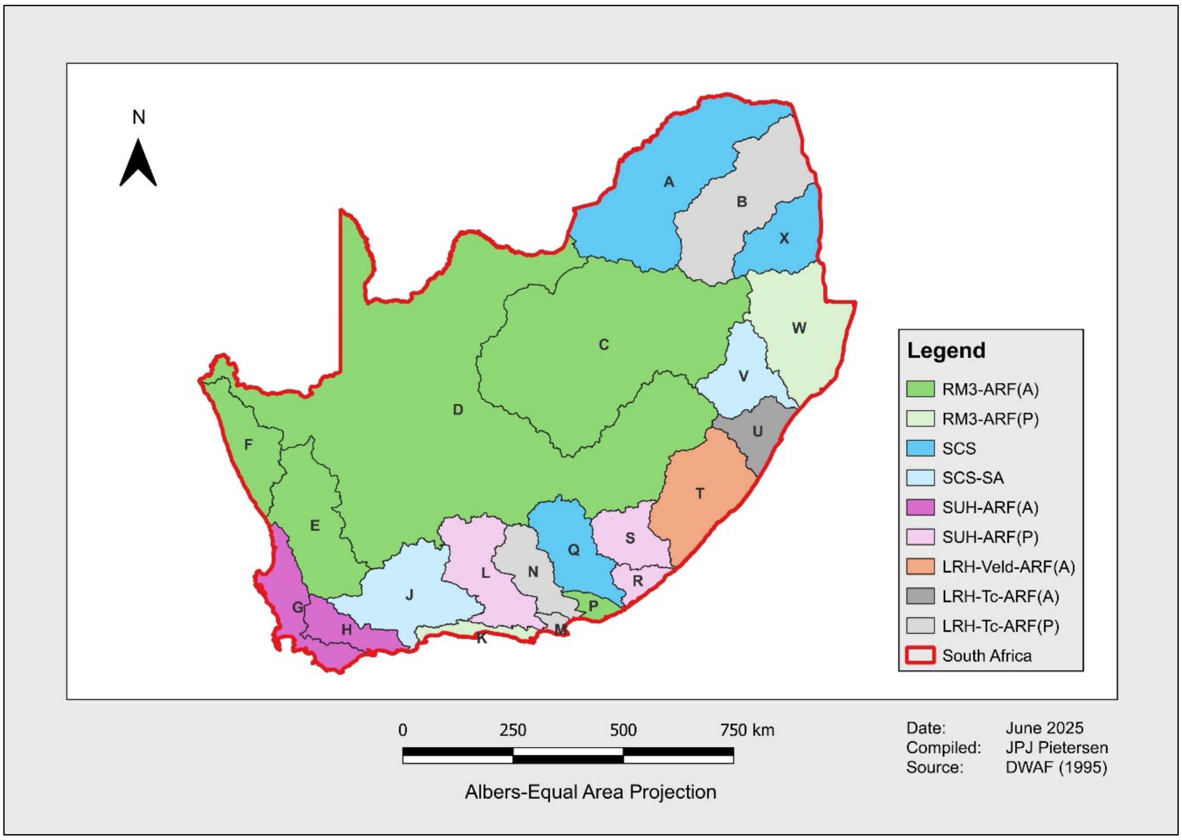

Figure 5.2: Best performing event-based deterministic DFE methods for all return periods in the PDRs

The results in Table 5.3 clearly highlight that the SCS and SCS-SA can be regarded on average as the most robust event-based deterministic DFE methods in South Africa. However, this is not necessarily evident in Figures 5.2 to 5.4, which show the spatial distribution of the performance of each DFE method within the 20 PDRs which vary significantly in size. For example, in Figure 5.2, the RM3-ARF (A) has the largest geographical distribution, inclusive of five PDRs, *i.e.,* C, D, E, F, and P. The SUH-ARF (A) method proved to be the best DFE method for the Western Cape (PDRs G and H), with the LRH-Veld-ARF (A) method being the best for parts of the Eastern Cape (PDR T).

As shown in Figure 5.3, the second-best event-based deterministic DFE methods are scattered randomly across South Africa. However, in the Western Cape (PDRs G and H), the SUH-ARF (P) method is recommended, while the SCS and LRH-T_C-ARF (P) methods are recommended in the Free State (PDR C) and parts of the Gauteng Province.

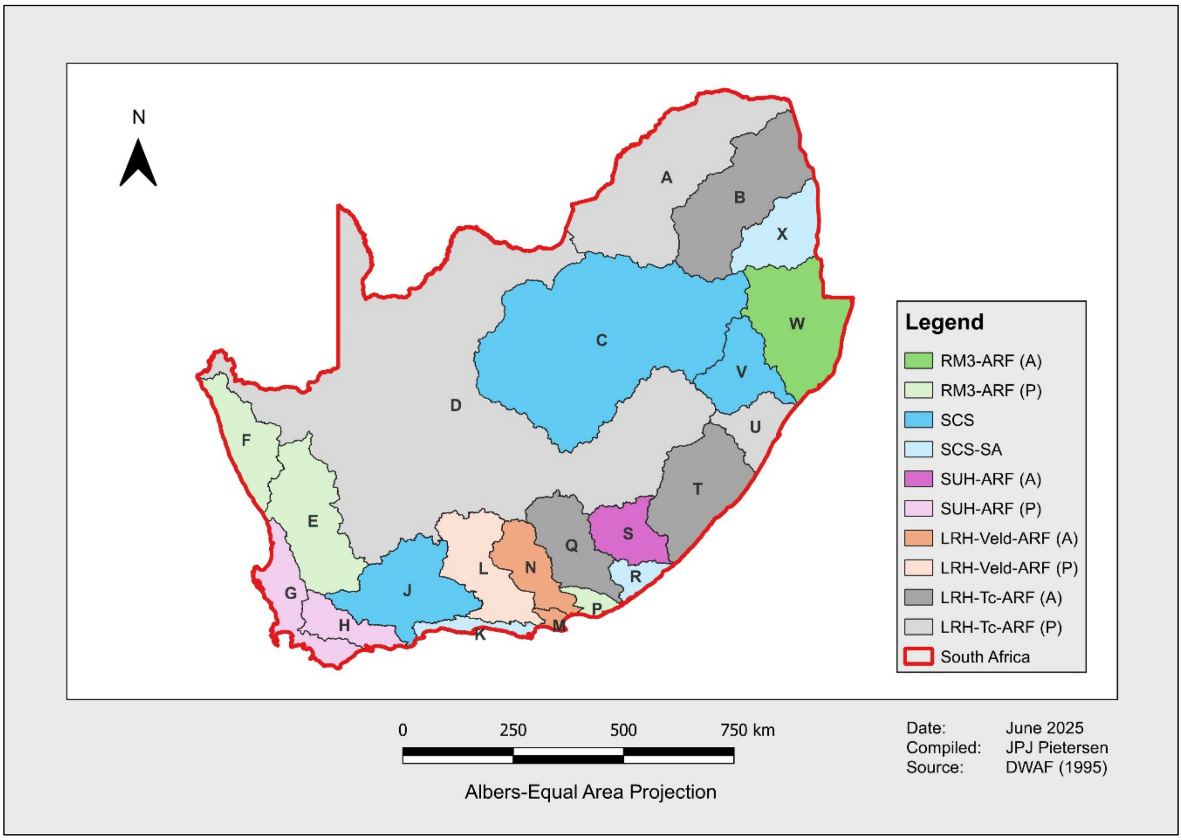

Figure 5.3: Second-best performing event-based deterministic DFE methods for all return periods in the PDRs

The third best event-based deterministic DFE methods, as shown in Figure 5.4, are also randomly scattered across South Africa, with the SCS-SA covering most of the PDRs, *i.e.*, D, F, G, H, S, and W.

In addition to the overall catchment rankings at a PDR level presented in Table 5.3, an extended ranking analysis was conducted for the event-based deterministic DFE methods in each PDR of South Africa for individual return periods, *i.e.*, 2-year ≤ T ≤ 200-year. This analysis employed the same GOF metrics: Equations 2.8 to 2.12 (*r^2, MARE, NSE, RMSE,* and *SE*), and is summarised in Table 5.4.

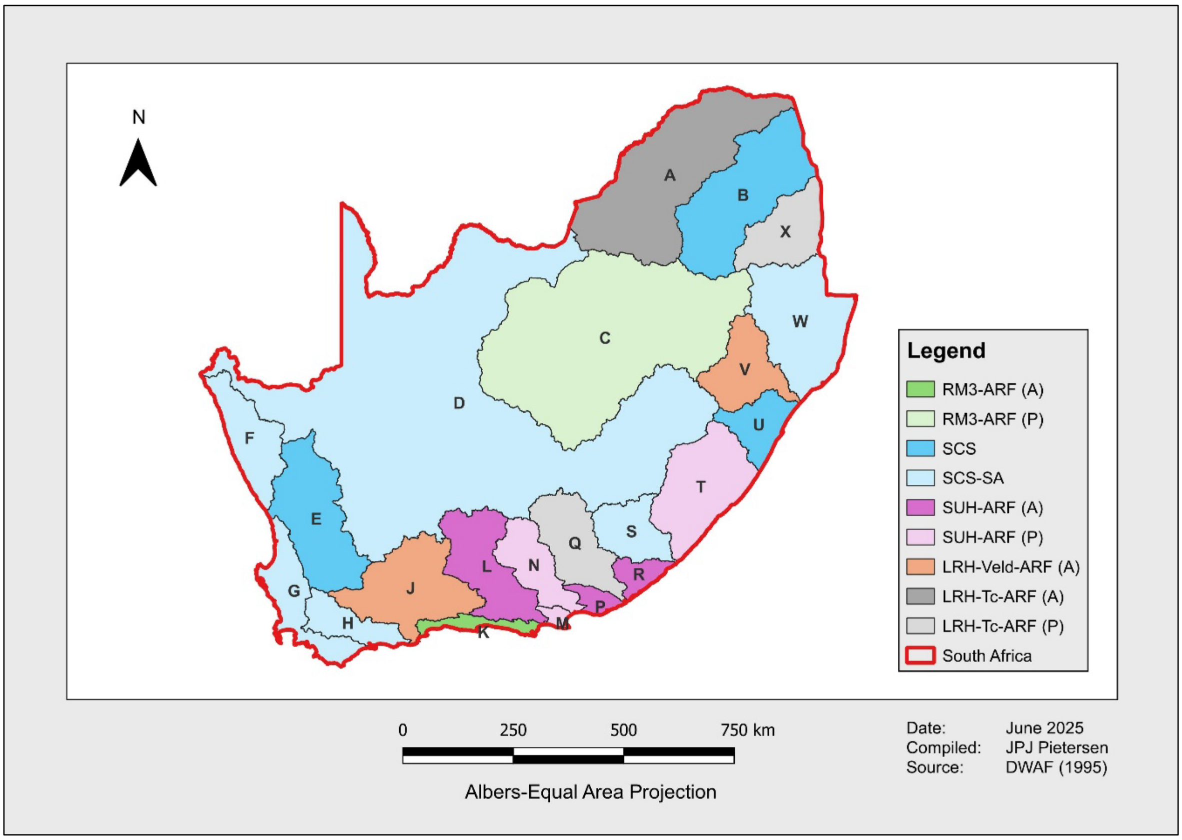

Figure 5.4: Third-best performing event-based deterministic DFE methods for all return periods in the PDRs

Table 5.4: Ranking of event-based deterministic DFE methods for individual return periods 2 ≤ *T* ≤ 200-year in the PDRs

PDR	***T* (years)**	**RM3-ARF (A)**	**RM3-ARF (P)**	**SCS**	**SCS-SA**	**SUH-ARF (A)**	**SUH-ARF (P)**	**LRH-Veld-ARF (A)**	**LRH-Veld-ARF (P)**	**LRH-T_C-ARF (A)**	**LRH-T_C-ARF (P)**
A	2	7	4	1	2	9	5	10	7	6	3
	5	6	2	1	4	8	7	10	9	5	2
	10	6	2	1	4	8	7	10	9	5	3
	20	6	3	1	5	8	7	9	10	4	2
	50	6	4	1	5	7	8	9	10	2	3
	100	6	8	1	4	5	7	9	10	2	3
	200	6	9	1	5	4	7	8	10	2	3
B	2	7	6	4	1	8	2	9	9	5	3
	5	6	5	7	2	8	4	10	9	3	1
	10	5	3	5	7	8	4	9	10	2	1
	20	5	3	4	7	8	6	9	10	1	2
	50	4	5	3	7	7	6	9	10	1	2
	100	6	7	2	8	4	4	9	10	1	2
	200	7	8	1	10	4	4	6	9	3	2

PDR	*T* (years)	RM3-ARF (A)	RM3-ARF (P)	SCS	SCS-SA	SUH-ARF (A)	SUH-ARF (P)	LRH-Veld-ARF (A)	LRH-Veld-ARF (P)	LRH-T_C-ARF (A)	LRH-T_C-ARF (P)
C	2	3	6	1	9	8	5	10	7	4	2
	5	1	3	2	6	6	8	9	10	5	4
	10	1	2	3	4	7	8	9	10	5	6
	20	1	2	3	4	7	8	9	10	6	5
	50	1	2	3	4	6	8	9	10	7	5
	100	1	4	2	3	5	8	8	10	5	7
	200	3	6	1	2	4	9	8	10	4	7
D	2	2	3	8	1	9	10	6	7	4	5
	5	1	3	10	5	8	8	6	7	2	3
	10	2	4	10	1	8	8	5	5	5	3
	20	2	4	10	1	8	9	6	7	5	3
	50	1	5	10	9	7	8	5	4	3	2
	100	2	6	10	8	7	8	5	4	3	1
	200	4	7	10	9	6	8	4	3	2	1
E	2	1	2	3	3	8	6	9	10	5	6
	5	1	2	3	4	6	8	9	10	5	6
	10	1	2	3	4	6	8	9	10	5	6
	20	1	2	3	4	6	8	8	10	5	7
	50	1	2	3	4	6	9	7	10	5	7
	100	1	2	3	4	6	9	7	10	5	7
	200	1	2	3	5	6	9	7	10	4	7
G	2	4	7	1	1	7	3	5	6	10	9
	5	3	7	2	1	5	3	6	8	10	9
	10	2	7	2	1	4	5	6	8	10	9
	20	1	7	3	1	4	5	6	8	10	8
	50	1	7	5	3	2	4	6	8	9	9
	100	2	6	5	4	1	3	6	8	9	10
	200	5	4	5	3	1	2	7	8	9	10
H	2	3	6	2	1	4	4	7	7	7	10
	5	5	6	3	1	2	4	7	9	8	9
	10	4	6	5	2	1	3	6	8	8	10
	20	4	7	5	3	1	2	6	8	9	10
	50	4	6	7	3	1	2	5	8	9	10
	100	4	6	7	3	1	2	5	8	9	9
	200	4	5	5	3	1	2	5	8	9	10
J	2	3	3	1	2	9	10	5	7	6	8
	5	2	5	1	2	9	10	4	6	7	8
	10	4	5	1	2	9	10	3	5	7	8
	20	4	6	1	3	9	10	2	5	6	8
	50	3	9	2	5	8	10	1	6	3	7
	100	6	9	3	1	8	10	1	6	4	5
	200	8	10	4	2	7	9	1	5	3	6
K	2	8	3	1	2	5	4	9	6	10	6
	5	3	1	2	3	5	6	10	8	8	7
	10	2	1	3	4	5	6	9	10	8	7
	20	2	1	4	3	5	6	9	10	7	8
	50	2	1	5	3	4	6	9	10	7	8

PDR	*T* (years)	RM3-ARF (A)	RM3-ARF (P)	SCS	SCS-SA	SUH-ARF (A)	SUH-ARF (P)	LRH-Veld-ARF (A)	LRH-Veld-ARF (P)	LRH-T_C-ARF (A)	LRH-T_C-ARF (P)
	100	2	1	5	3	4	6	9	10	7	8
	200	5	1	4	2	2	5	9	10	7	8
L	2	9	4	4	10	2	1	6	3	8	7
	5	8	4	3	10	2	1	6	5	7	8
	10	8	5	9	10	3	1	6	2	7	3
	20	7	5	9	10	3	1	6	2	7	3
	50	8	5	9	10	3	1	5	2	5	4
	100	8	9	7	10	2	1	6	2	5	4
	200	9	8	7	10	2	1	6	2	5	4
N	2	9	6	5	1	6	3	10	8	3	2
	5	4	5	7	1	10	3	8	9	6	2
	10	7	5	6	1	10	4	2	9	8	3
	20	8	4	7	5	10	3	1	6	8	1
	50	6	3	7	5	10	4	1	9	7	2
	100	4	5	5	10	9	3	1	8	7	2
	200	5	9	8	10	6	3	1	7	4	1
P	2	8	5	1	4	7	3	10	9	6	2
	5	1	2	8	3	4	5	10	9	6	7
	10	1	3	7	2	4	6	10	7	5	9
	20	2	3	8	1	4	7	9	6	5	10
	50	1	2	8	4	3	7	8	6	5	10
	100	1	2	8	5	3	6	9	6	4	10
	200	1	2	5	7	3	6	9	8	4	9
Q	2	6	8	1	2	10	3	7	8	5	4
	5	6	5	3	2	10	8	9	7	4	1
	10	6	5	3	2	10	9	8	7	4	1
	20	6	5	2	3	10	9	7	8	3	1
	50	7	5	1	4	9	10	6	8	3	2
	100	10	9	1	4	7	8	5	6	3	2
	200	9	9	1	4	7	8	5	6	2	2
R	2	7	2	8	1	9	4	6	5	10	3
	5	6	5	8	1	4	3	2	8	10	7
	10	6	5	8	1	3	4	2	8	10	7
	20	5	4	8	1	2	2	7	9	10	6
	50	6	4	8	1	4	1	3	8	10	7
	100	6	2	2	9	5	1	2	7	10	8
	200	6	2	8	8	5	1	3	4	10	7
S	2	10	7	2	1	6	3	7	4	9	4
	5	10	7	3	1	5	2	8	6	9	4
	10	10	6	3	2	4	1	9	7	8	5
	20	10	7	4	2	3	1	7	7	6	5
	50	10	9	3	4	2	1	7	8	6	5
	100	10	9	3	5	2	1	5	8	7	4
	200	9	10	3	5	2	1	5	8	7	4
T	2	10	5	8	5	9	1	7	3	3	2
	5	10	3	6	6	5	1	2	6	9	4
	10	9	4	6	7	5	1	2	10	7	3

PDR	*T* (years)	RM3-ARF (A)	RM3-ARF (P)	SCS	SCS-SA	SUH-ARF (A)	SUH-ARF (P)	LRH-Veld-ARF (A)	LRH-Veld-ARF (P)	LRH-T_C-ARF (A)	LRH-T_C-ARF (P)
	20	6	4	4	8	8	1	2	10	7	3
	50	8	9	5	6	7	2	1	10	4	3
	100	8	9	1	6	7	5	3	10	2	4
	200	8	10	1	5	7	6	3	8	2	4
U	2	10	9	2	7	8	4	5	6	3	1
	5	8	9	2	7	10	4	5	5	3	1
	10	8	9	2	4	10	5	6	7	1	3
	20	7	9	3	4	10	6	5	8	1	2
	50	7	10	2	4	8	6	5	8	1	3
	100	8	10	2	4	6	7	5	8	1	2
	200	8	10	2	4	6	7	5	8	1	2
V	2	10	7	1	3	6	9	4	8	2	5
	5	9	3	2	1	6	10	5	8	4	7
	10	9	4	2	1	6	10	3	8	5	6
	20	9	4	2	1	7	10	3	8	5	6
	50	10	8	2	1	6	9	3	7	4	5
	100	10	9	2	1	6	8	3	7	5	4
	200	10	8	2	1	5	8	3	7	6	4
W	2	4	2	1	8	6	3	10	9	5	7
	5	3	1	2	4	6	5	8	9	9	7
	10	2	1	3	3	6	5	7	7	10	7
	20	1	1	3	3	6	5	7	7	9	9
	50	3	1	2	3	6	5	7	10	8	8
	100	4	1	2	3	4	6	8	10	7	8
	200	6	1	2	2	4	5	8	10	7	8
X	2	10	9	1	5	6	4	7	8	2	3
	5	10	9	1	2	7	5	8	6	4	3
	10	10	9	2	1	8	5	6	6	4	3
	20	10	9	1	2	7	4	6	7	4	3
	50	9	10	1	2	7	6	5	8	3	4
	100	9	10	1	2	6	8	5	7	3	4
	200	9	10	1	2	7	8	5	6	3	4
Sum of rankings		**763**	**731**	**534**	**552**	**819**	**745**	**872**	**1062**	**774**	**710**
Final ranking		**6**	**4**	**1**	**2**	**8**	**5**	**9**	**10**	**7**	**3**

As shown in Table 5.4, the SCS and SCS-SA methods consistently ranked highest across most regions and return periods, with the SCS method ranked first and the SCS-SA method ranked second, which indicate a strong reliability and low uncertainty in the DFE. The LRH-T_C-ARF (P) method ranked third and also performed satisfactorily, while the LRH-T_C-ARF (A) method ranked seventh. The RM3 methods showed moderate performance, with the RM3-ARF (P) method ranked fourth, outperforming the RM3-ARF (A) method in the sixth position. The

SUH-ARF (P) and SUH-ARF (A) methods ranked fifth and eighth, respectively, while the LRH-Veld-ARF (P) and LRH-Veld-ARF (A) methods ranked the lowest at the ninth and tenth positions, respectively, reflecting a larger degree of uncertainty. Moreover, the ARF (P) outperformed the ARF (A) in three of the four groups of DFE methods where both methods were applied.

In summary, the ranking results highlighted that the SCS and SCS-SA methods were the most dependable. To a lesser extent, the LRH-T_C-ARF (P) proved to be satisfactory, while the SUH-ARF (A) methods and both LRH-Veld-ARF variants, (A) and (P), were less reliable. Notably, as previously highlighted, the ARF (P) variants generally outperformed their ARF (A) counterparts in several PDRs. In applying the same GOF metrics as before, a further evaluation was conducted of the overall performance of the event-based deterministic DFE methods across all catchments per individual return period, with results shown in Table 5.5. It is evident from Table 5.5 that the SCS method ranked first overall, with the best performance at the 2-, 50-, 100-, and 200-year return periods, while the SCS-SA method outperformed the other methods at the 5-, 10-, and 20-year return periods. The LRH-T_C-ARF (P) method is ranked at third position with an overall ranking of 33, showing consistent results without any first-place rankings. The RM3-ARF (A) method ranked fourth, with RM3-ARF (P) and LRH-T_C-ARF (A) methods tied at fifth position. However, the RM3-ARF (P) method was favoured and ranked higher owing to a stronger short- to mid-range performance and broader application in practice. The SUH-ARF (P) and SUH-ARF (A) methods ranked at the seventh and eighth positions, respectively, while the LRH-Veld-ARF (A) and LRH-Veld-ARF (P) methods followed in the ninth and tenth positions, respectively. Overall, in terms of individual return periods, the SCS and SCS-SA methods proved to be the most robust, while the ARF (P) approach surpassed the ARF (A) approach.

Table 5.5: Overall performance ranking in each return period category

Return period (T-year)	RM3-ARF (A)	RM3-ARF (P)	SCS	SCS-SA	SUH-ARF (A)	SUH-ARF (P)	LRH-Veld-ARF (A)	LRH-Veld-ARF (P)	LRH-T_C-ARF (A)	LRH-T_C-ARF (P)
2	7	5	1	2	8	3	10	8	6	4
5	4	3	2	1	8	5	9	10	7	6
10	4	3	2	1	8	6	9	10	7	5
20	4	3	2	1	8	6	9	10	7	5
50	3	5	1	2	7	7	9	10	5	4
100	6	9	1	2	4	7	8	10	3	5
200	8	9	1	5	3	7	6	10	2	4
Sum of rankings	**36**	**37**	**10**	**14**	**46**	**41**	**60**	**68**	**37**	**33**
Final ranking	**4**	**5**	**1**	**2**	**8**	**7**	**9**	**10**	**6**	**3**

5.4 Estimated versus Probabilistic Scatter Plots

The performance of the different event-based deterministic DFE methods was also evaluated using scatter plots (Figures 5.5 to 5.14), illustrating the relationship between the observed (Q_{Pi} – probabilistic) and estimated (Q_{Ti} – event-based deterministic) values. These plots provide a visual assessment of each event-based deterministic DFE method's performance to estimate the expected peak flows across all return periods accurately. Trends in predictive accuracy, as measured by the coefficient of determination (r^2) and regression slope, are evident from Figures 5.5 to 5.14.

The RM3-ARF (A) and RM3-ARF (P) methods, as shown in Figures 5.5 and 5.6, resulted in r^2 values of 0.65 and 0.66, respectively, indicating that up to 66% of the variance in the Q_{Pi} values are explained by the Q_{Ti} values. Furthermore, the slope of 0.95 (< 1) relating to the RM3-ARF (A), corresponds to a tendency to underestimate the higher flood peaks and overestimate lower flood peaks that occur more frequently. In contrast, the RM3-ARF (P) method has a slope of 1.21 (> 1) indicating the opposite, *i.e.,* overestimating the higher flood peaks, while the lower flood peaks are underestimated.

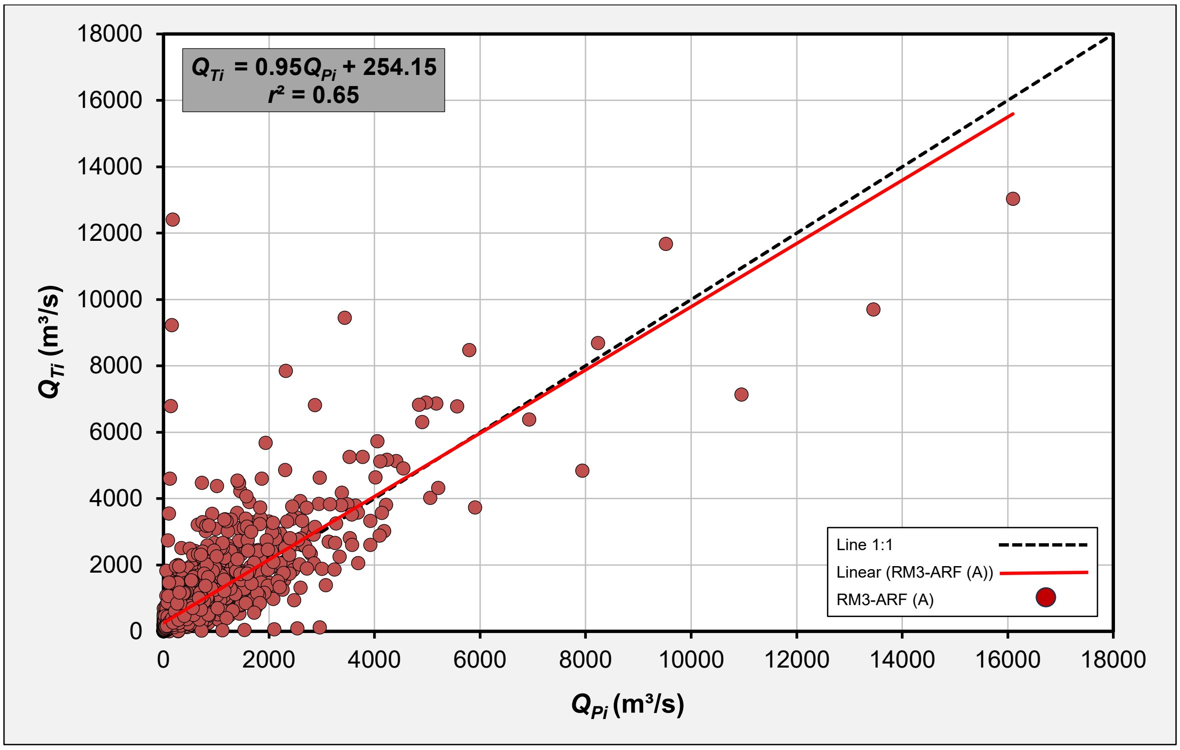

Figure 5.5: RM3-ARF (A) versus the Q_{Pi} (probabilistic) design floods

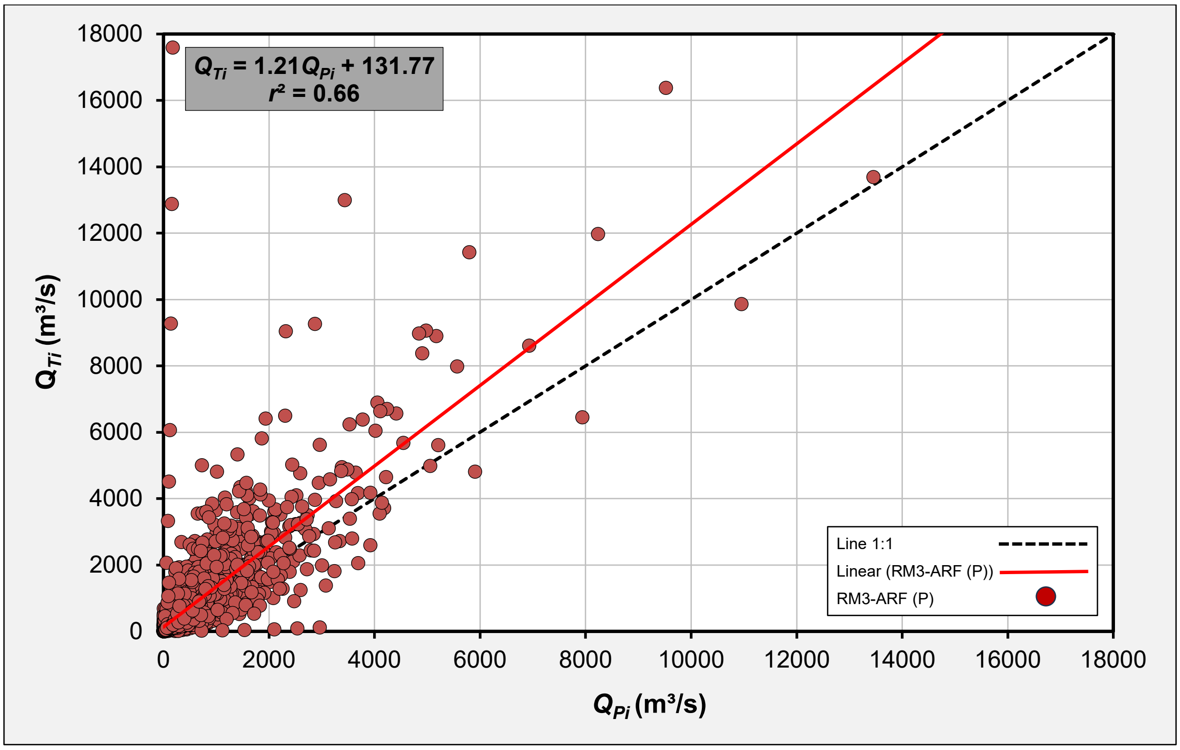

Figure 5.6: RM3-ARF (P) versus the Q_{Pi} (probabilistic) design floods

In Figures 5.7 and 5.8, the SCS and SCS-SA methods produced r^2 values of 0.52 and 0.60, respectively, indicating a moderate association between the Q_{Pi} and Q_{Ti} values. The respective regression slopes of 0.90 and 0.94, lower than unity, suggest a tendency to underestimate the higher Q_{Pi} values, while overestimating the lower values. Notably, the SCS-SA method exhibited an improved fit compared to the standard SCS, as reflected by the higher r^2 value.

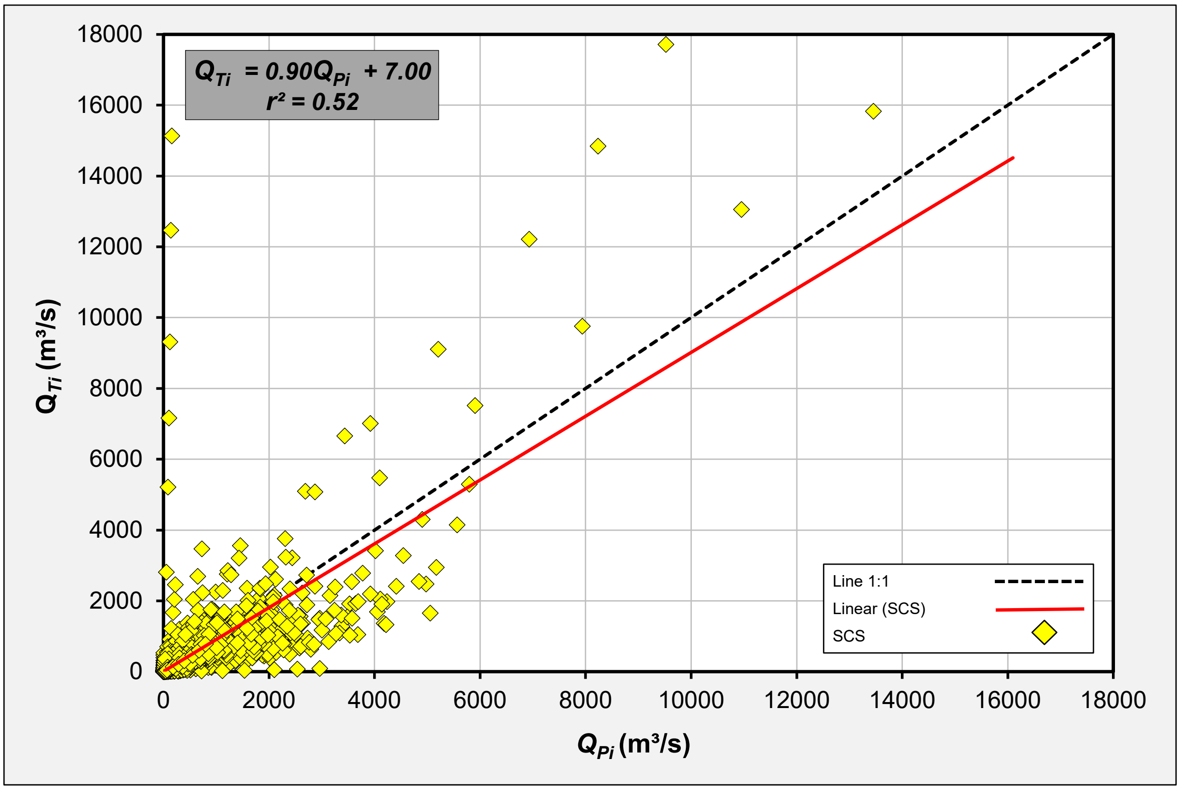

Figure 5.7: SCS versus the Q_{Pi} (probabilistic) design floods

The SUH-ARF (A) and SUH-ARF(P) variants, as shown in Figures 5.9 and 5.10, yielded r^2 values of 0.55 and 0.54, and slopes of 0.93 (< 1) and 1.08 (> 1), respectively. These slopes suggest a divergence in behaviour, where SUH-ARF (A) tends to underestimate the higher Q_{Pi} values, while the SUH-ARF (P) tends to overestimate these higher Q_{Pi} values.

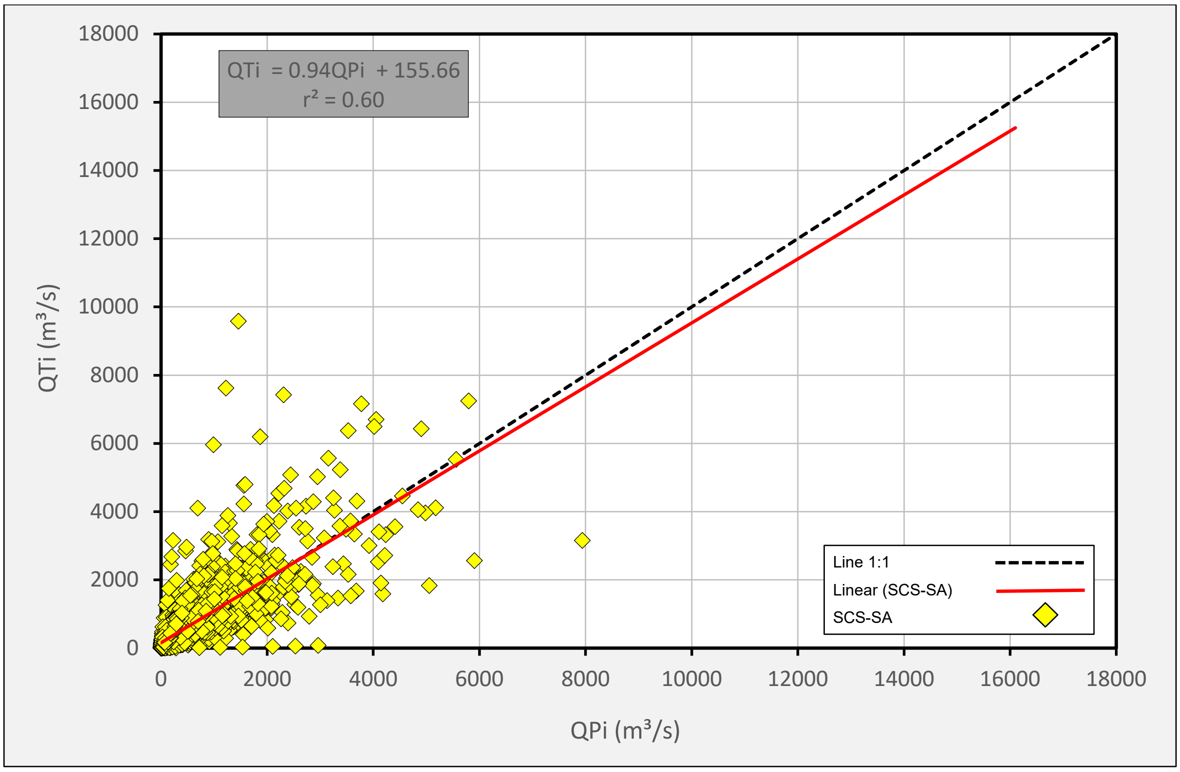

Figure 5.8: SCS-SA versus the Q_{Pi} (probabilistic) design floods

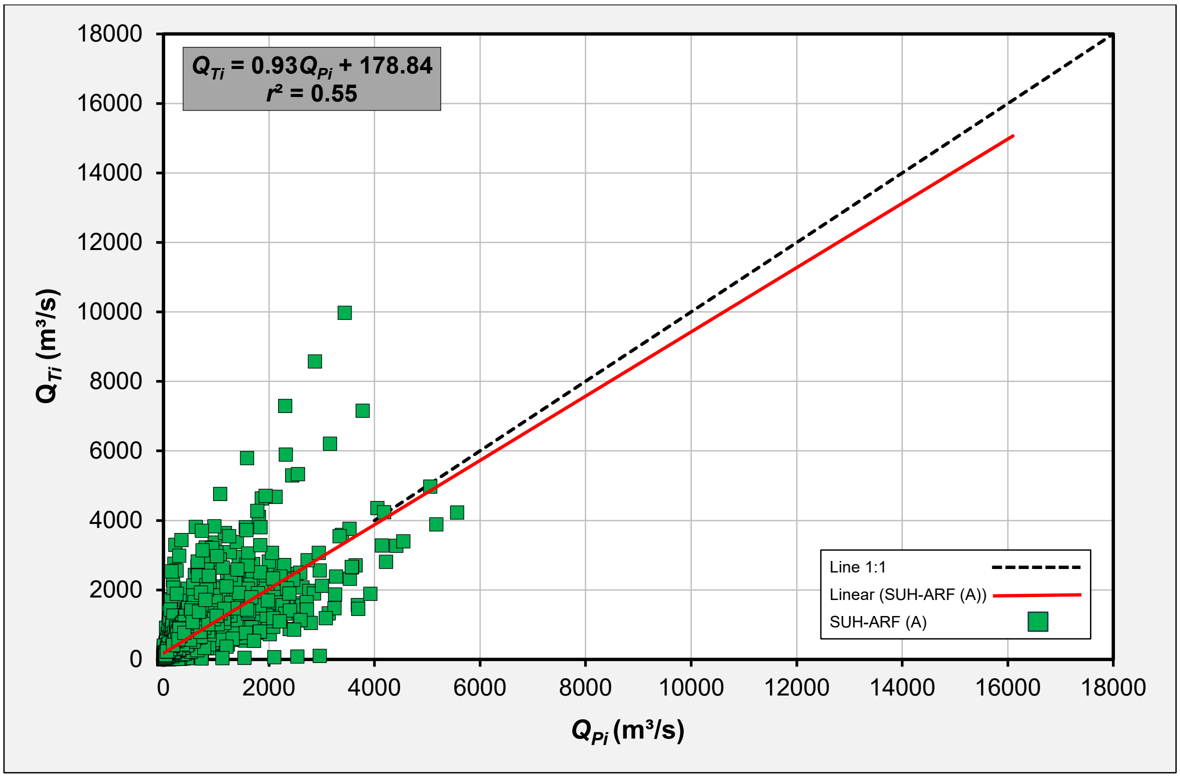

Figure 5.9: SUH-ARF (A) versus the Q_{Pi} (probabilistic) design floods

The LRH-based methods, as shown in Figures 5.11 to 5.14, resulted in r^2 values ranging from 0.53 for the LRH-T_C-ARF (A) method to 0.59 for LRH-Veld-ARF (A) method, representing a moderate degree of association. The slope of 0.99 for the LRH-Veld-ARF (A) methods depicts consistent Q_{Ti} estimates throughout the Q_{Pi} range. In contrast, the LRH-Veld-ARF (P) method, with a slope of 1.22 (> 1), typically overestimates the higher Q_{Pi} values. The LRH-T_C-ARF (A) method has a slope of 0.70, which is associated with the underestimation of the higher flood peaks, while the lower, more frequently occurring flood peaks are overestimated. Similarly, the LRH-T_C-ARF ARF (P) methods resulted in a comparable r^2 of 0.54, while the slightly higher slope of 0.88 demonstrates an improved performance.

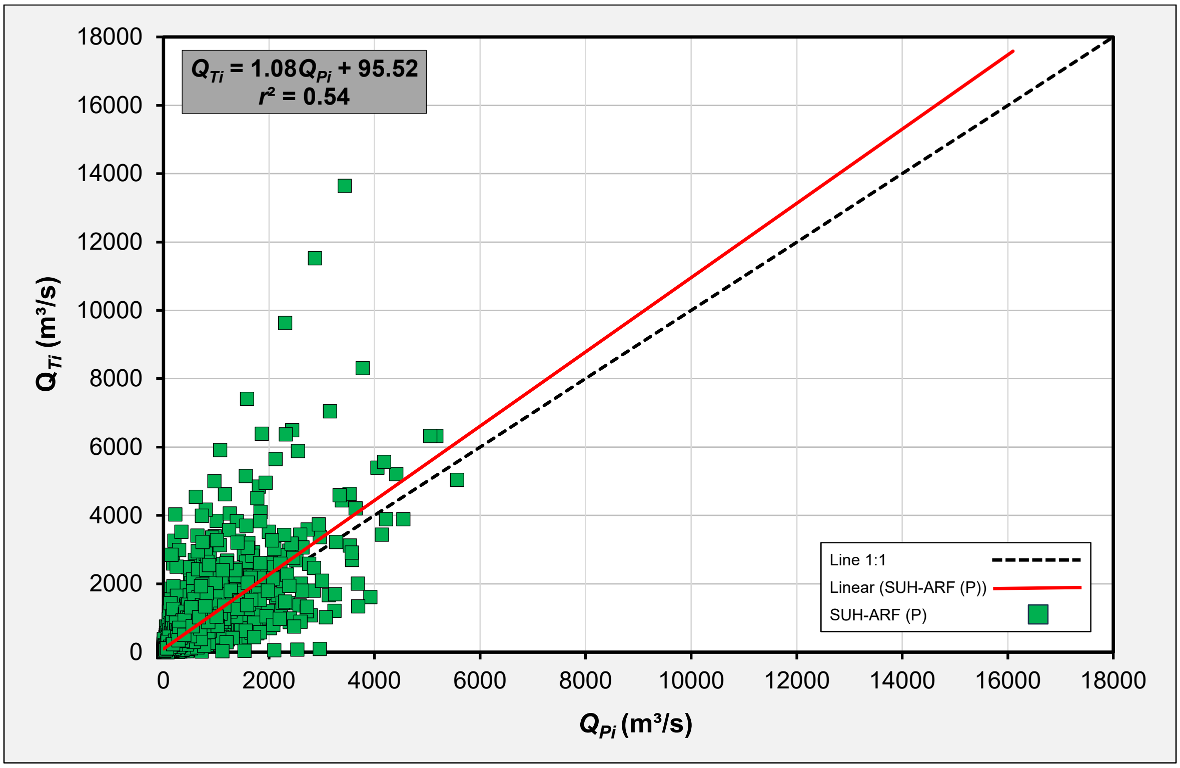

Figure 5.10: SUH-ARF (P) versus the Q_{Pi} (probabilistic) design floods

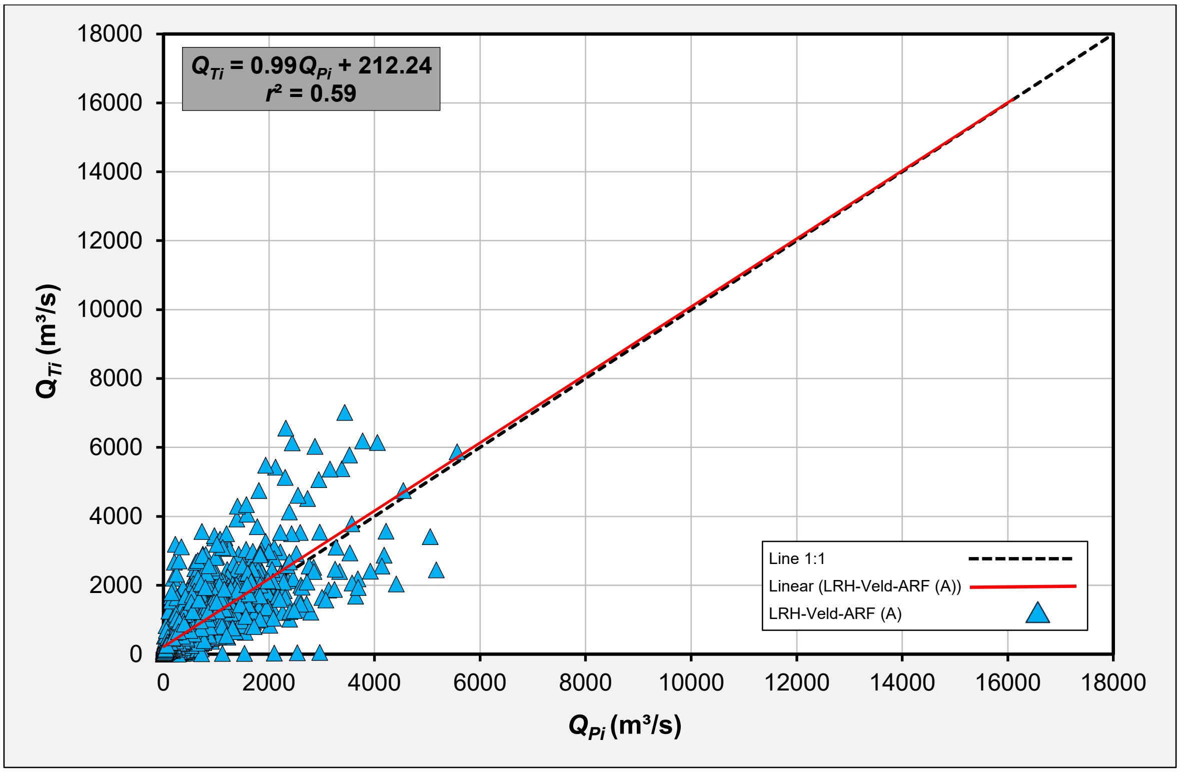

Figure 5.11: LRH-Veld-ARF (A) versus the Q_{Pi} (probabilistic) design floods

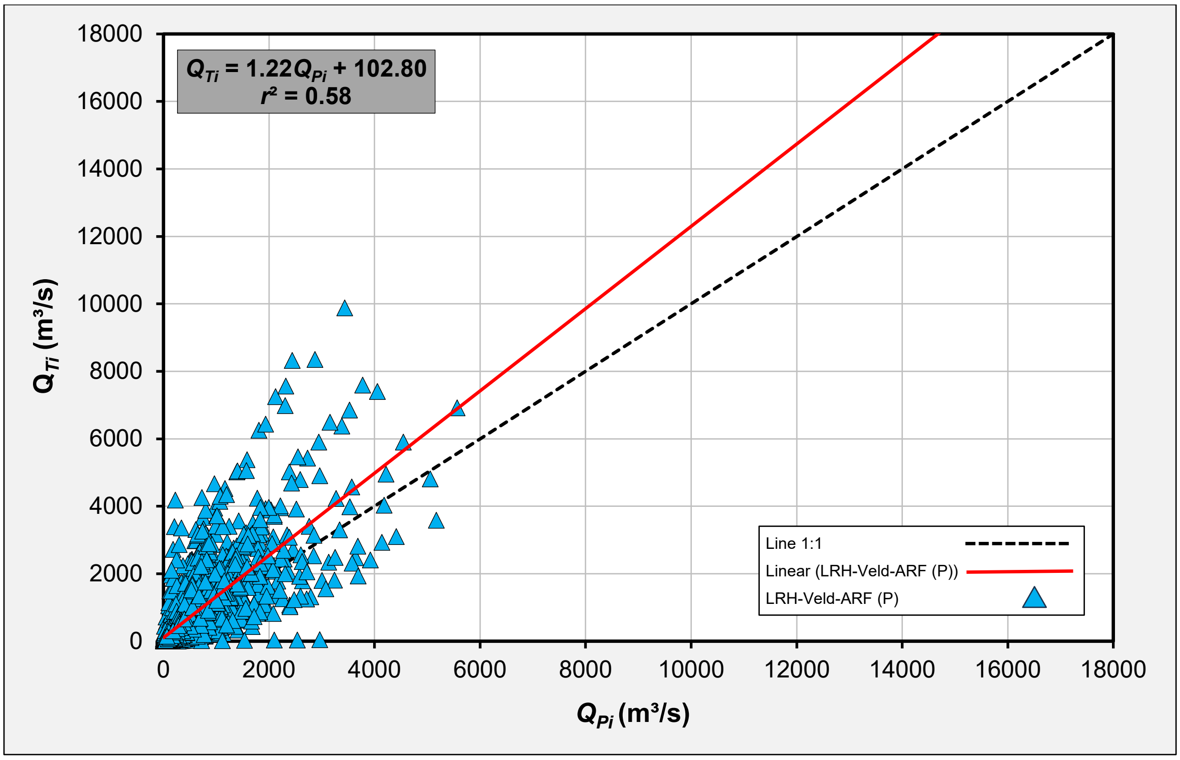

Figure 5.12: LRH-Veld-ARF (P) versus the Q_{Pi} (probabilistic) design floods

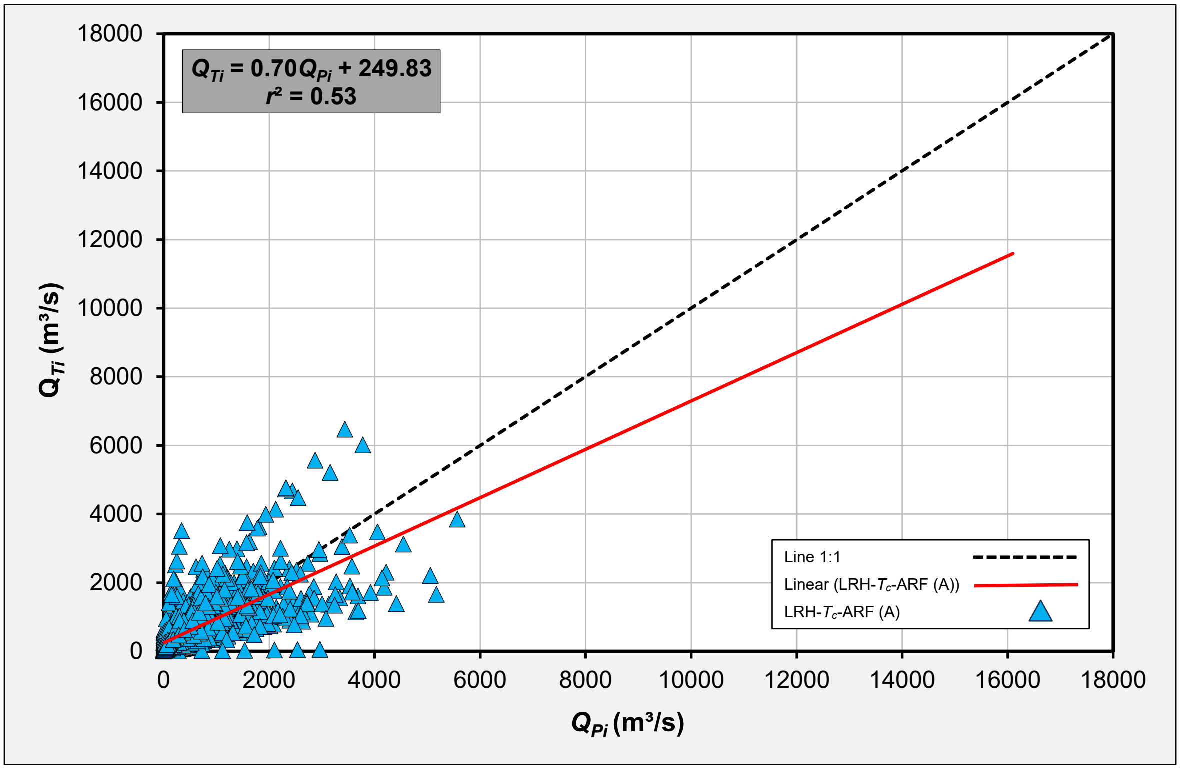

Figure 5.13: LRH-T_c-ARF (A) versus the Q_{Pi} (probabilistic) design floods

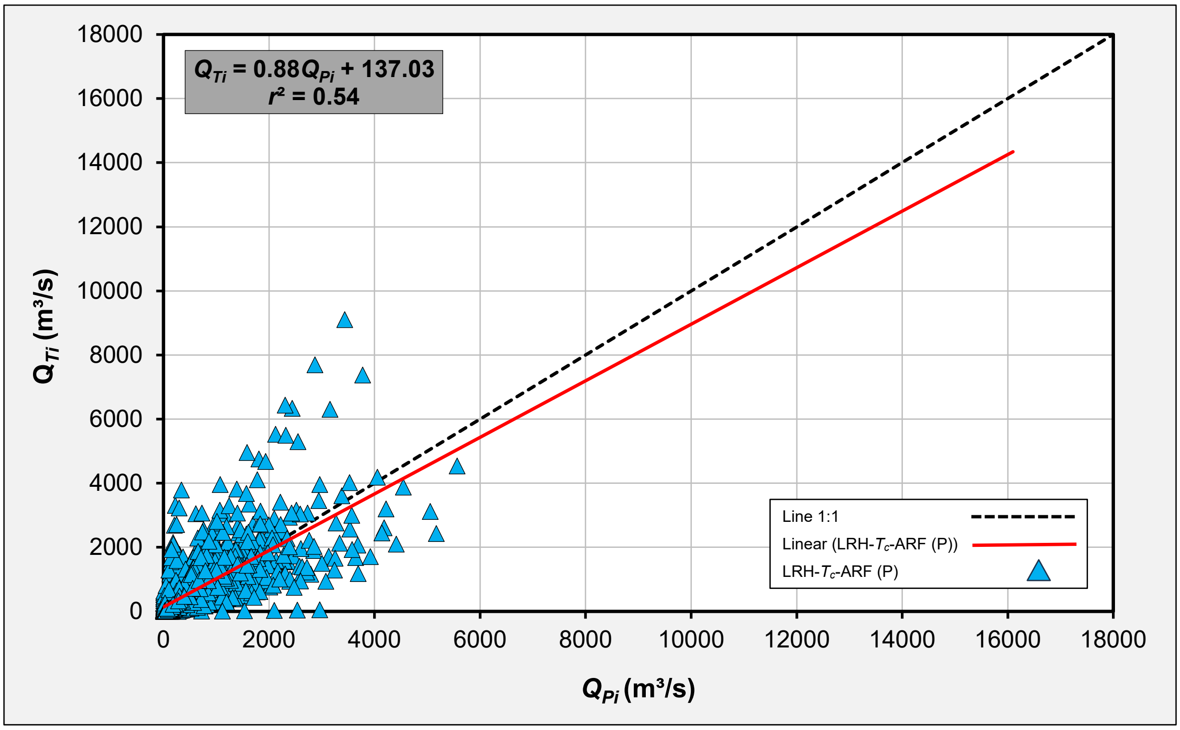

Figure 5.14: LRH-T_c-ARF (P) versus the Q_{Pi} (probabilistic) design floods

Collectively, these findings highlight a common bias pattern amongst most of these methods*, i.e.,* slopes less than unity which result in underestimated high flood peaks and overestimated low flood peaks. These systematic deviations, combined with typical r^2 values below 0.70, suggest a moderate predictive accuracy with method-specific strengths and weaknesses that should be considered in their practical application.

5.5 Mean Relative Error Estimates

As highlighted in Chapter 2 (*cf.* Section 2.6), the relative error (*RE*; Eq. 2.13) quantifies prediction accuracy and/or discrepancies by comparing observed (probabilistic) Q_{Pi} values with the estimated Q_{Ti} values and expressed as a proportion of Q_{Pi} . In this research, mean values, rather than absolute values, were used to calculate the *RE* statistics, which resulted in the mean relative error (*MRE*). The *MRE* involves dividing the sum of relative errors by the sample size (*N*). The results of all the event-based deterministic DFE methods applied in all the catchments for all return periods are shown as box-and-whisker plots in Figures 5.15 to 5.21. Consequently, these values indicate the average magnitude of over- or underestimation, rather than the absolute deviations of individual estimations. Figures 5.15 to 5.21 suggest that the event-based deterministic DFE methods present a consistent trend in variability and estimation bias, distinguishing more consistent methods from those prone to uncertainty over the full range of return periods. The RM3-ARF (A) method consistently exhibited the greatest variability, with uncertainty reaching 44.8%, with the minimum and maximum reaching −10% and 34.8%, respectively at *T* = 2-year (Figure 5.15) and up to 38.6% for *T* = 200-year (Figure 5.21). Similarly, the SUH-ARF (A) and RM3-ARF (P) methods demonstrated notable variability, where the SUH-ARF (A) method revealed a MRE range of 24.8% (−9.1% to 15.7%) at *T* = 10-year (Figure 5.18), while the RM3-ARF (P) method reached 32.6% at *T* = 200-year (Figure 5.22). These methods are also characterised by persistent positive median biases, such as the RM3-ARF (A) and SUH-ARF (A) methods with median biases of 6.2% and 5.3%, respectively at *T* = 2-year (Figure 5.16), while reducing to 3.4% and 1.8% at *T* = 100-year, respectively (Figure 5.20).

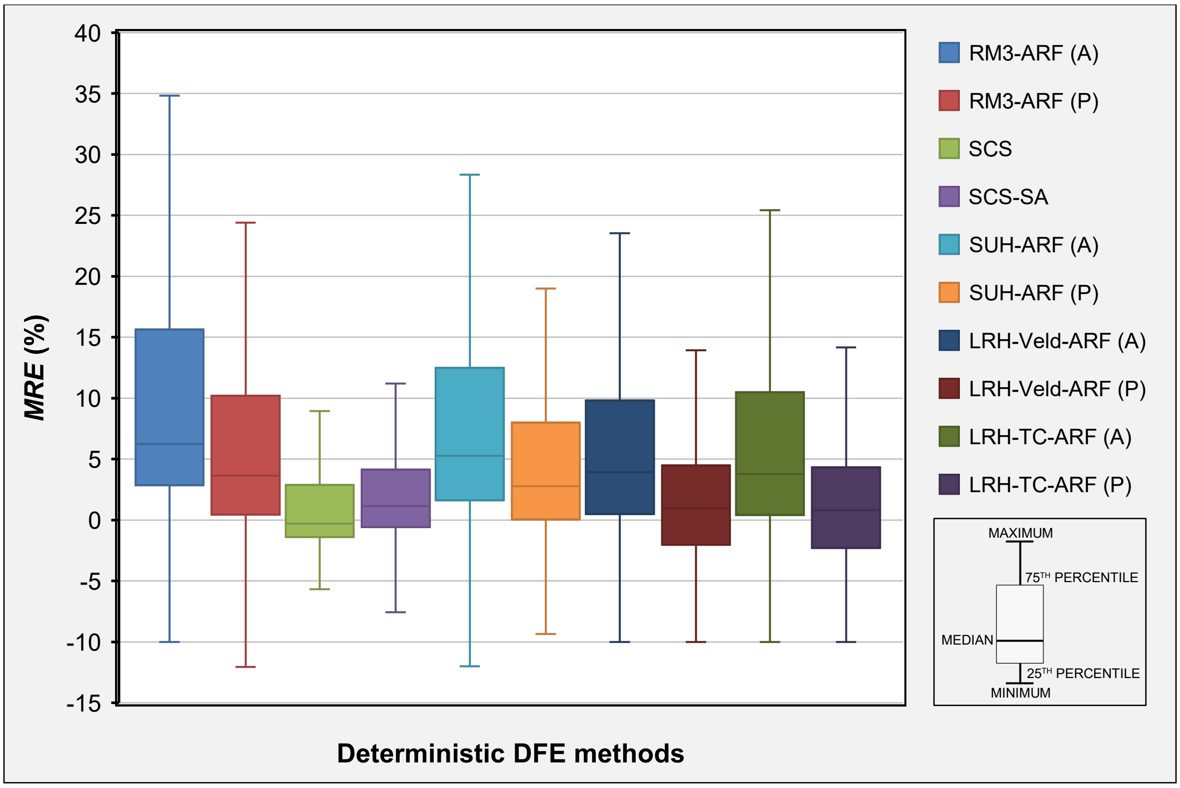

Figure 5.15: *MRE* (%) of event-based deterministic DFE methods (*T* = 2-year)

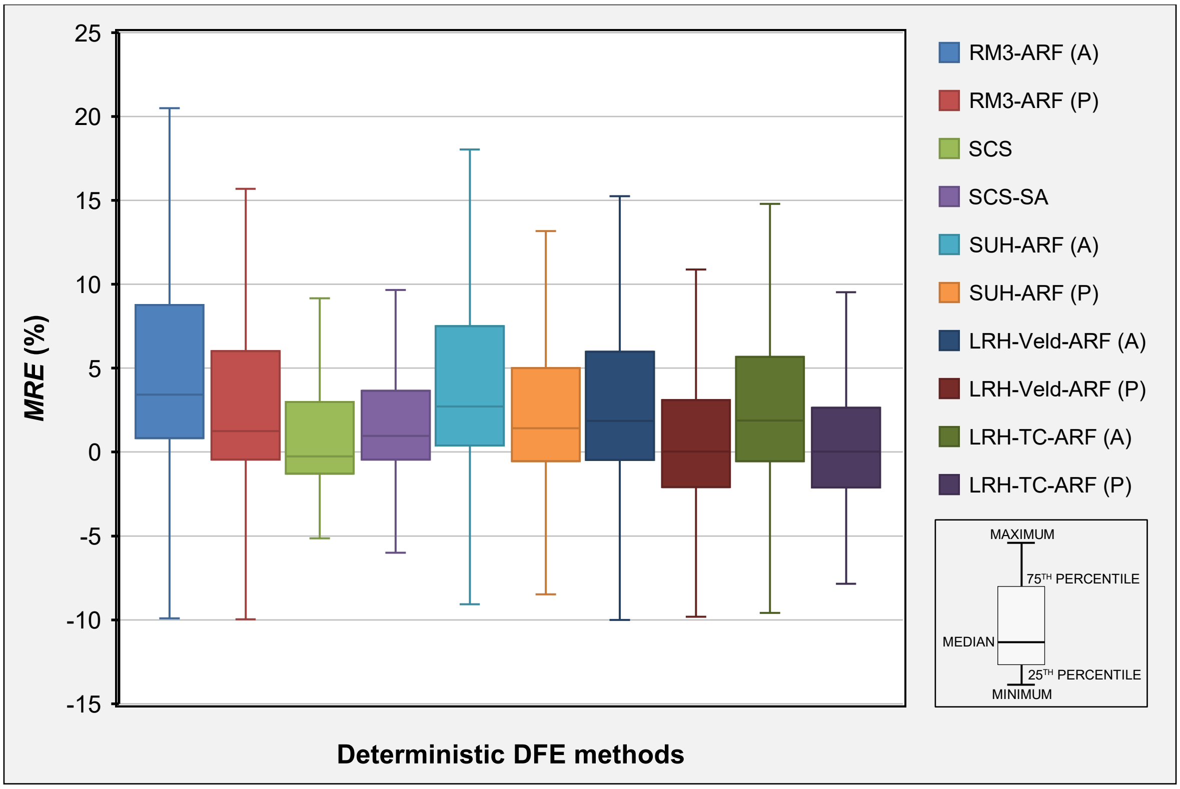

Figure 5.16: *MRE* (%) of event-based deterministic DFE methods (*T* = 5-year)

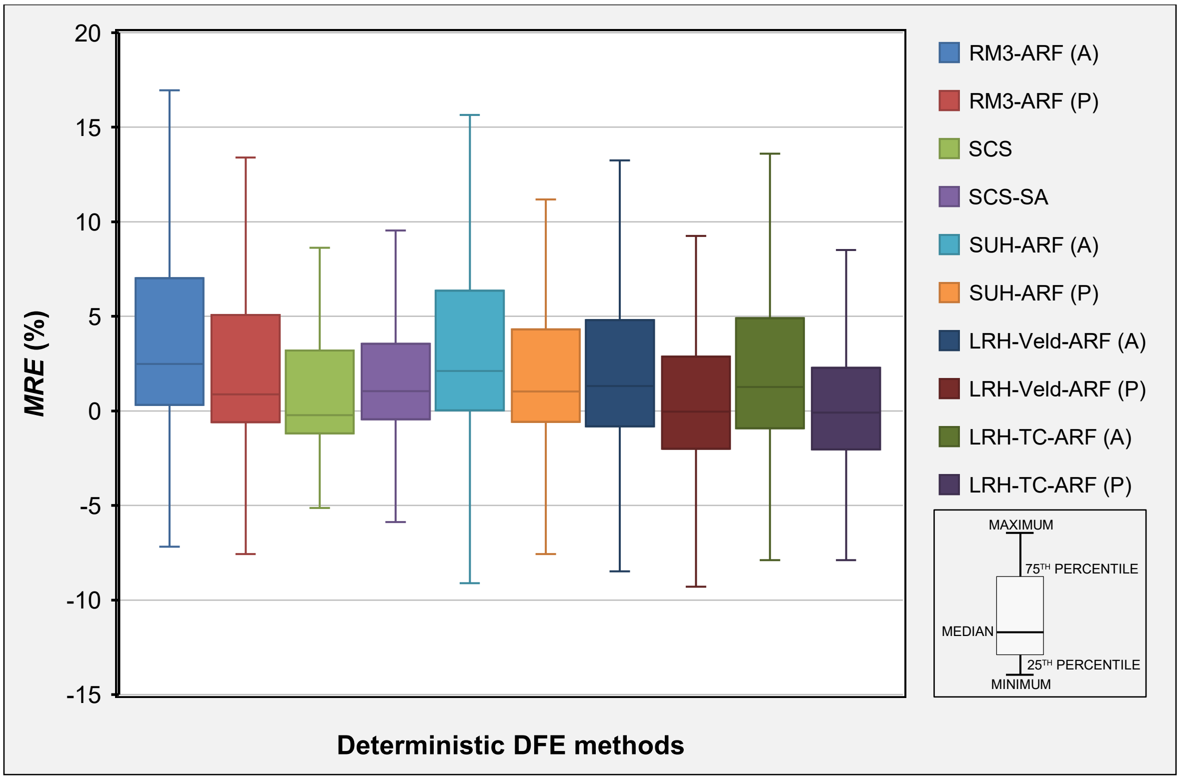

Figure 5.17: *MRE* (%) of event-based deterministic DFE methods (*T* = 10-year)

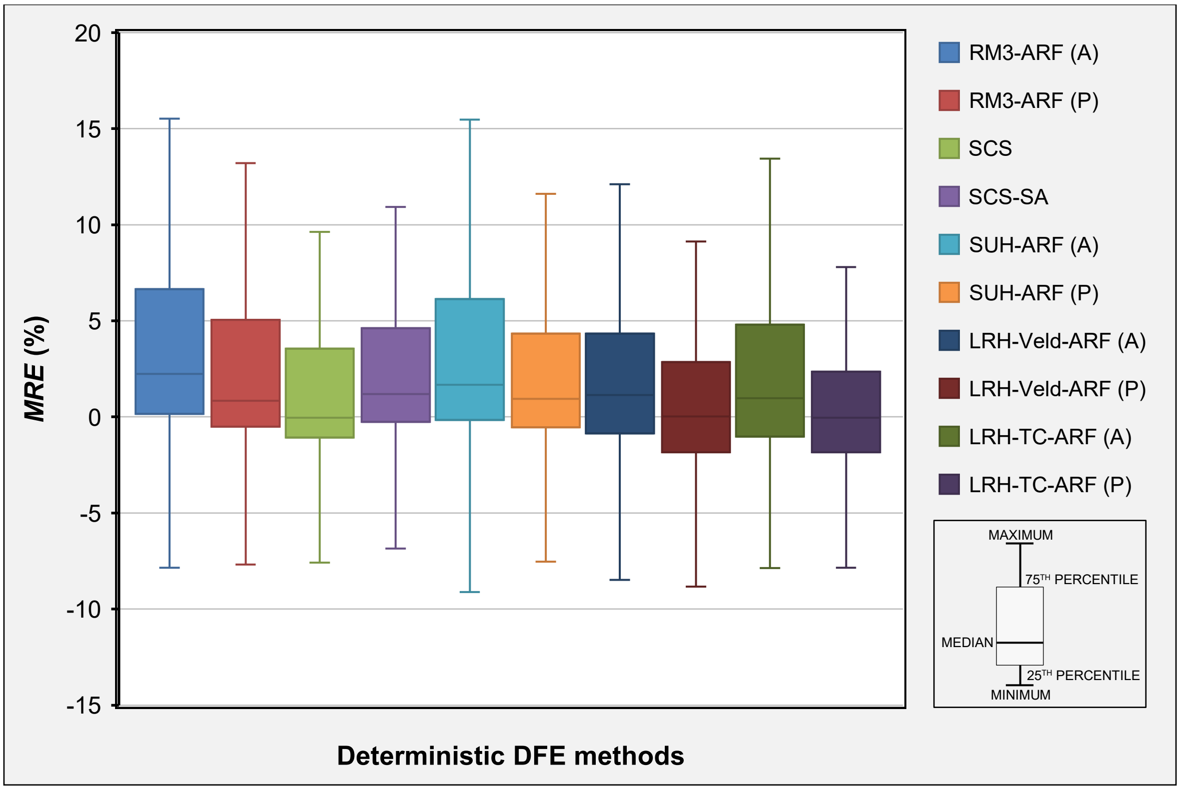

Figure 5.18: *MRE* (%) of event-based deterministic DFE methods (*T* = 20-year)

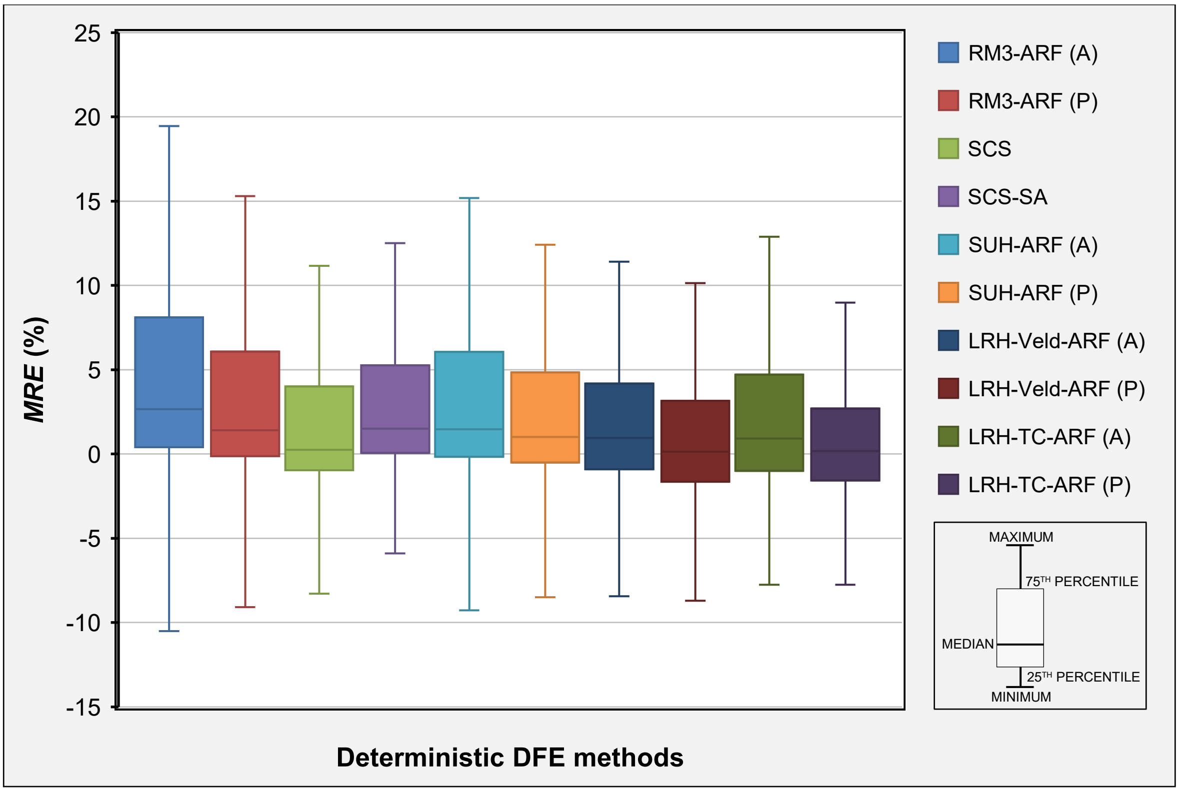

Figure 5.19: *MRE* (%) of event-based deterministic DFE methods (*T* = 50-year)

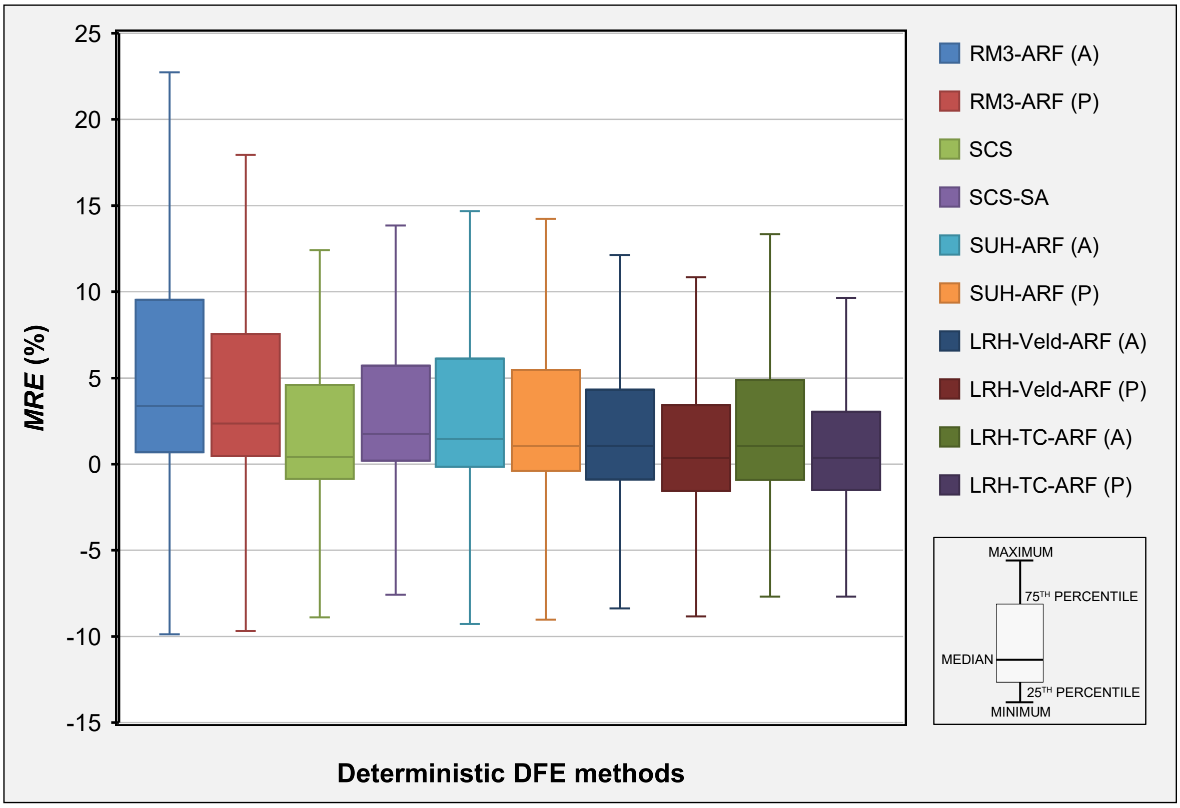

Figure 5.20: *MRE* (%) of event-based deterministic DFE methods (*T* = 100-year)

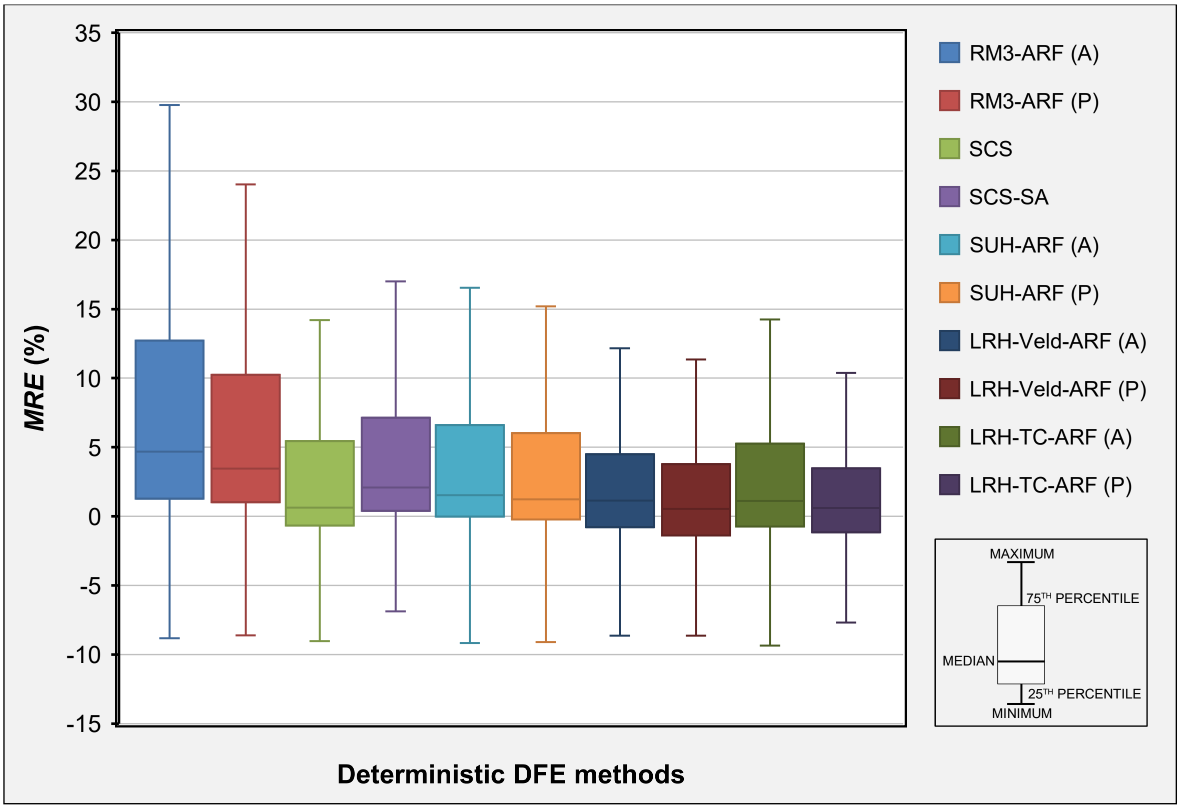

Figure 5.21: *MRE* (%) of event-based deterministic DFE methods (*T* = 200-year)

The SCS, SCS-SA, and LRH-T_C-ARF (P) methods maintained markedly more stable performances across the entire return period range. The variability remained constrained, with *MRE* ranges of 14.6% and 18.8% for the SCS and SCS-SA methods, respectively. For example, at *T* = 2-year (Figure 5.16), the *MRE* values ranged between 13.8% (SCS) and 15.4% (SCS-SA), while at *T* = 10-year (Figure 5.18), the LRH-T_C-ARF (P) method demonstrated *MRE* values up to 16.4%. At higher return periods, this stability persisted, *e.g.,* at *T* = 100-year (Figure 5.21), the LRH-T_C-ARF (P) method demonstrated a spread of 17.3%, with *MRE* values ranging from −7.7% to 9.6%. The SCS and SCS-SA methods demonstrated larger *MRE* ranges, *e.g.,* 17.2% (*T* = 20-year) and 18.4% (*T* = 50-year) as shown respectively in Figures 5.18 and 5.19. Although, in general, median biases across these methods were minimal and closely centred near zero, ranging from approximately −0.3% to 1.8%, hence, underscoring their reliable central tendency and reduced estimation errors.

In general, the *MRE* variability of the event-based deterministic DFE methods decreased from *T* = 2-year through to *T* = 10-year (Figures 5.15 to 5.17). However, the *MRE* values increased subsequently for *T* ≥ 50-year (Figures 5.19 to 5.21). Overall and on average, the RM3-ARF (A), SUH-ARF (A), and RM3-ARF (P) methods are consistently associated with higher *MRE* ranges, often exceeding 25% and positive biases with median errors approaching or exceeding 3%. Conversely, the SCS, SCS-SA, and LRH-T_C-ARF (P) methods exhibit lower variability, with *MRE* ranges generally below 20% and median biases close to zero.

5.6 Expected versus Observed Ratio Estimates

As discussed in Chapter 2 (*cf.* Section 2.6), the Expected/Observed (E/O) ratios, derived using Equation 2.14, compare estimated and observed values which serve as a common metric in statistical analyses used to evaluate the accuracy of deterministic or empirical methods. According to Naidoo (2020), categorising these ratios aids in assessing the acceptability of errors in DFE, thus supporting the evaluation of method reliability in practical applications. In this research, the E/O ratios provide a clear measure of performance, where values close to 1 are an indication of a strong agreement between the estimated Q_{Ti} and observed (probabilistic) Q_{Pi} values. The percentage distribution (%) of the event-based deterministic DFE results across all catchments and return periods in the different/various E/O categories are presented and shown in Table 5.6 and Figure 5.22, respectively.

Table 5.6: Percentage distribution of the event-based deterministic DFE results across all catchments and return periods in the different E/O categories

DFE method	Percentage (%) in E/O categories				
	E/O<0.5	0.5≤E/O<0.75	0.75≤E/O≤1.25	1.25<E/O≤1.5	E/O>1.5
RM3-ARF (A)	1.5	5.1	19.7	9.2	64.5
RM3-ARF (P)	5.4	9.4	21.3	9.3	54.5
SCS	17.1	17.9	25.4	8.4	31.3
SCS-SA	6.8	10.1	23.7	11.6	47.9
SUH-ARF (A)	7.3	7.2	21.8	7.4	56.4
SUH-ARF (P)	10.9	9.6	22.3	9.8	47.5
LRH-Veld-ARF (A)	16.6	6.1	18.3	8.5	50.5
LRH-Veld-ARF (P)	27.9	8.7	19.5	6.9	37.0
LRH-T_C-ARF (A)	16.4	7.1	18.3	7.4	50.7
LRH-T_C-ARF (P)	26.1	11.1	19.3	9.0	34.5

The E/O categories in Table 5.6 include: (i) gross underestimation (E/O < 0.5), (ii) reasonably acceptable underestimation (0.5 ≤ E/O < 0.75), (iii) acceptable estimation (0.75 ≤ E/O ≤ 1.25), (iv) reasonably acceptable overestimation (1.25 < E/O ≤ 1.5), and (v) gross overestimation (E/O > 1.5).

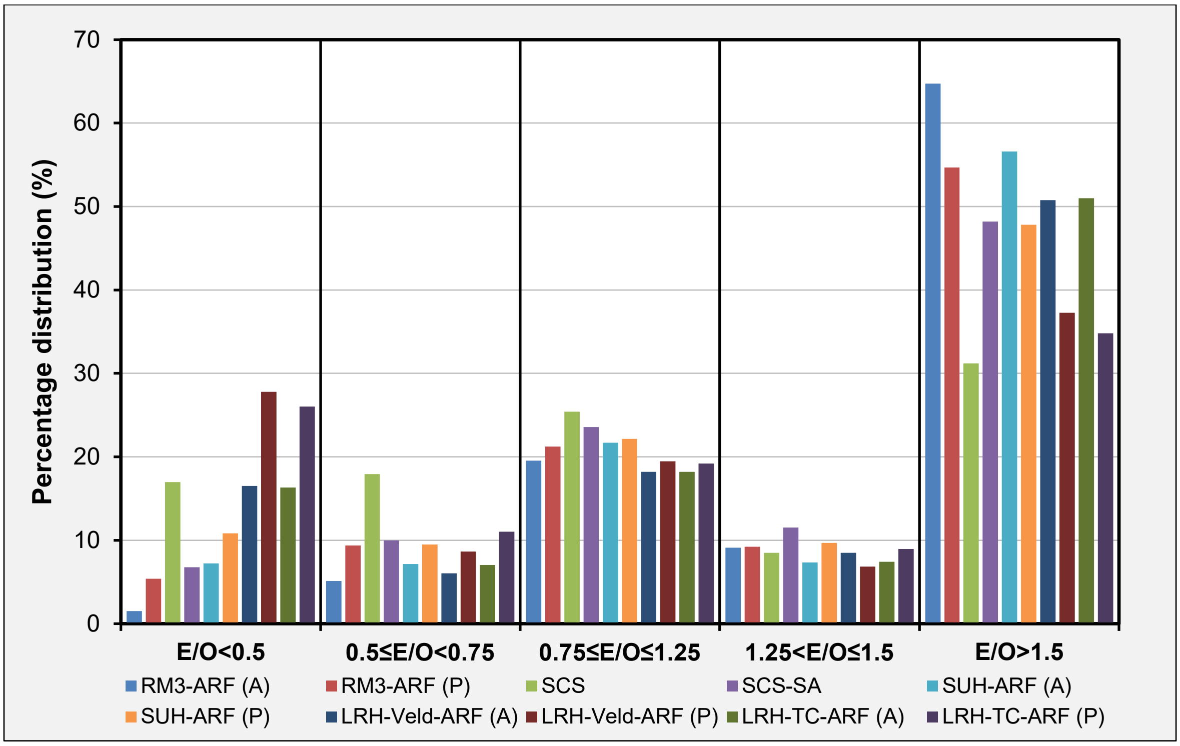

Figure 5.22: Percentage distribution of the event-based deterministic DFE results across all catchments and return periods in the different E/O categories

It is evident from Table 5.6 and Figure 5.22 that the LRH-Veld-ARF (P) method demonstrated the highest tendency to grossly underestimate with 27.9% of the estimation results within the E/O < 0.5 category, while the RM3-ARF (A) method demonstrated the lowest percentage distribution (1.5%) in this category. The SCS, SCS-SA, and SUH-ARF (P) methods demonstrated the highest percentage distribution of acceptable estimations within the 0.75 ≤ E/O ≤ 1.25 category, with 25.4%, 23.7%, and 22.3%, respectively. The RM3-ARF (A) method demonstrated the highest tendency to grossly overestimate with 64.5% of the estimation results within the E/O > 1.5 category, while the SCS method demonstrated the lowest percentage distribution (31.3%) in this category.

The observed overestimation in certain methods can be largely attributed to the methodological simplifications inherent in these approaches. In utilising event-based deterministic methods, the complex, and heterogeneous catchment processes are often simplified or lumped into a single, uniform process as previously highlighted (*cf*. Section 2.2). This simplification, while facilitating straightforward and robust estimation of individual design flood events, may neglect critical spatial and temporal variability, resulting in conservative assumptions and potential overestimation of flood magnitudes.

The combined percentage distribution of the reasonably acceptable underestimation ($0.5 \leq E/O < 0.75$), acceptable estimation ($0.75 \leq E/O \leq 1.25$), and reasonably acceptable overestimation ($1.25 < E/O \leq 1.5$) of DFE results are shown in Figure 5.23.

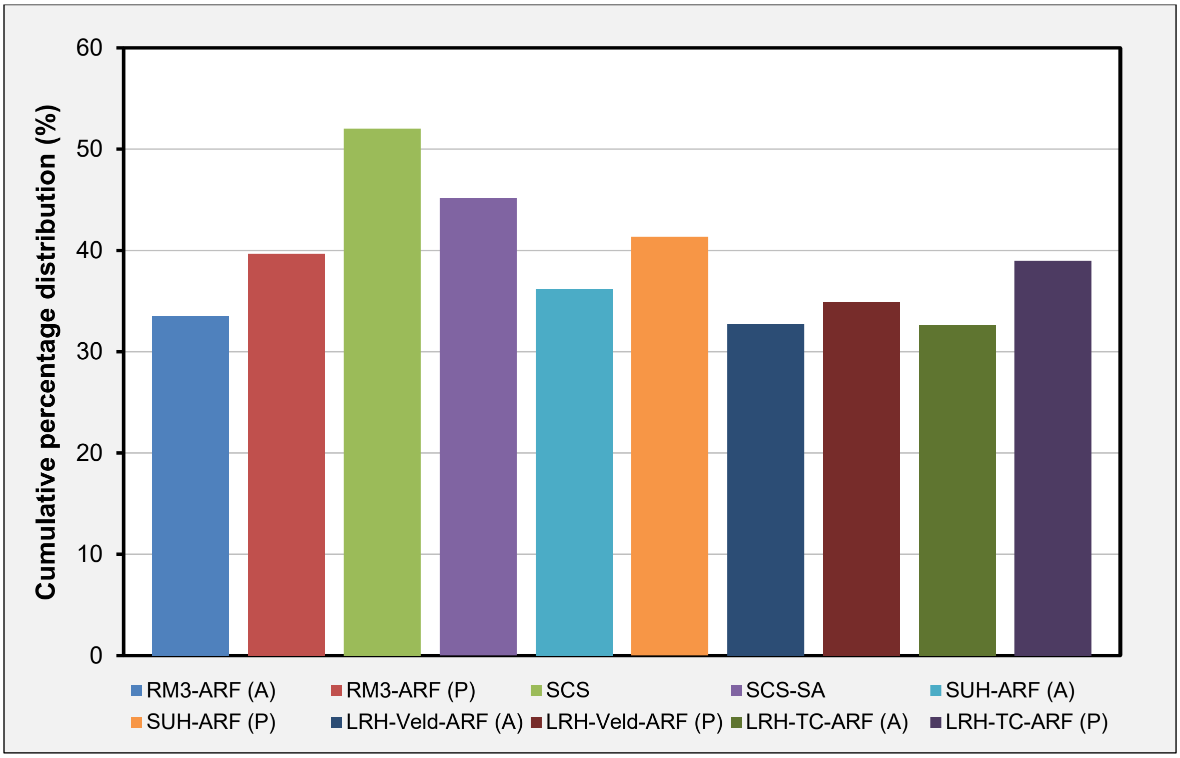

Figure 5.23: Combined percentage distribution of the event-based deterministic DFE results in the $0.5 \leq E/O < 1.5$ category

It is evident from Figure 5.23 that the highest cumulative percentage distribution of acceptable and reasonably acceptable estimates within the $0.5 \leq E/O < 1.5$ category are associated with the SCS (52%), SCS-SA (45.1%), and SUH-ARF (P) (41.3%) methods.

Overall, when considering the different ranking and grouping procedures adopted in this chapter, it is evident that the SCS and SCS-SA methods consistently emerged as the most reliable and robust event-based deterministic DFE methods across all catchments and return periods within the 20 PDRs distributed across South Africa. In contrast, the LRH-Veld-ARF (P) method is regarded as the least reliable. Both the LRH-T_C-ARF (A) and LRH-T_C-ARF (P) methods also demonstrated a consistent performance, frequently ranking amongst the top methods, while the SUH-ARF (A), SUH-ARF (P), LRH-Veld-ARF (A), and LRH-Veld-ARF (P) methods generally performed less satisfactorily. The RM3 methods demonstrated a moderate performance, with RM3-ARF (P) often ranking better than RM3-ARF (A). However, both these methods exhibit higher uncertainty at lower return periods.

In general, method-specific tendencies were evident, with the SCS and SCS-SA methods excelling in both ranking and estimation accuracy. The RM3 methods explained more variance but tend to over- and/or underestimate the probabilistic Q_{Pi} values in some catchments without it being possible to identify the causative factors clearly.

The tabulated information and graphical plots in this chapter are further supplemented in Appendix A.

The final conclusions and recommendations for future research are presented in the next chapter.

6. CONCLUSIONS AND RECOMMENDATIONS

This chapter offers a consolidated discussion of the research findings presented in Chapter 5, drawing on the methodology outlined in Chapter 4 and referencing the literature review conducted in Chapter 2. It also presents the conclusions and offers recommendations for future research.

6.1 Research Aim and Specific Objectives

The primary aim of this research was to assess the performance of event-based deterministic DFE methods utilised across South Africa at a national level. This assessment was intended to contribute to the development of best practice guidelines for the application of event-based deterministic DFE methods in South Africa, consistent with the objectives set out by the NFSP (Smithers *et al.*, 2014). Recognising the practitioners' dilemma in selecting a single, justifiable event-based deterministic method from several available options, the specific objectives of this research sought to establish a performance assessment and ranking system. This system was designed to guide practitioners in choosing the most appropriate event-based deterministic DFE method for application in specific PDRs and return periods, thereby, promoting its consistent adoption and application amongst engineering practitioners and hydrologists.

6.2 Data Development and Method Execution

In this research, the key catchment parameters, *e.g., A* (km^2), urban and lake area distributions (%), L_{CH} (km), S_{CH} (m/m), L_C (km), and S (%), were obtained from the hydrological catchment parameter database developed by Calitz (2020). Additional catchment parameters (*cf.* Sections 4.2.2 to 4.2.6) were primarily derived using a GIS platform to enable the automated extraction of a range of spatial data sets *e.g.*, actual land cover and land use classifications, five homogeneous ARF regions, generalised veld-type regions, and SRTM-based topographical data. In terms of observed streamflow data, only AMS data sets for 411 flow-gauging sites were obtained from DWS (Calitz, 2020; Van der Spuy and Du Plessis, 2022). However, 15 flow-gauging sites were excluded from the analysis owing to data uncertainties and insufficient record lengths, resulting in 396 gauged catchments being considered (*cf.* Section 4.3.1).

The methodology used to assess the performance of the event-based deterministic and at-site probabilistic DFE methods in South Africa was based on the core components of DFE, viz., input (observed and design rainfall), transfer functions (catchment characteristics), and output (runoff estimation). Event-based deterministic DFE was carried out using the RM3, SCS, SCS-SA, LRH, and SUH methods, as outlined in Chapter 2. With the exception of the SCS and SCS-SA methods, all other DFE methods incorporated the use of the Alexander (2001) and Pietersen (2023) ARF estimation methods currently available in South Africa. Standard application procedures associated with each DFE method were followed by employing the software tools as discussed in Chapter 4. The relevant assumptions, limitations, and intended applications of each DFE method were carefully considered.

The full suite of event-based deterministic DFE methods, inclusive of the alternative veld-type and T_C approaches, as used in the LRH method, was evaluated. Results from these methods were consolidated to facilitate the comparison of the deterministic (Q_{Ti}) flood peaks against the benchmark probabilistic (Q_{Pi}) flood peaks. The performance assessment was based on the ranking procedure as proposed by Gericke (2021), which was used to assess the relative accuracy and biases of each of the event-based deterministic DFE methods across 396 gauged catchments using GOF criteria, *e.g.*, r^2, *MARE, NSE, RMSE,* and *SE*. The DFE method with the lowest composite ranking value was considered as the best performer. Similarly, the GOF metrics *RMSE*, *AIC*, *KS*, R^2, and *SBC* were applied across all catchments and return periods (2-year ≤ T ≤ 200-year) to analyse and rank the best-performing probability distributions. Additionally, graphical tools such as box plots and scatter plots were used to visualise discrepancies and identify areas for improvement. The combination of statistical rankings and visual assessments enabled a comprehensive evaluation of the DFE methods.

6.3 Major Research Findings

The major research findings are outlined as follows:

6.3.1 Probability distribution rankings

The performance assessment of five theoretical probability distributions using multiple GOF criteria across all catchments and return periods identified the IPZA probability distribution as performing best overall. The IPZA probability distribution ranked first in all GOF metrics, except R^2, where it was positioned fifth, confirming its strong balance between accuracy and complexity. As a result, the IPZA probability distribution was selected as the most suitable distribution for this research. The GEV and GPA probability distributions were ranked in the second and third positions, respectively. The LP3 probability distribution demonstrated a moderate performance, while the LN probability distribution consistently ranked the lowest across all GOF criteria.

6.3.2 ARFs

Although the Pietersen (2023) ARF method, *i.e.*, ARF (P) produced negative values in certain catchments for T_C < 24-hour, it generally outperformed the Alexander (2001) ARF method, *i.e.*, ARF (A) when applied to the relevant event-based deterministic DFE estimation methods. However, at higher return periods, the ARF (A) method demonstrated a slightly better performance than the ARF (P) method.

6.3.3 Scatter plot analyses

The scatter plot analyses highlighted a common bias pattern amongst most of the event-based deterministic DFE methods, *i.e.,* slopes less than unity which result in underestimated high flood peaks and conservative (overestimated) low flood peaks. These systematic deviations, combined with typical r^2 values below 0.70, suggested a moderate predictive accuracy with method-specific strengths and weaknesses that should be considered in their practical application.

6.3.4 Mean relative error estimates

In general, the *MRE* variability of the event-based deterministic DFE methods decreased from *T* = 2-year through to *T* = 10-year; however, the *MRE* values increased subsequently for $T \geq$ 50-year. Overall and on average, the RM3-ARF (A), SUH-ARF (A), and RM3-ARF (P) methods were consistently associated with higher *MRE* ranges, often exceeding 25% and positive biases with median errors approaching or exceeding 3%. Conversely, the SCS, SCS-SA, and LRH-T_C-ARF (P) methods exhibited lower variability, with *MRE* ranges generally below 20% and median biases close to zero.

6.3.5 Expected versus observed ratio estimates

The LRH-Veld-ARF (P) method demonstrated the highest tendency to grossly underestimate with 27.9% of the estimation results within the E/O < 0.5 category, while the RM3-ARF (A) method demonstrated the lowest percentage distribution (1.5%) in this category. The SCS, SCS-SA, and SUH-ARF (P) methods demonstrated the highest percentage distribution of acceptable estimations within the 0.75 ≤ E/O ≤ 1.25 category. The RM3-ARF (A) method demonstrated the highest tendency to grossly overestimate with 64.5% of the estimation results within the E/O > 1.5 category, while the SCS method demonstrated the lowest percentage distribution (31.3%) in this category. The highest cumulative percentage distribution of acceptable and reasonably acceptable estimates within the 0.5 ≤ E/O < 1.5 category were associated with the SCS (52%), SCS-SA (45.1%), and SUH-ARF (P) (41.3%) methods.

6.3.6 Performance ranking of event-based deterministic DFE methods

Overall, when considering the different ranking and grouping procedures adopted in Chapter 5, it was evident that the SCS and SCS-SA methods consistently emerged as the most reliable and robust event-based deterministic DFE methods across all catchments and return periods within the 20 PDRs distributed across South Africa. In contrast, the LRH-Veld-ARF (P) method was regarded as the least reliable. Both the LRH-T_C-ARF (A) and LRH-T_C-ARF (P) methods also demonstrated a consistent performance, frequently ranking amongst the top methods, while the SUH-ARF (A), SUH-ARF (P), LRH-Veld-ARF (A), and LRH-Veld-ARF (P) methods generally performed less satisfactorily. The RM3 methods demonstrated a moderate performance, with RM3-ARF (P) often ranking better than RM3-ARF (A). However, both these methods demonstrated higher uncertainty at lower return periods.

6.4 Recommendations and Future Research

A significant challenge for engineering practitioners lies in the wide diversity of approaches, aged software applications, data sources and methodologies employed in DFE, which consequently elevates the risk of uncertainty and exposure faced by practitioners. To mitigate this risk, it is recommended that research efforts be standardised through a unified framework for catchment parameterisation, data processing, and probabilistic analyses. Such standardisation would facilitate more accurate method comparisons, promote consistency in refining the DFE methodologies, and advance the NFSP’s objectives to improve existing and/or develop new DFE methods in South Africa. Furthermore, dedicated efforts should be made to update and enhance design software, prioritising both competitiveness and user-friendliness. Moreover, a comparative analysis alongside concurrent research assessing DFE methods in South Africa is proposed, specifically considering the empirical DFE methods not covered in this research. By incorporating these additional methods, the comparison would contribute to a more comprehensive assessment of DFE approaches and support the development of a ranking-based system tailored to South African conditions.

Gericke (2021) proposed the ensemble-event approach as a viable solution to address joint-probability issues and uncertainties when applying event-based DFE methods in South Africa. Rather than relying on a single input parameter value, the probabilistic range of multiple input parameters can be considered to generate a range of possible design flood estimates associated with a specific event or catchment. Subsequently, by adopting the latter ensemble-event approach, professional judgement through best practice guidelines developed under the NFSP initiative will not only improve professional judgement but will also assist in bridging the gap between research and practice. Hence, this research study strongly supports adopting an ensemble-event approach, especially given the varied DFE results obtained, since no single method is universally superior and no definitive criteria exist for identifying the most appropriate DFE method.

This study was primarily guided by the recommendations of the NFSP, with particular emphasis on the foundational hydrological data set, software design tools, relevant literature, and methodologies employed. The recommendations and proposals for future research presented in this study are directly aligned with advancing and refining the NFSP requirements. In addition to the general recommendations made above, the following specific aspects should be considered in future research:

- **Integrated catchment parameter database:** Ongoing contributions to the integrated catchment parameter database established for hydrological studies in South Africa, as identified by the NFSP (Smithers *et al.,* 2014), are essential and recommended.
- **Areal reduction factors:** The Pietersen (2023) ARF method should be calibrated and refined to incorporate critical storm durations of less than 24 hours.
- **SCS-SA method:** Further assessments of the SCS-SA method are recommended, particularly for catchment areas exceeding 80 km². A comprehensive national-scale investigation and refinement of the *CN* values are also required, given that various researchers, *e.g.,* Dlamini (2019), Maharaj (2020), and Smithers *et al*. (2021) concur with this recommendation.
- **Upgrading of the Visual SCS-SA software:** The Visual SCS-SA Version 1.03 software (Schulze *et al.,* 2004) needs upgrading to align with advancements in technology over the past 21 years. Enhancements should improve user-friendliness for data input, optimise functionality, and refine the GUI for more efficient application in hydrological analyses. Additionally, updating the software should ensure compatibility with current operating systems and data formats, enable integration with GIS and even remote

sensing data, and improve computational speed and accuracy, while expanding its applicability to larger catchment sizes. Incorporating automated quality control and visualisation tools would further assist practitioners.

- **Deterministic runoff coefficients:** Future research should focus on refining deterministic runoff coefficients (*C*) for application in ungauged or poorly gauged catchments undergoing urban development. In such areas, accurate estimation of runoff is often limited by data scarcity, yet urban expansion can dramatically alter hydrological responses owing to increased impervious surfaces. Particular attention should be given to catchments with more than 10% urban land cover, where conventional runoff coefficients may no longer reflect actual conditions. Improved methods for estimating the *C* values under changing land use could support more reliable flood estimation, stormwater management, and infrastructure planning.
- **AMS data sets:** Annual updates of the AMS data sets in the NFSP database are necessary and proposed to ensure that up-to-date and current AMS data sets from both river and reservoir flow-gauging sites are available and maintained, with appropriate record lengths and data quality. This would establish uniformity amongst practitioners utilising these AMS data sets.
- **Maintenance of meteorological and hydrological networks:** It is crucial to prioritise the maintenance of the rainfall monitoring and continuous flow-gauging station networks to ensure reliable data collection to support informed decision-making in hydrology and water resources management.
- **Assessment of current rainfall and flow-gauging stations:** It is recommended that new studies be conducted to evaluate the number of operational stations, their spatial distribution, and current operational status for both rainfall monitoring and continuous flow-gauging networks. Conducting such updated assessments will provide a clear understanding of data availability, identify gaps in the networks, and support informed hydrological analyses and water resources management.

6.5 Conclusions

The selection of hydrological input parameters and methods, along with the application of various event-based deterministic and probabilistic DFE methods, can lead to estimates that are significantly different. A comparison between literature, the results obtained in this study, and results from other studies revealed several key factors that may contribute to the observed discrepancies, including the following:

- Deterioration of the current rainfall monitoring and flow-gauging networks;
- Overall quality of rainfall, streamflow, and catchment parameter data sets;
- Characteristics of the AMS data sets, particularly record lengths and outlier handling methods;
- Selection of plotting positions and theoretical probability distributions; and
- GOF criteria and employed ranking procedure(s).

The factors listed above underscore the need for rigorous assessments and standardisation in DFE, all of which were adopted in this research at a national scale. Subsequently, the spatial and qualitative performance rankings of the event-based deterministic DFE methods across all PDRs and return periods can be incorporated for the development of a best practice guideline framework for DFE in South Africa.

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APPENDIX A: TABULATED INFORMATION AND RESULTS

Table A.1: AMS data sets (Van der Spuy and Du Plessis, 2022)

Station	*N*	Station	*N*	Station	*N*	Station	*N*	Station	*N*
A2H006	113	B6H006	60	D5H011	45	J1H004	33	Q9H008	49
A2H007	46	B7H003	40	D5H013	33	J1H015	45	Q9H014	22
A2H012	114	B7H008	34	D5H016	39	J1H016	45	Q9H029	27
A2H013	117	B7H010	55	D7H002	108	J1R001	35	Q9H030	37
A2H023	61	B7H014	30	D7H008	44	J1R004	38	Q9R001	25
A2H024	58	B7H019	29	E1H006	44	J2H007	64	R1H013	37
A2H027	57	B8H010	60	E1H013	27	J2R001	84	R2H005	59
A2H029	56	B8H011	41	E2H003	92	J2R002	54	R2H012	38
A2H032	49	B8H014	50	E2H007	48	J2R003	82	R2H015	31
A2H040	23	B8H017	42	G1H004	57	J2R004	51	S3H003	30
A2H042	25	B8H018	34	G1H008	65	J2R006	73	S3H004	55
A2H044	48	B8H019	21	G1H010	55	J3H005	22	S3H006	54
A2H045	47	B8H034	28	G1H011	55	J3H012	30	S6H001	72
A2H047	46	B9H002	26	G1H012	33	J3H015	53	T1H001	34
A2H049	47	B9H003	22	G1H016	37	J3H020	44	T1H004	25
A2H050	46	C1H002	112	G1H017	25	J3R001	101	T3H005	61
A2H053	46	C1H008	45	G1H018	40	J3R002	90	T3H006	64
A2H054	37	C1H027	24	G1H028	46	J4H004	31	T3H007	43
A2H056	37	C2H018	80	G1H029	46	K1H002	61	T3H009	55
A2H058	37	C2H024	31	G1H038	39	K1H018	37	T4H001	68
A2H061	35	C2H070	20	G1H040	40	K3H002	58	T5H003	60
A2H077	33	C2H073	23	G2H008	49	K3H004	58	T5H004	70
A4H005	55	C2H141	27	G4H008	29	K4H001	34	T5H005	54
A4H007	47	C3H004	23	G4H009	29	K4H003	57	T5H012	49
A5H004	63	C4H002	45	G4H010	29	K6H001	58	U1H005	59
A6H010	53	C4H004	51	G4H012	28	K8H001	58	U2H002	36
A6H011	50	C5H015	34	G4H013	27	K8H002	58	U2H006	65
A6H012	52	C5H018	39	G4H014	52	K8H005	24	U2H007	65
A6H018	46	C5H022	38	G4H033	42	L1H001	30	U2H011	60
A6H020	45	C5H023	25	H1H013	54	L2H003	38	U2H012	59
A6H021	41	C6H003	40	H1H016	22	L6H001	66	U2H013	59
A6H022	21	C7H005	39	H1H017	24	L8H001	54	U2H055	29
A6H024	46	C8H003	63	H1H018	50	L8H002	49	U6H003	20
A7H001	32	C8H004	32	H1H033	28	L8H005	29	U7H001	70
A7H003	42	C8H011	27	H2H005	50	N2H002	68	U7H004	20
A9H004	73	C8H014	29	H2H008	37	N2H005	20	U7H008	33
A9H012	31	C8H020	44	H3H001	21	N2H008	36	U8H001	30
B1H002	62	C8H022	47	H3H004	25	N2R001	90	U8H003	27
B1H004	58	C8H026	32	H4H005	33	N3H001	20	V1H001	74
B1H005	46	C9H010	39	H4H007	28	P3H001	35	V1H009	65
B1H012	41	D1H001	106	H4H009	25	P4H001	49	V1H010	58
B1H017	29	D1H004	53	H4H012	24	Q1H012	42	V1H029	25
B1H018	29	D1H011	53	H4H013	22	Q3H005	42	V1H030	26
B1H019	29	D1H032	33	H4H015	35	Q4H003	28	V1H032	20
B2H007	34	D1R002	24	H6H007	29	Q4R002	57	V1H038	47
B3H007	39	D2R001	76	H6H010	50	Q6H003	38	V1R001	72
B4H005	59	D2R002	74	H7H004	65	Q8H004	31	V1R002	68
B4H007	51	D4H002	38	H7H005	59	Q8H008	39	V1R003	28
B6H001	77	D4H013	55	H8H001	52	Q8H010	32	V2H004	58
B6H002	28	D4H032	38	H9H002	55	Q8R001	31	V2H005	46
B6H003	60	D5H003	81	H9H005	50	Q9H002	84	V2H007	47

Station	*N*	Station	*N*	Station	*N*	Station	*N*	Station	*N*
V2R001	47	W1H017	22	W5R002	57	X2H010	69	X2H072	23
V3H007	71	W1R001	47	W5H024	42	X2H011	44	X2R001	37
V3H010	59	W2H006	54	W5R001	43	X2H014	59	X2R002	54
V3R001	48	W2H007	30	W5R002	57	X2H017	40	X2R003	43
V3R003	61	W2H028	31	W5R003	57	X2H018	27	X2H028	27
V6H003	65	W2R001	41	X1H012	25	X2H024	55	X2R004	51
V6H004	65	W3R001	45	X1H014	50	X2H025	27	X2R005	54
V7H012	56	W5H001	65	X1H016	49	X2H026	27	X3H002	55
V7H016	46	W5H005	69	X1H019	45	X2H008	71	X3H006	43
V7H017	46	W5H011	55	X1H020	36	X2H027	27	X3H011	39
V7R001	66	W5H016	30	X1R001	54	X2H028	27	X3R001	40
W1H004	69	W5H022	51	X1R003	42	X2H031	53	X2R004	51
W1H005	70	W5H024	42	X1R004	45	X2H035	37	X2R005	54
W1H015	21	W5R001	43	X2H008	71	X2H047	33	X3R002	33

Table A.2: AMS data sets (Calitz, 2020)

Station	*N*	Station	*N*	Station	*N*	Station	*N*	Station	*N*
A2H038	24	A2H039	24	B7H004	24	J3H014	24	V2H001	24

Table A.3: AMS data sets (processed dam records) (DWS, 2024)

Station	*N*	Station	*N*	Station	*N*	Station	*N*	Station	*N*
A2R001	101	A2R015	68	A6R002	62	B2R001	117	B6R003	71
A2R003	84	A3R001	84	A8R002	55	B3R001	88	B7R001	72
A2R005	84	A3R002	112	A8R003	55	B3R002	85	B7R003	69
A2R006	81	A3R003	111	A8R004	25	B3R005	83	B8R001	68
A2R007	71	A3R004	61	A9R001	78	B4R001	57	B8R002	40
A2R009	64	A4R001	59	A9R002	53	B4R002	57	B8R003	48
A2R011	58	A5R001	56	A9R004	60	B4R004	62	B8R006	42
A2R012	67	A5R002	54	B1R001	113	B5R002	82	B8R007	34
A2R014	71	A6R001	82	B1R002	52	B6R001	63		

Table A.4: AMS data sets (processed river records) (DWS, 2024)

Station	*N*	Station	*N*	Station	*N*	Station	*N*	Station	*N*
B9H004	22	C7H006	62	D7H005	94	V2H002	70	X2H016	58
C1H004	60	C8H005	58	H6H009	55	X1H001	113	X2H022	58
C1H006	56	C8H027	37	J4H002	46	X1H003	78	X2H032	51
C1H007	49	C8H028	33	N1R001	99	X1H017	48	X3H001	72
C1H012	35	C9H003	136	T5H001	49	X1H018	48	X4H004	40
C1H015	114	C9H009	110	T5H007	41	X2H013	61		

Table A.5: AMS data sets (stations omitted due to record length)

Station	*N*	Station	*N*	Station	*N*
A2H063	10	B7H020	19	D1R003	17

Table A.6: AMS data sets (stations omitted due to poor accuracy and/or data)

Stations					
A9H006	C2H027	D2H034	G1H015	Q4R001	V2R003
B5H002	D1H033	E2H010	J2H005	V2R002	W1R002

Table A.7: Theoretical probability distribution rankings (*RMSE*, Eq. 2.11)

Station	***N***	**Score**					**Rank**				
		LN	**LP3**	**GEV**	**IPZA**	**GPA**	**LN**	**LP3**	**GEV**	**IPZA**	**GPA**
A2H006	113	262	73	35	24	41	5	4	2	1	3
A2H007	46	15	20	11	7	16	3	5	2	1	4
A2H012	114	193	549	178	42	71	4	5	3	1	2
A2H013	117	99	56	37	21	24	5	4	3	1	2
A2H023	61	38	9	26	4	24	5	2	4	1	3
A2H024	58	1	1	0	0	0	5	4	2	1	3
A2H027	57	321	1.E+04	94	45	99	4	5	2	1	3
A2H029	56	49	2.E+04	7	10	8	4	5	1	3	2
A2H032	49	49	28	10	13	17	5	4	1	2	3
A2H038	24	10	0	2	4	4	5	1	2	4	3
A2H039	23	3	1	2	2	2	5	1	4	3	2
A2H040	23	6	3	4	5	6	4	1	2	3	5
A2H042	25	7	4	5	6	6	5	1	2	3	4
A2H044	48	45	7	26	13	21	5	1	4	2	3
A2H045	47	24	8	10	4	14	5	2	3	1	4
A2H047	46	15	8.E+09	10	7	5	4	5	3	2	1
A2H049	47	6	1	2	1	4	5	2	3	1	4
A2H050	46	20	10	7	4	9	5	4	2	1	3
A2H053	46	12	2	5	4	5	5	1	3	2	4
A2H054	37	21	1 983	9	9	5	4	5	2	3	1
A2H056	37	11	3.E+07	4	5	4	4	5	1	3	2
A2H058	37	13	0	2	3	3	5	1	2	3	4
A2H061	35	23	4	13	2	27	4	2	3	1	5
A2H077	33	99	145	43	21	74	4	5	2	1	3
A2R001	101	156	94	52	21	32	5	4	3	1	2
A2R003	84	110	988	100	9	40	4	5	3	1	2
A2R005	84	76	12	27	8	21	5	2	4	1	3
A2R006	81	225	224	37	24	40	5	4	2	1	3
A2R007	71	178	34	21	20	32	5	4	2	1	3
A2R009	64	233	21	124	27	97	5	1	4	2	3
A2R011	58	26	37	14	1	14	4	5	2	1	3
A2R012	67	53	69	20	1	22	4	5	2	1	3
A2R012	67	53	69	20	1	22	4	5	2	1	3
A2R014	71	275	244	66	33	80	5	4	2	1	3
A2R015	68	176	119	70	17	85	5	4	2	1	3
A3R001	84	403	2 134	362	7	120	4	5	3	1	2
A3R002	112	141	47	21	10	20	5	4	3	1	2
A3R003	111	190	7	16	19	20	5	1	2	3	4
A3R004	61	160	52	56	20	81	5	2	3	1	4
A4H005	55	431	121	91	78	85	5	4	3	1	2
A4H007	47	142	69	12	14	23	5	4	1	2	3
A4R001	59	128	381	67	16	82	4	5	2	1	3
A5H004	63	60	35	23	15	19	5	4	3	1	2
A5R001	56	152	59	46	35	40	5	4	3	1	2
A5R002	54	385	988	330	40	172	4	5	3	1	2
A6H010	53	12	3	4	4	2	5	2	4	3	1
A6H011	50	168	9	11	20	21	5	1	2	3	4
A6H012	52	12	4	6	5	2	5	2	4	3	1
A6H018	46	5	5	1	1	2	5	4	2	1	3
A6H020	45	26	10	5	4	7	5	4	2	1	3
A6H021	41	7	0	2	3	1	5	1	3	4	2
A6H022	21	0	0	0	0	0	5	1	3	4	2
A6H024	46	14	4	2	2	4	5	3	2	1	4
A6R001	82	19	3	5	3	7	5	2	3	1	4

Station	*N*	Score					Rank				
		LN	LP3	GEV	IPZA	GPA	LN	LP3	GEV	IPZA	GPA
A6R002	62	82	7	20	14	31	5	1	3	2	4
A7H001	32	243	86	55	67	50	5	4	2	3	1
A7H003	42	377	115	62	78	124	5	3	1	2	4
A8R002	55	59	53	18	8	21	5	4	2	1	3
A8R003	55	56	16	8	10	15	5	4	1	2	3
A8R004	25	61	99	25	23	46	4	5	2	1	3
A9H004	73	113	209	51	16	67	4	5	2	1	3
A9H012	31	143	38	51	59	52	5	1	2	4	3
A9R001	78	380	339	130	17	102	5	4	3	1	2
A9R002	53	39	8	13	7	20	5	2	3	1	4
A9R004	60	670	1 920	217	43	221	4	5	2	1	3
B1H002	62	120	129	41	10	39	4	5	3	1	2
B1H004	58	8	9	5	1	5	4	5	2	1	3
B1H005	46	158	10	70	43	89	5	1	3	2	4
B1H012	41	39	24	10	10	18	5	4	2	1	3
B1H017	29	17	9	17	9	8	5	3	4	2	1
B1H018	29	77	31	36	36	28	5	2	4	3	1
B1H019	29	3	2	3	2	1	4	2	5	3	1
B1R001	113	413	251	68	40	61	5	4	3	1	2
B1R002	52	34	130	17	14	11	4	5	3	2	1
B2H007	34	22	2 835	10	10	5	4	5	2	3	1
B2R001	117	372	275	136	14	72	5	4	3	1	2
B3H007	39	44	20	7	15	26	5	3	1	2	4
B3R001	88	77	234	62	8	31	4	5	3	1	2
B3R002	85	316	331	106	5	104	4	5	3	1	2
B3R005	83	162	215	44	12	40	4	5	3	1	2
B4H005	59	6	2	3	0	3	5	2	3	1	4
B4H007	51	51	2.E+05	5	13	15	4	5	1	2	3
B4R001	57	16	12	10	2	8	5	4	3	1	2
B4R002	57	4	3	1	1	1	5	4	2	1	3
B4R004	62	19	4	4	3	9	5	3	2	1	4
B6H001	77	65	24	56	3	38	5	2	4	1	3
B6H002	28	15	32	10	3	16	3	5	2	1	4
B6H003	60	54	20	31	23	14	5	2	4	3	1
B6H006	60	8	1	5	4	4	5	1	4	3	2
B6R001	63	21	10	8	3	8	5	4	3	1	2
B6R003	71	143	63	30	23	53	5	4	2	1	3
B7H003	40	103	98	24	15	33	5	4	2	1	3
B7H004	43	54	45	25	15	24	5	4	3	1	2
B7H008	34	648	1 507	161	123	252	4	5	2	1	3
B7H010	55	403	31	117	94	123	5	1	3	2	4
B7H014	30	106	5	13	17	17	5	1	2	4	3
B7H019	29	222	48	58	74	53	5	1	3	4	2
B7R001	72	241	8	22	35	42	5	1	2	3	4
B7R003	69	118	271	38	8	30	4	5	3	1	2
B8H010	60	442	28	22	34	32	5	2	1	4	3
B8H011	41	461	17	32	43	37	5	1	2	4	3
B8H014	50	41	47	15	5	20	4	5	2	1	3
B8H017	42	325	147	84	91	183	5	3	1	2	4
B8H018	34	1 229	349	213	332	405	5	3	1	2	4
B8H019	21	122	83	38	35	44	5	4	2	1	3
B8H034	28	1 693	409	333	432	368	5	3	1	4	2
B8R001	68	14	14	5	1	5	4	5	2	1	3
B8R002	40	41	26	21	8	25	5	4	2	1	3
B8R003	48	97	15	20	18	40	5	1	3	2	4
B8R006	42	2	0	1	1	1	5	1	4	3	2

Station	*N*	Score					Rank				
		LN	LP3	GEV	IPZA	GPA	LN	LP3	GEV	IPZA	GPA
B8R007	34	1 196	225	150	330	389	5	2	1	3	4
B9H002	26	207	111	58	82	123	5	3	1	2	4
C1H006	56	79	29	64	33	56	5	1	4	2	3
C1H007	49	88	54	40	12	47	5	4	2	1	3
C1H008	45	66	42	48	28	24	5	3	4	2	1
C1H012	35	440	44	110	158	161	5	1	2	3	4
C1H015	114	93	176	58	18	91	4	5	2	1	3
C1H027	24	58	7	12	29	39	5	1	2	3	4
C2H018	80	413	532	209	36	244	4	5	2	1	3
C2H024	31	1	1	1	0	1	5	4	2	1	3
C2H070	20	49	72	30	24	42	4	5	2	1	3
C2H073	23	115	14	75	66	73	5	1	4	2	3
C2H141	27	9	3	9	1	4	4	2	5	1	3
C3H004	23	11	7	9	4	6	5	3	4	1	2
C4H002	45	639	272	105	143	216	5	4	1	2	3
C4H004	51	179	55	72	66	39	5	2	4	3	1
C5H015	34	239	45	126	115	51	5	1	4	3	2
C5H018	39	316	48	115	84	163	5	1	3	2	4
C5H022	38	9	1	4	3	4	5	1	4	2	3
C5H023	25	22	9	6	11	17	5	2	1	3	4
C6H003	40	441	2 010	162	169	110	4	5	2	3	1
C7H005	39	59	12	29	26	18	5	1	4	3	2
C7H006	62	189	16	75	55	69	5	1	4	2	3
C8H003	63	48	5	19	17	9	5	1	4	3	2
C8H004	32	52	43	30	17	35	5	4	2	1	3
C8H005	58	113	113	46	6	77	4	5	2	1	3
C8H011	27	104	48	21	51	79	5	2	1	3	4
C8H014	29	97	180	58	13	91	4	5	2	1	3
C8H020	44	303	296	109	53	143	5	4	2	1	3
C8H022	47	916	3 286	623	39	587	4	5	3	1	2
C8H026	32	395	17	124	131	138	5	1	2	3	4
C8H027	37	110	156	70	8	118	3	5	2	1	4
C8H028	33	67	27	12	21	59	5	3	1	2	4
C9H003	136	518	547	233	82	256	4	5	2	1	3
C9H009	110	726	535	274	165	231	5	4	3	1	2
C9H010	39	1 130	414	415	365	318	5	3	4	2	1
D1H001	106	441	91	51	49	74	5	4	2	1	3
D1H004	53	44	2	9	12	12	5	1	2	4	3
D1H011	53	289	523	192	43	240	4	5	2	1	3
D1H032	33	86	58	56	40	40	5	4	3	2	1
D1R002	24	237	676	258	96	319	2	5	3	1	4
D2R001	76	23	75	18	8	12	4	5	3	1	2
D2R002	74	56	36	13	4	27	5	4	2	1	3
D4H002	38	4	8	2	0	4	4	5	2	1	3
D4H013	55	0	0	0	0	0	5	4	3	1	2
D4H032	38	4	8	2	0	4	4	5	2	1	3
D5H003	81	39	12	23	13	9	5	2	4	3	1
D5H011	45	224	44	34	50	47	5	2	1	4	3
D5H013	33	850	766	201	167	367	5	4	2	1	3
D5H016	39	328	280	115	72	165	5	4	2	1	3
D7H002	108	1.E+04	807	6 033	873	2 800	5	1	4	2	3
D7H005	94	820	471	335	166	180	5	4	3	1	2
D7H008	44	8	200	191	19	27	1	5	4	2	3
E1H006	44	8	200	191	19	27	1	5	4	2	3
E1H013	27	31	12	30	43	30	4	1	2	5	3
E2H003	92	188	12	74	35	39	5	1	4	2	3

Station	***N***	**Score**					**Rank**				
		LN	**LP3**	**GEV**	**IPZA**	**GPA**	**LN**	**LP3**	**GEV**	**IPZA**	**GPA**
E2H007	48	3	39	6	1	2	3	5	4	1	2
G1H004	57	18	17	14	24	20	3	2	1	5	4
G1H008	65	39	11	15	9	16	5	2	3	1	4
G1H010	55	2	0	1	1	0	5	1	4	3	2
G1H011	55	2	1	2	3	2	3	1	4	5	2
G1H012	33	1	0	1	2	1	3	1	2	5	4
G1H016	37	1	1	1	1	1	5	4	2	1	3
G1H017	25	0	0	0	0	0	5	3	1	2	4
G1H018	40	0	1	0	0	1	2	5	3	1	4
G1H028	46	249	5 722	88	78	43	4	5	3	2	1
G1H029	46	38	1.E+46	8	11	13	4	5	1	2	3
G1H038	39	24	13	9	9	18	5	3	2	1	4
G1H040	40	6	7.E+59	4	3	1	4	5	3	2	1
G2H008	49	0	1	1	7	1	1	3	2	5	4
G4H008	29	0	4	1	0	1	2	5	4	1	3
G4H009	29	0	0	0	0	0	5	2	3	1	4
G4H010	29	0	3	1	0	1	2	5	3	1	4
G4H012	28	0	1	0	0	0	2	5	4	1	3
G4H013	27	0	5	1	0	1	2	5	4	1	3
G4H014	52	32	43	21	6	33	3	5	2	1	4
G4H033	42	12	1	3	3	3	5	1	2	4	3
H1H013	54	20	2	6	7	8	5	1	2	3	4
H1H016	22	5	3.E+04	4	2	2	4	5	3	1	2
H1H017	24	0	3	1	0	1	2	5	3	1	4
H1H018	50	15	6	11	35	12	4	1	2	5	3
H1H033	28	18	16	9	5	18	4	3	2	1	5
H2H005	50	2	2.E+27	1	1	1	4	5	2	1	3
H2H008	37	8	4.E+18	3	2	1	4	5	3	2	1
H3H001	21	37	13	22	22	20	5	1	4	3	2
H3H004	25	2	5	1	1	2	4	5	2	1	3
H4H005	33	16	8	5	5	11	5	3	2	1	4
H4H007	28	9	11	3	2	5	4	5	2	1	3
H4H009	25	3	1	2	1	2	5	1	4	2	3
H4H012	24	2	4	1	1	2	4	5	2	1	3
H4H013	22	37	263	21	9	39	3	5	2	1	4
H4H015	35	6	3	5	4	5	5	1	4	2	3
H6H007	29	4	9	4	6	6	2	5	1	4	3
H6H009	55	202	438	119	17	130	4	5	2	1	3
H6H010	50	9	25	3	1	4	4	5	2	1	3
H7H004	65	21	10	5	5	5	5	4	2	3	1
H7H005	59	1	0	1	4	2	2	1	3	5	4
H8H001	52	49	56	32	4	40	4	5	2	1	3
H9H002	55	30	37	8	5	11	4	5	2	1	3
H9H005	50	98	47	57	39	42	5	3	4	1	2
J1H004	33	22	6	15	10	11	5	1	4	2	3
J1H015	45	1	0	0	0	1	5	3	2	1	4
J1H016	45	9	3	3	3	2	5	4	2	3	1
J1R001	35	81	275	174	10	93	2	5	4	1	3
J1R004	38	151	268	33	33	59	4	5	2	1	3
J2H007	64	10	2	1	1	1	5	4	2	3	1
J2R001	84	23	20	9	1	8	5	4	3	1	2
J2R002	54	337	73	67	72	96	5	3	1	2	4
J2R003	82	34	30	9	2	11	5	4	2	1	3
J2R004	51	80	26	16	11	26	5	4	2	1	3
J2R006	73	1 488	68	199	222	235	5	1	2	3	4
J3H005	22	50	33	15	24	38	5	3	1	2	4

Station	***N***	**Score**					**Rank**				
		LN	**LP3**	**GEV**	**IPZA**	**GPA**	**LN**	**LP3**	**GEV**	**IPZA**	**GPA**
J3H012	30	95	18	38	38	23	5	1	3	4	2
J3H014	28	3	1	3	1	2	5	2	4	1	3
J3H015	53	8	8	4	2	4	4	5	3	1	2
J3H020	44	26	48	10	4	14	4	5	2	1	3
J3R001	101	718	4 808	288	93	245	4	5	3	1	2
J3R002	90	976	37	239	95	212	5	1	4	2	3
J4H002	46	2 214	215	347	314	290	5	1	4	3	2
J4H004	31	35	85	11	8	18	4	5	2	1	3
K1H002	61	2	2.E+04	1	1	0	4	5	3	2	1
K1H018	37	457	71	3	3	2	5	4	2	3	1
K3H002	58	0	0	0	0	0	5	1	2	3	4
K3H004	58	15	18	9	5	14	4	5	2	1	3
K4H001	34	46	32	14	16	18	5	4	1	2	3
K4H003	57	59	77	16	6	21	4	5	2	1	3
K6H001	58	122	198	38	12	60	4	5	2	1	3
K8H001	58	6	4	4	5	3	5	3	2	4	1
K8H002	58	51	11	20	2	28	5	2	3	1	4
K8H005	24	37	42	18	10	36	4	5	2	1	3
L1H001	30	47	210	133	33	111	2	5	4	1	3
L2H003	38	84	6	14	25	32	5	1	2	3	4
L6H001	66	195	73	46	52	37	5	4	2	3	1
L8H001	54	47	41	17	10	13	5	4	3	1	2
L8H002	49	61	6	16	16	15	5	1	3	4	2
L8H005	29	155	303	78	26	143	4	5	2	1	3
N1R001	99	826	745	230	45	150	5	4	3	1	2
N2H002	68	258	14	97	57	121	5	1	3	2	4
N2H005	20	158	2 621	520	57	474	2	5	4	1	3
N2H008	36	5	4	3	0	4	5	4	2	1	3
N2R001	90	528	1 479	307	107	285	4	5	3	1	2
N3H001	20	150	350	113	48	235	3	5	2	1	4
P3H001	35	181	484	49	31	79	4	5	2	1	3
P4H001	49	367	311	87	60	99	5	4	2	1	3
Q1H012	42	9	4	3	7	9	5	2	1	3	4
Q3H005	42	73	174	42	7	48	4	5	2	1	3
Q4H003	28	12	13	7	1	13	3	4	2	1	5
Q4R002	57	31	32	11	1	14	4	5	2	1	3
Q6H003	38	30	2	15	12	12	5	1	4	2	3
Q8H004	31	94	5	45	32	67	5	1	3	2	4
Q8H008	39	110	49	48	33	56	5	3	2	1	4
Q8H010	32	21	42	11	4	16	4	5	2	1	3
Q8R001	31	51	91	36	8	58	3	5	2	1	4
Q9H002	84	489	1 215	161	33	175	4	5	2	1	3
Q9H008	49	31	9	21	8	15	5	2	4	1	3
Q9H014	22	10	3	7	6	5	5	1	4	3	2
Q9H029	27	37	49	18	9	34	4	5	2	1	3
Q9H030	37	14	4	5	4	8	5	2	3	1	4
Q9R001	25	28	4	8	13	27	5	1	2	3	4
R1H013	37	509	418	111	125	194	5	4	1	2	3
R2H005	59	234	21	58	45	78	5	1	3	2	4
R2H012	38	23	9	5	7	6	5	4	1	3	2
R2H015	31	29	7	12	12	17	5	1	3	2	4
S3H003	30	9	1	3	4	3	5	1	2	4	3
S3H004	55	40	20	16	3	26	5	3	2	1	4
S3H006	54	33	3	15	9	11	5	1	4	2	3
S6H001	72	18	1	5	4	4	5	1	4	3	2
T1H001	34	272	117	82	81	39	5	4	3	2	1

Station	*N*	Score					Rank				
		LN	LP3	GEV	IPZA	GPA	LN	LP3	GEV	IPZA	GPA
T1H004	25	159	17	63	81	104	5	1	2	3	4
T3H005	61	95	8	28	4	50	5	2	3	1	4
T3H006	64	88	28	48	9	36	5	2	4	1	3
T3H007	43	285	202	88	108	98	5	4	1	3	2
T3H009	55	23	10	15	2	10	5	2	4	1	3
T4H001	68	140	726	165	51	104	3	5	4	1	2
T5H001	49	159	1 136	356	228	253	1	5	4	2	3
T5H003	60	21	3	5	5	7	5	1	3	2	4
T5H004	70	32	48	22	9	25	4	5	2	1	3
T5H005	54	51	66	26	7	40	4	5	2	1	3
T5H007	41	49	59	15	12	46	4	5	2	1	3
T5H012	49	117	53	37	39	23	5	4	2	3	1
U1H005	59	134	500	359	92	172	2	5	4	1	3
U2H002	36	25	5	13	9	26	4	1	3	2	5
U2H006	65	76	8 484	356	35	67	3	5	4	1	2
U2H007	65	46	118	109	2	30	3	5	4	1	2
U2H011	60	106	507	121	4	57	3	5	4	1	2
U2H012	59	98	3	24	15	36	5	1	3	2	4
U2H013	59	48	21	17	9	22	5	3	2	1	4
U2H055	29	61	45	30	29	37	5	4	2	1	3
U6H003	20	91	98	32	34	55	4	5	1	2	3
U7H001	70	4	375	11	5	6	1	5	4	2	3
U7H004	20	0	0	0	0	0	5	3	2	4	1
U7H008	33	14	210	72	10	28	2	5	4	1	3
U8H001	30	360	272	107	100	201	5	4	2	1	3
U8H003	27	237	20	77	92	80	5	1	2	4	3
V1H001	74	397	118	184	158	37	5	2	4	3	1
V1H009	65	24	4	16	1	10	5	2	4	1	3
V1H010	58	42	46	24	28	36	4	5	1	2	3
V1H029	25	12	59	31	4	21	2	5	4	1	3
V1H030	26	55	6	30	17	42	5	1	3	2	4
V1H032	20	29	26	37	10	13	4	3	5	1	2
V1H038	47	52	126	50	60	89	2	5	1	3	4
V1R001	72	75	60	44	18	45	5	4	2	1	3
V1R002	68	33	67	29	52	44	2	5	1	4	3
V1R003	28	156	92	67	40	174	4	3	2	1	5
V2H001	28	55	196	76	33	99	2	5	3	1	4
V2H002	70	39	355	97	18	30	3	5	4	1	2
V2H004	58	125	520	229	37	106	3	5	4	1	2
V2H005	46	15	107	55	7	22	2	5	4	1	3
V2H007	47	11	9	3	3	6	5	4	2	1	3
V2R001	47	25	208	59	4	24	3	5	4	1	2
V3H007	71	12	2	4	1	6	5	2	3	1	4
V3H010	59	26	19	26	9	12	4	3	5	1	2
V3R001	48	77	43	27	20	42	5	4	2	1	3
V3R003	61	16	12	6	6	14	5	3	2	1	4
V6H003	65	29	4	14	3	13	5	2	4	1	3
V6H004	65	21	33	14	14	20	4	5	1	2	3
V7H012	56	36	32	62	3	32	4	3	5	1	2
V7H016	46	13	34	19	10	20	2	5	3	1	4
V7H017	46	9	35	17	10	11	1	5	4	2	3
V7R001	66	74	58	62	3	59	5	2	4	1	3
W1H004	69	182	62	22	11	24	5	4	2	1	3
W1H005	70	12	1	3	3	2	5	1	4	3	2
W1H015	21	43	10	12	16	13	5	1	2	4	3
W1H017	22	1	0	1	1	1	5	1	2	4	3

Station	***N***	**Score**					**Rank**				
		LN	**LP3**	**GEV**	**IPZA**	**GPA**	**LN**	**LP3**	**GEV**	**IPZA**	**GPA**
W1R001	47	306	3 419	532	131	331	2	5	4	1	3
W2H006	54	1 050	1 614	913	97	531	4	5	3	1	2
W2H007	30	49	185	93	9	62	2	5	4	1	3
W2H028	31	74	71	28	20	54	5	4	2	1	3
W2R001	41	67	37	25	11	42	5	3	2	1	4
W3R001	45	874	319	197	173	306	5	4	2	1	3
W5H001	65	172	210	128	85	225	3	4	2	1	5
W5H005	69	49	88	64	2	29	3	5	4	1	2
W5H011	55	29	45	18	2	15	4	5	3	1	2
W5H016	30	2	1	1	1	1	5	2	4	3	1
W5H022	51	45	29	23	16	15	5	4	3	2	1
W5H024	42	46	28	12	14	23	5	4	1	2	3
W5R001	43	9	2	7	1	3	5	2	4	1	3
W5R002	57	16	15	7	1	8	5	4	2	1	3
W5R003	57	18	22	11	2	11	4	5	3	1	2
X1H001	113	216	834	292	122	139	3	5	4	1	2
X1H003	78	214	190	136	5	88	5	4	3	1	2
X1H012	25	21	29	9	7	15	4	5	2	1	3
X1H014	50	404	148	68	89	99	5	4	1	2	3
X1H016	49	195	3 742	367	25	152	3	5	4	1	2
X1H017	48	36	3	12	4	25	5	1	3	2	4
X1H018	48	51	5	19	11	26	5	1	3	2	4
X1H019	45	230	119	38	56	81	5	4	1	2	3
X1H020	36	19	7	7	5	9	5	3	2	1	4
X1R001	54	30	30	13	5	20	5	4	2	1	3
X1R003	42	38	98	37	26	41	3	5	2	1	4
X1R004	45	137	58	31	34	76	5	3	1	2	4
X2H008	71	33	5	8	7	9	5	1	3	2	4
X2H010	69	31	10	6	7	9	5	4	1	2	3
X2H011	44	24	5	20	11	6	5	1	4	3	2
X2H013	61	15	2	6	3	9	5	1	3	2	4
X2H014	59	3	1	1	0	1	5	2	4	1	3
X2H016	58	1 585	17 687	1 158	108	773	4	5	3	1	2
X2H017	40	338	1 175	429	19	289	3	5	4	1	2
X2H018	27	287	60	76	85	125	5	1	2	3	4
X2H022	58	439	97	59	68	103	5	3	1	2	4
X2H024	55	8	2	4	2	3	5	2	4	1	3
X2H025	27	1	0	1	0	0	5	3	4	1	2
X2H026	27	3	2	1	2	2	5	3	1	2	4
X2H027	27	2	2	1	1	2	5	4	2	1	3
X2H028	27	0	0	0	0	0	5	3	1	2	4
X2H031	53	61	48	22	12	25	5	4	2	1	3
X2H032	51	118	294	197	12	97	3	5	4	1	2
X2H035	37	3	1	1	1	1	5	4	1	3	2
X2H047	33	2	2	2	1	1	5	4	3	1	2
X2H072	23	121	1 722	128	21	164	2	5	3	1	4
X2R001	37	7	21	9	1	7	3	5	4	1	2
X2R002	54	64	48	22	8	22	5	4	3	1	2
X2R003	43	5	4	2	1	5	5	3	2	1	4
X2R004	51	157	101	19	22	34	5	4	1	2	3
X2R005	54	6	4	5	10	3	4	2	3	5	1
X3H001	72	6	13	5	3	4	4	5	3	1	2
X3H002	55	3	19	12	1	3	2	5	4	1	3
X3H006	43	124	305	49	16	63	4	5	2	1	3
X3H011	39	65	49	20	13	34	5	4	2	1	3
X3R001	40	3	9	4	2	3	2	5	4	1	3

Station	*N*	Score					Rank				
		LN	LP3	GEV	IPZA	GPA	LN	LP3	GEV	IPZA	GPA
X3R002	33	29	11	9	10	14	5	3	1	2	4
X4H004	40	145	44	52	46	39	5	2	4	3	1

Table A.8: Theoretical probability distribution rankings (*AIC*, Eq. 4.6)

Station	*N*	Score					Rank				
		LN	LP3	GEV	IPZA	GPA	LN	LP3	GEV	IPZA	GPA
A2H006	113	1 583	1 295	1 130	1 042	1 168	5	4	2	1	3
A2H007	46	385	414	355	314	391	3	5	2	1	4
A2H012	114	1 528	1 768	1 511	1 184	1 301	4	5	3	1	2
A2H013	117	1 411	1 280	1 181	1 051	1 085	5	4	3	1	2
A2H023	61	621	444	579	360	568	5	2	4	1	3
A2H024	58	134	119	32	-90	40	5	4	2	1	3
A2H027	57	824	1 240	686	602	691	4	5	2	1	3
A2H029	56	598	1 273	390	425	403	4	5	1	3	2
A2H032	49	525	470	370	400	426	5	4	1	2	3
A2H038	24	181	21	110	136	135	5	1	2	4	3
A2H039	23	120	83	103	96	93	5	1	4	3	2
A2H040	23	150	116	134	149	155	4	1	2	3	5
A2H042	25	174	142	159	166	171	5	1	2	3	4
A2H044	48	505	333	454	388	435	5	1	4	2	3
A2H045	47	436	339	355	258	389	5	2	3	1	4
A2H047	46	382	2 239	349	316	293	4	5	3	2	1
A2H049	47	305	114	224	94	267	5	2	3	1	4
A2H050	46	411	348	317	271	336	5	4	2	1	3
A2H053	46	365	193	284	273	285	5	1	3	2	4
A2H054	37	335	673	271	273	230	4	5	2	3	1
A2H056	37	286	1 389	213	226	221	4	5	1	3	2
A2H058	37	298	10	145	188	194	5	1	2	3	4
A2H061	35	323	205	287	148	335	4	2	3	1	5
A2H077	33	401	428	348	301	384	4	5	2	1	3
A2R001	101	1 310	1 211	1 090	911	991	5	4	3	1	2
A2R003	84	1 031	1 403	1 019	622	866	4	5	3	1	2
A2R005	84	969	666	801	598	758	5	2	4	1	3
A2R006	81	1 111	1 113	820	754	833	4	5	2	1	3
A2R007	71	941	710	637	631	699	5	4	2	1	3
A2R009	64	883	579	804	609	773	5	1	4	2	3
A2R011	58	548	591	475	193	478	4	5	2	1	3
A2R012	67	727	764	600	239	612	4	5	2	1	3
A2R014	71	1 003	988	803	704	831	5	4	2	1	3
A2R015	68	900	849	776	580	803	5	4	2	1	3
A3R001	84	1 250	1 532	1 234	579	1 049	4	5	3	1	2
A3R002	112	1 430	1 184	1 009	846	997	5	4	3	1	2
A3R003	111	1 484	749	935	975	982	5	1	2	3	4
A3R004	61	797	662	670	542	715	5	2	3	1	4
A4H005	55	827	690	658	641	651	5	4	3	1	2
A4H007	47	604	537	373	389	433	5	4	1	2	3
A4R001	59	744	875	670	498	693	4	5	2	1	3
A5H004	63	699	631	580	528	553	5	4	3	1	2
A5R001	56	726	622	594	562	577	5	4	3	1	2
A5R002	54	800	904	785	558	715	4	5	3	1	2
A6H010	53	418	260	306	303	219	5	2	4	3	1
A6H011	50	658	369	390	449	454	5	1	2	3	4
A6H012	52	414	302	344	331	235	5	2	4	3	1
A6H018	46	288	277	158	135	176	5	4	2	1	3

Station	*N*	Score					Rank				
		LN	LP3	GEV	IPZA	GPA	LN	LP3	GEV	IPZA	GPA
A6H020	45	426	341	277	258	305	5	4	2	1	3
A6H021	41	279	31	196	199	145	5	1	3	4	2
A6H022	21	5	-40	-18	-17	-22	5	1	3	4	2
A6H024	46	375	260	217	178	261	5	3	2	1	4
A6R001	82	723	422	506	414	566	5	2	3	1	4
A6R002	62	726	416	551	506	609	5	1	3	2	4
A7H001	32	446	382	354	366	347	5	4	2	3	1
A7H003	42	622	524	472	491	530	5	3	1	2	4
A8R002	55	608	599	482	394	499	5	4	2	1	3
A8R003	55	602	468	394	419	463	5	4	1	2	3
A8R004	25	280	307	238	233	269	4	5	2	1	3
A9H004	73	901	993	786	621	828	4	5	2	1	3
A9H012	31	400	319	338	347	339	5	1	2	4	3
A9R001	78	1 152	1 136	986	665	949	5	4	3	1	2
A9R002	53	544	374	432	356	473	5	2	3	1	4
A9R004	60	955	1 084	822	628	824	4	5	2	1	3
B1H002	62	774	785	644	463	638	4	5	3	1	2
B1H004	58	408	424	354	103	364	4	5	2	1	3
B1H005	46	600	349	527	482	549	5	1	3	2	4
B1H012	41	421	383	315	313	359	5	4	2	1	3
B1H017	29	251	216	253	215	207	4	3	5	2	1
B1H018	29	339	288	297	296	282	5	2	4	3	1
B1H019	29	143	114	158	116	90	4	2	5	3	1
B1R001	113	1 686	1 576	1 279	1 162	1 256	5	4	3	1	2
B1R002	52	520	660	448	426	402	4	5	3	2	1
B2H007	34	312	643	259	261	218	4	5	2	3	1
B2R001	117	1 721	1 653	1 488	948	1 340	5	4	3	1	2
B3H007	39	410	350	272	328	371	5	3	1	2	4
B3R001	88	1 019	1 216	982	621	861	4	5	3	1	2
B3R002	85	1 224	1 234	1 039	521	1 037	4	5	3	1	2
B3R005	83	1 084	1 133	872	655	852	4	5	3	1	2
B4H005	59	385	222	284	4	299	5	2	3	1	4
B4H007	51	550	1 403	314	409	426	4	5	1	2	3
B4R001	57	480	452	427	242	398	5	4	3	1	2
B4R002	57	315	289	190	97	206	5	4	2	1	3
B4R004	62	542	368	345	317	460	5	3	2	1	4
B6H001	77	866	717	843	414	783	5	2	4	1	3
B6H002	28	237	280	215	144	240	3	5	2	1	4
B6H003	60	652	538	588	551	490	5	2	4	3	1
B6H006	60	423	202	357	331	329	5	1	4	3	2
B6R001	63	565	472	447	304	443	5	4	3	1	2
B6R003	71	910	796	692	651	771	5	4	2	1	3
B7H003	40	488	486	375	334	400	5	4	2	1	3
B7H004	43	469	456	404	359	403	5	4	3	1	2
B7H008	34	541	600	448	430	479	4	5	2	1	3
B7H010	55	820	541	686	661	692	5	1	3	2	4
B7H014	30	369	185	246	260	260	5	1	2	4	3
B7H019	29	400	313	324	338	319	5	1	3	4	2
B7R001	72	998	516	654	721	748	5	1	2	3	4
B7R003	69	858	975	704	488	671	4	5	3	1	2
B8H010	60	905	575	549	599	592	5	2	1	4	3
B8H011	41	623	357	406	430	419	5	1	2	4	3
B8H014	50	517	533	419	311	446	4	5	2	1	3
B8H017	42	609	544	498	504	563	5	3	1	2	4
B8H018	34	584	501	467	497	511	5	3	1	2	4
B8H019	21	266	251	219	215	225	5	4	2	1	3

Station	*N*	Score					Rank				
		LN	LP3	GEV	IPZA	GPA	LN	LP3	GEV	IPZA	GPA
B8H034	28	500	422	411	425	417	5	3	1	4	2
B8R001	68	555	560	416	249	421	4	5	2	1	3
B8R002	40	414	379	364	285	379	5	4	2	1	3
B8R003	48	579	399	431	419	496	5	1	3	2	4
B8R006	42	195	18	147	126	99	5	1	4	3	2
B8R007	34	582	471	443	497	508	5	2	1	3	4
B9H002	26	355	325	291	309	330	5	3	1	2	4
B9H003	22	289	234	247	258	247	5	1	2	4	3
B9H004	22	290	234	247	258	247	5	1	2	4	3
C1H002	112	1 307	1 534	1 239	1 127	1 258	4	5	2	1	3
C1H004	60	704	497	652	608	537	5	1	4	3	2
C1H006	56	652	543	631	556	616	5	1	4	2	3
C1H007	49	582	536	506	389	523	5	4	2	1	3
C1H008	45	509	471	482	433	419	5	3	4	2	1
C1H012	35	530	371	435	460	461	5	1	2	3	4
C1H015	114	1 360	1 509	1 255	985	1 357	4	5	2	1	3
C1H027	24	267	169	192	236	251	5	1	2	3	4
C2H018	80	1 195	1 237	1 088	808	1 112	4	5	2	1	3
C2H024	31	102	103	64	-19	86	4	5	2	1	3
C2H070	20	216	234	199	189	212	4	5	2	1	3
C2H073	23	288	194	270	265	269	5	1	4	2	3
C2H141	27	197	141	202	94	163	4	2	5	1	3
C3H004	23	179	162	172	138	157	5	3	4	1	2
C4H002	45	713	638	553	580	617	5	4	1	2	3
C4H004	51	678	559	587	579	524	5	2	4	3	1
C5H015	34	473	362	431	425	370	5	1	4	3	2
C5H018	39	564	418	487	462	514	5	1	3	2	4
C5H022	38	278	133	212	199	210	5	1	4	2	3
C5H023	25	229	189	166	195	218	5	2	1	3	4
C6H003	40	605	728	527	530	496	4	5	2	3	1
C7H005	39	433	308	381	371	344	5	1	4	3	2
C7H006	62	830	529	717	679	707	5	1	4	2	3
C8H003	63	670	394	559	538	460	5	1	4	3	2
C8H004	32	348	337	316	277	325	5	4	2	1	3
C8H005	58	717	719	615	369	675	4	5	2	1	3
C8H011	27	331	291	248	295	318	5	2	1	3	4
C8H014	29	352	390	324	239	350	4	5	2	1	3
C8H020	44	632	632	544	480	568	4	5	2	1	3
C8H022	47	778	901	744	483	739	4	5	3	1	2
C8H026	32	478	278	406	409	412	5	1	2	3	4
C8H027	37	457	485	426	267	464	3	5	2	1	4
C8H028	33	375	316	262	301	369	5	3	1	2	4
C9H003	136	2 090	2 107	1 875	1 591	1 900	4	5	2	1	3
C9H009	110	1 766	1 700	1 553	1 442	1 515	5	4	3	1	2
C9H010	39	663	587	587	577	566	5	3	4	2	1
D1H001	106	1 596	1 264	1 142	1 131	1 220	5	4	2	1	3
D1H004	53	555	231	391	420	417	5	1	2	4	3
D1H011	53	755	820	714	555	737	4	5	2	1	3
D1H032	33	391	368	365	344	343	5	4	3	2	1
D1R002	24	335	387	341	293	351	2	5	3	1	4
D2R001	76	699	878	663	536	604	4	5	3	1	2
D2R002	74	809	745	600	421	703	5	4	2	1	3
D4H002	38	220	268	150	45	211	4	5	2	1	3
D4H013	55	78	3	-28	-79	-52	5	4	3	1	2
D4H032	38	220	268	150	45	211	4	5	2	1	3
D5H003	81	827	634	743	656	587	5	2	4	3	1

Station	*N*	Score					Rank				
		LN	LP3	GEV	IPZA	GPA	LN	LP3	GEV	IPZA	GPA
D5H011	45	619	475	452	485	480	5	2	1	4	3
D5H013	33	543	538	450	438	490	5	4	2	1	3
D5H016	39	567	556	487	451	515	5	4	2	1	3
D7H002	108	2 313	1 758	2 193	1 775	2 027	5	1	4	2	3
D7H005	94	1 532	1 430	1 366	1 234	1 249	5	4	3	1	2
D7H008	44	307	597	593	389	420	1	5	4	2	3
E1H006	44	307	597	593	389	420	1	5	4	2	3
E1H013	27	266	215	267	285	267	2	1	3	5	4
E2H003	92	1 229	722	1 060	922	942	5	1	4	2	3
E2H007	48	242	495	320	158	216	3	5	4	1	2
G1H004	57	496	488	467	529	510	3	2	1	5	4
G1H008	65	666	505	545	472	553	5	2	3	1	4
G1H010	55	243	22	168	151	61	5	1	4	3	2
G1H011	55	226	145	230	265	209	3	1	4	5	2
G1H012	33	81	29	72	131	95	3	1	2	5	4
G1H016	37	129	121	78	66	82	5	4	2	1	3
G1H017	25	33	7	-24	-6	20	5	3	1	2	4
G1H018	40	47	83	52	49	71	1	5	3	2	4
G1H028	46	642	933	548	538	483	4	5	3	2	1
G1H029	46	468	9 881	327	358	372	4	5	1	2	3
G1H038	39	364	316	289	284	341	5	3	2	1	4
G1H040	40	265	11 143	226	203	105	4	5	3	2	1
G2H008	49	63	142	123	336	160	1	3	2	5	4
G4H008	29	38	162	72	-87	57	2	5	4	1	3
G4H009	29	-15	-62	-54	-82	-22	5	2	3	1	4
G4H010	29	25	145	56	-13	60	2	5	3	1	4
G4H012	28	-18	90	17	-141	6	2	5	4	1	3
G4H013	27	25	167	85	-73	57	2	5	4	1	3
G4H014	52	514	544	468	334	518	3	5	2	1	4
G4H033	42	331	154	207	222	209	5	1	2	4	3
H1H013	54	481	212	355	362	380	5	1	2	3	4
H1H016	22	135	517	133	103	103	4	5	3	1	2
H1H017	24	10	124	48	0	56	2	5	3	1	4
H1H018	50	414	327	385	505	395	4	1	2	5	3
H1H033	28	244	240	207	171	247	4	3	2	1	5
H2H005	50	209	6 415	166	105	171	4	5	2	1	3
H2H008	37	264	3 278	185	178	136	4	5	3	2	1
H3H001	21	215	172	196	196	191	5	1	4	3	2
H3H004	25	118	160	71	69	102	4	5	2	1	3
H4H005	33	282	241	209	208	259	5	3	2	1	4
H4H007	28	206	220	139	134	179	4	5	2	1	3
H4H009	25	125	51	108	76	103	5	1	4	2	3
H4H012	24	111	137	84	62	109	4	5	2	1	3
H4H013	22	225	314	203	167	230	3	5	2	1	4
H4H015	35	234	177	223	198	212	5	1	4	2	3
H6H007	29	172	214	163	195	190	2	5	1	4	3
H6H009	55	744	831	688	476	698	4	5	2	1	3
H6H010	50	368	471	249	154	283	4	5	2	1	3
H7H004	65	583	488	399	402	387	5	4	2	3	1
H7H005	59	138	79	207	332	267	2	1	3	5	4
H8H001	52	557	572	515	291	537	4	5	2	1	3
H9H002	55	535	560	390	334	427	4	5	2	1	3
H9H005	50	605	532	552	514	521	5	3	4	1	2
J1H004	33	300	216	280	254	257	5	1	4	2	3
J1H015	45	82	50	-39	-49	76	5	3	2	1	4
J1H016	45	325	235	220	225	175	5	4	2	3	1

Station	*N*	Score					Rank				
		LN	LP3	GEV	IPZA	GPA	LN	LP3	GEV	IPZA	GPA
J1R001	35	411	499	466	268	423	2	5	4	1	3
J1R004	38	493	539	381	380	424	4	5	2	1	3
J2H007	64	484	260	192	216	138	5	4	2	3	1
J2R001	84	768	744	615	132	587	5	4	3	1	2
J2R002	54	786	623	614	621	652	5	3	1	2	4
J2R003	82	814	799	605	330	631	5	4	2	1	3
J2R004	51	595	484	433	392	482	5	4	2	1	3
J2R006	73	1 278	830	986	1 002	1 010	5	1	2	3	4
J3H005	22	239	223	187	209	228	5	3	1	2	4
J3H012	30	362	265	309	309	280	5	1	3	4	2
J3H014	28	142	89	139	70	122	5	2	4	1	3
J3H015	53	375	379	302	230	302	4	5	3	1	2
J3H020	44	416	471	338	261	366	4	5	2	1	3
J3R001	101	1 619	2 005	1 437	1 208	1 404	4	5	3	1	2
K6H001	58	726	784	593	456	646	4	5	2	1	3
K8H001	58	367	328	326	354	289	5	3	2	4	1
K8H002	58	626	444	520	246	557	5	2	3	1	4
K8H005	24	246	254	213	187	246	3	5	2	1	4
L1H001	30	321	412	385	301	374	2	5	4	1	3
L2H003	38	449	249	313	360	377	5	1	2	3	4
L6H001	66	888	759	699	714	668	5	4	2	3	1
L8H001	54	572	560	465	413	435	5	4	3	1	2
L8H002	49	546	322	417	417	409	5	1	3	4	2
L8H005	29	379	420	341	278	376	4	5	2	1	3
N1R001	99	1 615	1 596	1 363	1 041	1 279	5	4	3	1	2
N2H002	68	952	560	822	748	851	5	1	3	2	4
N2H005	20	263	378	313	225	309	2	5	4	1	3
N2H008	36	216	213	191	29	212	5	4	2	1	3
N2R001	90	1 388	1 575	1 292	1 102	1 279	4	5	3	1	2
N3H001	20	261	297	252	218	281	3	5	2	1	4
P3H001	35	467	538	377	345	412	4	5	2	1	3
P4H001	49	722	708	583	546	596	5	4	2	1	3
Q1H012	42	312	240	222	290	311	5	2	1	3	4
Q3H005	42	484	559	439	286	451	4	5	2	1	3
Q4H003	28	225	229	198	99	231	3	4	2	1	5
Q4R002	57	557	564	442	194	468	4	5	2	1	3
Q6H003	38	371	176	320	304	304	5	1	4	2	3
Q8H004	31	374	194	331	309	355	5	1	3	2	4
Q8H008	39	482	420	418	389	430	5	3	2	1	4
Q8H010	32	291	336	250	179	274	4	5	2	1	3
Q8R001	31	336	374	317	222	346	3	5	2	1	4
Q9H002	84	1 283	1 438	1 098	833	1 112	4	5	2	1	3
Q9H008	49	479	356	443	352	409	5	2	4	1	3
Q9H014	22	166	117	156	150	137	5	1	4	3	2
Q9H029	27	275	293	239	200	273	4	5	2	1	3
Q9H030	37	306	221	229	217	268	5	2	3	1	4
Q9R001	25	242	144	182	205	242	4	1	2	3	5
R1H013	37	570	558	459	468	501	5	4	1	2	3
R2H005	59	815	533	652	623	687	5	1	3	2	4
R2H012	38	349	279	239	265	249	5	4	1	3	2
R2H015	31	300	213	248	246	271	5	1	3	2	4
S3H003	30	222	56	156	168	164	5	1	2	4	3
S3H004	55	565	491	468	267	520	5	3	2	1	4
S3H006	54	535	272	450	400	420	5	1	4	2	3
S6H001	72	621	142	449	421	412	5	1	4	3	2
T1H001	34	482	426	402	402	351	5	4	3	2	1

Station	*N*	Score					Rank				
		LN	LP3	GEV	IPZA	GPA	LN	LP3	GEV	IPZA	GPA
T1H004	25	328	218	285	297	309	5	1	2	3	4
T3H005	61	733	436	586	356	657	5	2	3	1	4
T3H006	64	759	615	683	470	646	5	2	4	1	3
T3H007	43	612	585	513	531	522	5	4	1	3	2
T3H009	55	505	413	456	212	420	5	2	4	1	3
T4H001	68	869	1 095	893	734	830	3	5	4	1	2
T5H001	49	640	835	721	677	687	1	5	4	2	3
T5H003	60	538	296	377	373	410	5	1	3	2	4
T5H004	70	690	746	638	507	655	4	5	2	1	3
T5H005	54	581	612	513	364	557	4	5	2	1	3
T5H007	41	440	457	344	324	437	4	5	2	1	3
T5H012	49	610	534	500	504	451	5	4	2	3	1
U1H005	59	749	907	868	707	781	2	5	4	1	3
U2H002	36	337	224	293	266	342	4	1	3	2	5
U2H006	65	752	1 367	954	654	737	3	5	4	1	2
U2H007	65	687	811	800	305	632	3	5	4	1	2
U2H011	60	734	924	752	357	661	3	5	4	1	2
U2H012	59	712	321	550	494	596	5	1	3	2	4
U6H003	20	241	246	201	204	223	4	5	1	2	3
U7H001	70	411	1 034	537	423	451	1	5	4	2	3
U7H004	20	-57	-84	-84	-83	-98	5	3	2	4	1
U7H008	33	271	453	382	253	319	2	5	4	1	3
U8H001	30	442	428	372	368	410	5	4	2	1	3
U8H003	27	376	245	317	327	320	5	1	2	4	3
V1H001	74	1 100	922	988	965	750	5	2	4	3	1
V1H009	65	600	370	551	190	487	5	2	4	1	3
V1H010	58	601	614	539	557	587	4	5	1	2	3
V1H029	25	200	281	249	148	229	2	5	4	1	3
V1H030	26	286	174	256	228	275	5	1	3	2	4
V1H032	20	195	194	208	154	166	4	3	5	1	2
V1H038	47	509	594	508	525	561	2	5	1	3	4
V1R001	72	831	800	755	624	759	5	4	2	1	3
V1R002	68	674	771	658	737	714	2	5	1	4	3
V1R003	28	366	339	321	292	374	4	3	2	1	5
V2H001	28	308	381	328	281	343	2	5	3	1	4
V2H002	70	716	1 027	845	606	680	3	5	4	1	2
V2H004	58	729	896	801	591	712	3	5	4	1	2
V2H005	46	385	566	505	313	420	2	5	4	1	3
V2H007	47	360	346	257	241	309	5	4	2	1	3
V2R001	47	441	641	523	280	437	3	5	4	1	2
V3H007	71	562	311	415	261	451	5	2	3	1	4
V3H010	59	555	523	559	435	467	4	3	5	1	2
V3R001	48	558	503	460	431	501	5	4	2	1	3
V3R003	61	515	480	396	389	504	5	3	2	1	4
V6H003	65	628	359	531	344	522	5	2	4	1	3
V6H004	65	586	645	536	536	578	4	5	1	2	3
V7H012	56	565	555	627	269	552	4	3	5	1	2
V7H016	46	372	460	408	350	410	2	5	3	1	4
V7H017	46	341	463	400	344	358	1	5	4	2	3
V7R001	66	760	730	737	321	731	5	2	4	1	3
W1H004	69	918	770	629	536	639	5	4	2	1	3
W1H005	70	553	233	353	344	294	5	1	4	3	2
W1H015	21	222	161	170	183	175	5	1	2	4	3
W1H017	22	78	-40	45	54	48	5	1	2	4	3
W1R001	47	675	904	729	598	685	2	5	4	1	3
W2H006	54	909	957	895	653	837	4	5	3	1	2

Station	***N***	**Score**					**Rank**				
		LN	**LP3**	**GEV**	**IPZA**	**GPA**	**LN**	**LP3**	**GEV**	**IPZA**	**GPA**
W2H007	30	322	405	363	220	339	2	5	4	1	3
W2H028	31	359	358	301	280	341	5	4	2	1	3
W2R001	41	466	419	388	320	429	5	3	2	1	4
W3R001	45	741	653	610	598	649	5	4	2	1	3
W5H001	65	858	886	821	768	895	3	4	2	1	5
W5H005	69	738	820	776	291	666	3	5	4	1	2
W5H011	55	532	581	479	240	457	4	5	3	1	2
W5H016	30	115	74	90	82	61	5	2	4	3	1
W5H022	51	538	495	469	432	428	5	4	3	2	1
W5H024	42	446	406	336	347	387	5	4	1	2	3
W5R001	43	312	198	295	72	231	5	2	4	1	3
W5R002	57	485	479	382	121	407	5	4	2	1	3
W5R003	57	494	520	445	247	441	4	5	3	1	2
X1H001	113	1 540	1 847	1 610	1 412	1 442	3	5	4	1	2
X1H003	78	1 062	1 046	993	476	926	5	4	3	1	2
X1H012	25	227	245	186	174	214	4	5	2	1	3
X1H014	50	746	648	570	597	608	5	4	1	2	3
X1H016	49	660	951	724	462	638	3	5	4	1	2
X1H017	48	484	249	383	279	451	5	1	3	2	4
X1H018	48	519	304	422	371	455	5	1	3	2	4
X1H019	45	621	564	461	496	530	5	4	1	2	3
X1H020	36	319	251	246	229	270	5	3	2	1	4
X1R001	54	524	525	435	340	484	4	5	2	1	3
X1R003	42	430	510	428	400	438	3	5	2	1	4
X1R004	45	575	499	444	452	524	5	3	1	2	4
X2H008	71	703	432	498	488	523	5	1	3	2	4
X2H010	69	675	522	438	473	505	5	4	1	2	3
X2H011	44	409	278	393	340	288	5	1	4	3	2
X2H013	61	506	262	390	296	447	5	1	3	2	4
X2H014	59	280	136	203	-11	182	5	2	4	1	3
X2H016	58	1 023	1 305	989	713	942	4	5	3	1	2
X2H017	40	584	685	604	354	573	3	5	4	1	2
X2H018	27	386	304	316	323	344	5	1	2	3	4
X2H022	58	875	702	644	661	709	5	3	1	2	4
X2H024	55	387	263	303	237	290	5	2	4	1	3
X2H025	27	54	40	48	2	14	5	3	4	1	2
X2H026	27	146	107	68	106	115	5	3	1	2	4
X2H027	27	126	108	97	87	105	5	4	2	1	3
X2H028	27	26	-3	-22	-19	20	5	3	1	2	4
X2H031	53	590	567	482	418	499	5	4	2	1	3
X2H032	51	635	730	690	401	617	3	5	4	1	2
X2H035	37	195	118	108	116	113	5	4	1	3	2
X2H047	33	155	140	128	71	110	5	4	3	1	2
X2H072	23	290	414	295	212	306	2	5	3	1	4
X2R001	37	258	335	270	88	255	3	5	4	1	2
X2R002	54	607	576	493	386	491	5	4	3	1	2
X2R003	43	266	244	193	121	262	5	3	2	1	4
X2R004	51	664	622	451	468	512	5	4	1	2	3
X2R005	54	355	301	338	412	284	4	2	3	5	1
X3H001	72	474	585	438	345	424	4	5	3	1	2
X3H002	55	293	484	434	140	296	2	5	4	1	3
X3H006	43	541	620	463	368	485	4	5	2	1	3
X3H011	39	441	420	349	316	392	5	4	2	1	3
X3R001	40	203	293	237	184	214	2	5	4	1	3
X3R002	33	320	260	247	254	273	5	3	1	2	4
X4H004	40	516	423	436	425	412	5	2	4	3	1

Table A.9: Theoretical probability distribution rankings (*KS*, Eq. 4.7)

Station	*N*	Score					Rank				
		LN	LP3	GEV	IPZA	GPA	LN	LP3	GEV	IPZA	GPA
A2H006	113	2 578	571	164	166	224	5	4	1	2	3
A2H007	46	85	114	51	27	71	4	5	2	1	3
A2H012	114	1 906	5 492	1 630	244	505	4	5	3	1	2
A2H013	117	730	409	110	87	99	5	4	3	1	2
A2H023	61	250	22	111	24	157	5	1	3	2	4
A2H024	58	5	4	1	0	1	5	4	2	1	3
A2H027	57	2 419	9.E+04	668	308	738	4	5	2	1	3
A2H029	56	359	1.E+05	33	56	52	4	5	1	3	2
A2H032	49	298	150	36	65	84	5	4	1	2	3
A2H038	24	47	2	7	16	17	5	1	2	3	4
A2H039	23	12	4	5	5	4	5	1	3	4	2
A2H040	23	20	5	13	11	19	5	1	3	2	4
A2H042	25	30	14	11	12	18	5	3	1	2	4
A2H044	48	262	15	95	53	115	5	1	3	2	4
A2H045	47	146	52	41	13	45	5	4	2	1	3
A2H047	46	73	6.E+10	34	23	19	4	5	3	2	1
A2H049	47	30	3	11	2	18	5	2	3	1	4
A2H050	46	125	62	21	18	30	5	4	2	1	3
A2H053	46	72	9	18	18	22	5	1	2	3	4
A2H054	37	114	1.E+04	34	36	23	4	5	2	3	1
A2H056	37	61	2.E+08	15	21	23	4	5	1	2	3
A2H058	37	78	1	5	15	18	5	1	2	3	4
A2H061	35	93	20	55	6	101	4	2	3	1	5
A2H077	33	553	809	137	90	353	4	5	2	1	3
A2R001	101	1 266	756	152	96	108	5	4	3	1	2
A2R003	84	983	8 964	844	40	312	4	5	3	1	2
A2R005	84	691	112	244	61	191	5	2	4	1	3
A2R006	81	1 962	1 955	89	161	185	5	4	1	2	3
A2R007	71	1 478	287	85	135	239	5	4	1	2	3
A2R009	64	1 843	167	939	169	755	5	1	4	2	3
A2R011	58	183	260	65	5	60	4	5	3	1	2
A2R012	67	324	419	58	7	126	4	5	2	1	3
A2R014	71	2 228	1 972	191	194	385	5	4	1	2	3
A2R015	68	997	680	238	71	327	5	4	2	1	3
A3R001	84	3 687	2.E+04	3 222	22	1 068	4	5	3	1	2
A3R002	112	1 470	485	189	84	194	5	4	2	1	3
A3R003	111	1 972	43	46	141	183	5	1	2	3	4
A3R004	61	1 020	344	178	80	308	5	4	2	1	3
A4H005	55	2 832	794	266	365	371	5	4	1	2	3
A4H007	47	975	470	26	86	140	5	4	1	2	3
A4R001	59	747	2 230	152	52	443	4	5	2	1	3
A5H004	63	315	183	53	56	60	5	4	1	2	3
A5R001	56	921	360	118	149	195	5	4	1	2	3
A5R002	54	2 830	7 263	2 352	264	1 258	4	5	3	1	2
A6H010	53	69	13	15	15	7	5	2	3	4	1
A6H011	50	1 188	60	42	128	147	5	2	1	3	4
A6H012	52	61	16	19	17	9	5	2	4	3	1
A6H018	46	32	28	2	5	7	5	4	1	2	3
A6H020	45	133	51	12	18	36	5	4	1	2	3
A6H021	41	41	1	9	11	7	5	1	3	4	2
A6H022	21	1	0	0	0	0	5	1	2	4	3
A6H024	46	92	26	10	10	25	5	4	2	1	3
A6R001	82	136	21	19	13	32	5	3	2	1	4
A6R002	62	517	45	72	61	187	5	1	3	2	4

Station	*N*	Score					Rank				
		LN	LP3	GEV	IPZA	GPA	LN	LP3	GEV	IPZA	GPA
A7H001	32	1 314	416	222	294	228	5	4	1	3	2
A7H003	42	2 444	737	284	477	804	5	3	1	2	4
A8R002	55	432	390	106	50	150	5	4	2	1	3
A8R003	55	397	115	24	60	96	5	4	1	2	3
A8R004	25	304	493	76	104	226	4	5	1	2	3
A9H004	73	576	1 062	134	52	269	4	5	2	1	3
A9H012	31	721	173	185	239	208	5	1	2	4	3
A9R001	78	3 278	2 926	979	120	743	5	4	3	1	2
A9R002	53	202	33	56	29	97	5	2	3	1	4
A9R004	60	5 108	1.E+04	1 272	273	1 429	4	5	2	1	3
B1H002	62	931	1 002	272	65	274	4	5	2	1	3
B1H004	58	59	66	35	3	38	4	5	2	1	3
B1H005	46	742	40	237	138	362	5	1	3	2	4
B1H012	41	244	150	26	48	95	5	4	1	2	3
B1H017	29	72	13	52	23	25	5	1	4	2	3
B1H018	29	333	117	97	114	109	5	4	1	3	2
B1H019	29	8	3	11	3	2	4	2	5	3	1
B1R001	113	4 138	2 502	223	284	458	5	4	1	2	3
B1R002	52	184	898	66	48	35	4	5	3	2	1
B2H007	34	116	2.E+04	35	39	21	4	5	2	3	1
B2R001	117	3 966	2 931	1 366	127	696	5	4	3	1	2
B3H007	39	275	121	34	79	153	5	3	1	2	4
B3R001	88	703	2 140	515	40	219	4	5	3	1	2
B3R002	85	2 267	2 374	308	25	693	4	5	2	1	3
B3R005	83	1 430	1 901	313	87	317	4	5	2	1	3
B4H005	59	32	8	9	1	13	5	2	3	1	4
B4H007	51	365	2.E+06	25	76	103	4	5	1	2	3
B4R001	57	118	91	70	12	54	5	4	3	1	2
B4R002	57	21	16	3	2	8	5	4	2	1	3
B4R004	62	139	32	13	17	68	5	3	1	2	4
B6H001	77	561	194	474	17	290	5	2	4	1	3
B6H002	28	72	149	21	7	49	4	5	2	1	3
B6H003	60	251	78	98	69	46	5	3	4	2	1
B6H006	60	30	3	16	9	16	5	1	4	2	3
B6R001	63	163	76	58	17	58	5	4	2	1	3
B6R003	71	1 119	485	95	126	398	5	4	1	2	3
B7H003	40	653	618	118	90	209	5	4	2	1	3
B7H004	43	259	218	61	50	84	5	4	2	1	3
B7H008	34	3 776	8 785	608	684	1 450	4	5	1	2	3
B7H010	55	2 023	125	288	343	600	5	1	2	3	4
B7H014	30	577	24	49	79	80	5	1	2	3	4
B7H019	29	1 185	247	225	318	249	5	2	1	4	3
B7R001	72	2 026	64	83	232	339	5	1	2	3	4
B7R003	69	978	2 245	275	59	232	4	5	3	1	2
B8H010	60	3 407	204	121	228	235	5	2	1	3	4
B8H011	41	2 941	111	153	242	225	5	1	2	4	3
B8H014	50	238	275	43	22	90	4	5	2	1	3
B8H017	42	2 103	948	486	529	1 133	5	3	1	2	4
B8H018	34	7 130	2 027	570	1 677	2 244	5	3	1	2	4
B8H019	21	521	353	72	105	106	5	4	1	2	3
B8H034	28	8 845	2 001	1 300	1 917	1 723	5	4	1	3	2
B8R001	68	83	85	13	7	24	4	5	2	1	3
B8R002	40	255	160	116	42	149	5	4	2	1	3
B8R003	48	621	71	59	91	187	5	2	1	3	4
B8R006	42	13	1	4	4	2	5	1	4	3	2
B8R007	34	6 971	1 295	418	1 769	2 240	5	2	1	3	4

Station	*N*	Score					Rank				
		LN	LP3	GEV	IPZA	GPA	LN	LP3	GEV	IPZA	GPA
B9H002	26	1 038	557	119	352	562	5	3	1	2	4
B9H003	22	728	192	201	286	240	5	1	2	4	3
B9H004	22	730	192	202	286	240	5	1	2	4	3
C1H002	112	565	1 540	223	163	249	4	5	2	1	3
C1H004	60	486	38	173	118	64	5	1	4	3	2
C1H006	56	301	122	152	75	232	5	2	3	1	4
C1H007	49	462	286	141	41	177	5	4	2	1	3
C1H008	45	325	168	147	95	100	5	4	3	1	2
C1H012	35	2 574	251	388	742	863	5	1	2	3	4
C1H015	114	644	1 220	162	81	452	4	5	2	1	3
C1H027	24	281	34	30	131	183	5	2	1	3	4
C2H018	80	2 511	3 234	542	120	949	4	5	2	1	3
C2H024	31	5	5	2	0	3	5	4	2	1	3
C2H070	20	195	290	54	67	114	4	5	1	2	3
C2H073	23	357	39	203	159	216	5	1	3	2	4
C2H141	27	31	7	22	4	15	5	2	4	1	3
C3H004	23	43	22	24	14	17	5	3	4	1	2
C4H002	45	4 252	1 809	248	801	1 399	5	4	1	2	3
C4H004	51	1 126	304	259	252	118	5	4	3	2	1
C5H015	34	1 123	158	361	372	171	5	1	3	4	2
C5H018	39	1 975	297	639	489	990	5	1	3	2	4
C5H022	38	45	7	9	11	15	5	1	2	3	4
C5H023	25	108	46	17	49	81	5	2	1	3	4
C6H003	40	2 456	12 565	554	641	322	4	5	2	3	1
C7H005	39	262	31	94	89	82	5	1	4	3	2
C7H006	62	888	95	178	188	274	5	1	2	3	4
C8H003	63	318	29	70	67	39	5	1	4	3	2
C8H004	32	237	194	73	47	144	5	4	2	1	3
C8H005	58	728	730	262	24	386	4	5	2	1	3
C8H011	27	539	246	68	245	391	5	3	1	2	4
C8H014	29	505	936	172	47	378	4	5	2	1	3
C8H020	44	1 998	1 954	546	290	885	5	4	2	1	3
C8H022	47	6 002	2.E+04	3 332	116	3 154	4	5	3	1	2
C8H026	32	2 095	73	349	531	486	5	1	2	4	3
C8H027	37	439	612	182	45	523	3	5	2	1	4
C8H028	33	373	144	45	111	315	5	3	1	2	4
C9H003	136	3 688	3 898	476	279	1 734	4	5	2	1	3
C9H009	110	5 213	3 805	732	632	1 230	5	4	2	1	3
C9H010	39	6 159	2 222	1 092	1 262	782	5	4	2	3	1
D1H001	106	4 033	684	205	316	456	5	4	1	2	3
D1H004	53	309	13	33	64	81	5	1	2	3	4
D1H011	53	1 954	3 522	787	197	868	4	5	2	1	3
D1H032	33	411	277	127	113	86	5	4	3	2	1
D1R002	24	1 157	3 308	1 188	415	1 497	2	5	3	1	4
D2R001	76	162	522	97	38	70	4	5	3	1	2
D2R002	74	324	210	39	21	145	5	4	2	1	3
D4H002	38	25	46	3	1	16	4	5	2	1	3
D4H013	55	3	1	1	0	1	5	4	2	1	3
D4H032	38	25	46	3	1	16	4	5	2	1	3
D5H003	81	213	51	78	40	39	5	3	4	2	1
D5H011	45	1 485	274	128	267	289	5	3	1	2	4
D5H013	33	4 737	4 268	363	763	1 557	5	4	1	2	3
D5H016	39	1 321	1 132	210	271	785	5	4	1	2	3
D7H002	108	1.E+05	8 376	6.E+04	7 791	3.E+04	5	2	4	1	3
D7H005	94	5 293	2 994	923	577	766	5	4	3	1	2
D7H008	44	50	1 327	1 268	120	167	1	5	4	2	3

Station	*N*	Score					Rank				
		LN	LP3	GEV	IPZA	GPA	LN	LP3	GEV	IPZA	GPA
E1H006	44	50	1 327	1 268	120	167	1	5	4	2	3
E1H013	27	108	30	93	98	76	5	1	3	4	2
E2H003	92	1 357	21	301	142	192	5	1	4	2	3
E2H007	48	10	271	33	2	6	3	5	4	1	2
G1H004	57	89	69	55	50	70	5	3	2	1	4
G1H008	65	263	71	57	42	103	5	3	2	1	4
G1H010	55	14	1	4	3	2	5	1	4	3	2
G1H011	55	9	2	7	6	6	5	1	4	2	3
G1H012	33	3	1	2	4	2	4	1	2	5	3
G1H016	37	6	5	2	2	3	5	4	2	1	3
G1H017	25	2	1	0	1	1	5	3	1	2	4
G1H018	40	2	3	2	1	2	4	5	3	1	2
G1H028	46	1 342	4.E+04	328	302	177	4	5	3	2	1
G1H029	46	254	7.E+46	42	66	81	4	5	1	2	3
G1H038	39	110	50	26	30	70	5	3	1	2	4
G1H040	40	26	4.E+60	14	7	2	4	5	3	2	1
G2H008	49	2	4	3	11	4	1	4	2	5	3
G4H008	29	2	19	4	0	3	2	5	4	1	3
G4H009	29	1	0	0	0	1	5	3	2	1	4
G4H010	29	2	14	2	1	2	2	5	4	1	3
G4H012	28	1	6	1	0	1	2	5	4	1	3
G4H013	27	2	25	5	0	3	2	5	4	1	3
G4H014	52	172	225	74	13	89	4	5	2	1	3
G4H033	42	74	7	13	16	15	5	1	2	4	3
H1H013	54	134	3	28	32	46	5	1	2	3	4
H1H016	22	17	1.E+05	13	6	4	4	5	3	2	1
H1H017	24	1	13	2	1	2	2	5	3	1	4
H1H018	50	65	20	48	82	38	4	1	3	5	2
H1H033	28	69	54	32	9	71	4	3	2	1	5
H2H005	50	11	1.E+28	5	3	7	4	5	2	1	3
H2H008	37	41	2.E+19	10	9	5	4	5	3	2	1
H3H001	21	162	53	57	69	51	5	2	3	4	1
H3H004	25	12	26	2	3	7	4	5	1	2	3
H4H005	33	92	45	20	25	59	5	3	1	2	4
H4H007	28	46	57	5	11	24	4	5	1	2	3
H4H009	25	11	2	4	3	6	5	1	3	2	4
H4H012	24	10	17	3	3	6	4	5	2	1	3
H4H013	22	171	1 228	50	37	160	4	5	2	1	3
H4H015	35	25	8	18	8	11	5	1	4	2	3
H6H007	29	18	35	9	18	20	3	5	1	2	4
H6H009	55	1 391	3 021	519	62	570	4	5	2	1	3
H6H010	50	64	175	5	6	15	4	5	1	2	3
H7H004	65	154	63	24	25	24	5	4	1	3	2
H7H005	59	4	2	7	7	9	2	1	3	4	5
H8H001	52	222	252	73	19	127	4	5	2	1	3
H9H002	55	218	270	20	25	64	4	5	1	2	3
H9H005	50	454	218	145	111	133	5	4	3	1	2
J1H004	33	91	25	36	26	35	5	1	4	2	3
J1H015	45	3	2	1	0	3	5	3	2	1	4
J1H016	45	52	16	10	12	6	5	4	2	3	1
J1R001	35	479	1 624	1 007	28	545	2	5	4	1	3
J1R004	38	929	1 648	112	185	354	4	5	1	2	3
J2H007	64	82	11	6	7	5	5	4	2	3	1
J2R001	84	195	167	64	3	49	5	4	3	1	2
J2R002	54	2 073	392	211	350	547	5	3	1	2	4
J2R003	82	266	240	36	9	57	5	4	2	1	3

Station	*N*	Score					Rank				
		LN	LP3	GEV	IPZA	GPA	LN	LP3	GEV	IPZA	GPA
J2R004	51	560	186	64	64	159	5	4	1	2	3
J2R006	73	1.E+04	304	543	1 325	1 448	5	1	2	3	4
J3H005	22	234	157	44	102	163	5	3	1	2	4
J3H012	30	439	81	111	131	82	5	1	3	4	2
J3H014	28	11	4	7	2	4	5	2	4	1	3
J3H015	53	41	42	7	6	14	4	5	2	1	3
J3H020	44	136	249	21	14	47	4	5	2	1	3
J3R001	101	6 131	4.E+04	1 708	262	1 461	4	5	3	1	2
J3R002	90	9 173	312	2 124	728	1 933	5	1	4	2	3
J4H002	46	12 454	1 194	914	1 082	1 089	5	4	1	2	3
J4H004	31	190	467	15	38	78	4	5	1	2	3
K1H002	61	12	1.E+05	4	3	2	4	5	3	2	1
K1H018	37	2 779	431	14	16	9	5	4	2	3	1
K3H002	58	1	0	0	0	1	5	2	3	1	4
K3H004	58	71	85	22	21	48	4	5	2	1	3
K4H001	34	260	181	32	69	94	5	4	1	2	3
K4H003	57	407	535	37	35	94	4	5	2	1	3
K6H001	58	765	1 247	82	35	252	4	5	2	1	3
K8H001	58	27	19	13	15	10	5	4	2	3	1
K8H002	58	303	65	90	10	183	5	2	3	1	4
K8H005	24	143	161	40	37	147	3	5	2	1	4
L1H001	30	239	1 044	623	146	418	2	5	4	1	3
L2H003	38	512	33	49	131	191	5	1	2	3	4
L6H001	66	1 530	510	242	282	266	5	4	1	3	2
L8H001	54	301	263	36	44	47	5	4	1	2	3
L8H002	49	400	40	51	76	61	5	1	2	4	3
L8H005	29	683	1 330	172	97	610	4	5	2	1	3
N1R001	99	8 161	7 364	2 060	381	1 365	5	4	3	1	2
N2H002	68	1 435	55	290	201	532	5	1	3	2	4
N2H005	20	706	1.E+04	2 117	230	1 894	2	5	4	1	3
N2H008	36	20	18	9	1	13	5	4	2	1	3
N2R001	90	4 447	1.E+04	1 570	430	1 215	4	5	3	1	2
N3H001	20	645	1 497	245	161	796	3	5	2	1	4
P3H001	35	1 042	2 799	75	141	313	4	5	1	2	3
P4H001	49	2 316	1 963	194	255	337	5	4	1	2	3
Q1H012	42	46	16	16	18	32	5	1	2	3	4
Q3H005	42	469	1 118	212	27	271	4	5	2	1	3
Q4H003	28	61	64	24	4	51	4	5	2	1	3
Q4R002	57	210	220	32	3	74	4	5	2	1	3
Q6H003	38	171	6	48	47	48	5	1	4	2	3
Q8H004	31	522	22	219	163	372	5	1	3	2	4
Q8H008	39	460	211	100	105	220	5	3	1	2	4
Q8H010	32	117	231	34	14	75	4	5	2	1	3
Q8R001	31	208	366	93	22	189	4	5	2	1	3
Q9H002	84	4 185	1.E+04	732	85	793	4	5	2	1	3
Q9H008	49	145	41	77	20	49	5	2	4	1	3
Q9H014	22	37	9	16	16	16	5	1	2	4	3
Q9H029	27	166	222	42	30	137	4	5	2	1	3
Q9H030	37	76	23	13	17	32	5	3	1	2	4
Q9R001	25	137	10	31	58	118	5	1	2	3	4
R1H013	37	3 065	2 517	269	626	1 036	5	4	1	2	3
R2H005	59	1 702	150	178	229	301	5	1	2	3	4
R2H012	38	138	51	24	37	36	5	4	1	3	2
R2H015	31	118	25	37	42	74	5	1	2	3	4
S3H003	30	48	2	9	15	15	5	1	2	3	4
S3H004	55	211	109	51	12	143	5	3	2	1	4

Station	*N*	Score					Rank				
		LN	LP3	GEV	IPZA	GPA	LN	LP3	GEV	IPZA	GPA
S3H006	54	168	8	44	32	58	5	1	3	2	4
S6H001	72	118	3	18	20	24	5	1	2	3	4
T1H001	34	1 284	525	243	272	127	5	4	2	3	1
T1H004	25	783	56	210	323	428	5	1	2	3	4
T3H005	61	618	25	125	10	252	5	2	3	1	4
T3H006	64	493	140	150	32	161	5	2	3	1	4
T3H007	43	1 816	1 189	390	538	584	5	4	1	2	3
T3H009	55	121	44	63	6	39	5	3	4	1	2
T4H001	68	894	4 671	939	255	669	3	5	4	1	2
T5H001	49	811	5 668	1 563	931	1 209	1	5	4	2	3
T5H003	60	149	18	23	26	49	5	1	2	3	4
T5H004	70	230	286	151	36	122	4	5	3	1	2
T5H005	54	279	361	74	21	165	4	5	2	1	3
T5H007	41	289	331	43	65	245	4	5	1	2	3
T5H012	49	713	285	148	170	110	5	4	2	3	1
U1H005	59	955	3 570	2 463	506	942	3	5	4	1	2
U2H002	36	104	19	46	28	87	5	1	3	2	4
U2H006	65	615	7.E+04	2 822	239	508	3	5	4	1	2
U2H007	65	372	952	871	7	234	3	5	4	1	2
U2H011	60	814	3 911	888	25	421	3	5	4	1	2
U2H012	59	724	20	142	89	245	5	1	3	2	4
U2H013	59	363	154	122	58	162	5	3	2	1	4
U2H055	29	297	204	110	116	149	5	4	1	2	3
U6H003	20	403	433	63	127	188	4	5	1	2	3
U7H001	70	34	3 016	64	21	26	3	5	4	1	2
U7H004	20	0	0	0	0	0	5	4	2	3	1
U7H008	33	79	1 205	406	52	156	2	5	4	1	3
U8H001	30	1 929	1 459	241	439	850	5	4	1	2	3
U8H003	27	1 151	82	251	362	312	5	1	2	4	3
V1H001	74	2 451	474	629	566	206	5	2	4	3	1
V1H009	65	113	7	53	6	26	5	2	4	1	3
V1H010	58	233	255	82	104	167	4	5	1	2	3
V1H029	25	61	294	153	17	103	2	5	4	1	3
V1H030	26	280	30	124	85	215	5	1	3	2	4
V1H032	20	89	37	111	18	26	4	3	5	1	2
V1H038	47	214	486	107	200	315	3	5	1	2	4
V1R001	72	431	343	186	81	114	5	4	3	1	2
V1R002	68	163	323	74	169	185	2	5	1	3	4
V1R003	28	810	477	309	196	853	4	3	2	1	5
V2H001	28	254	889	285	125	378	2	5	3	1	4
V2H002	70	322	2 942	779	113	228	3	5	4	1	2
V2H004	58	914	3 816	1 589	220	667	3	5	4	1	2
V2H005	46	103	724	370	38	140	2	5	4	1	3
V2H007	47	72	59	22	17	41	5	4	2	1	3
V2R001	47	173	1 423	395	29	159	3	5	4	1	2
V3H007	71	84	11	16	7	35	5	2	3	1	4
V3H010	59	121	74	135	22	39	4	3	5	1	2
V3R001	48	478	249	88	100	228	5	4	1	2	3
V3R003	61	103	76	31	18	77	5	3	2	1	4
V6H003	65	149	9	42	13	62	5	1	3	2	4
V6H004	65	116	178	34	56	82	4	5	1	2	3
V7H012	56	270	242	461	12	227	4	3	5	1	2
V7H016	46	70	177	92	43	93	2	5	3	1	4
V7H017	46	60	226	107	36	64	2	5	4	1	3
V7R001	66	567	446	470	10	399	5	3	4	1	2
W1H004	69	1 511	511	157	89	195	5	4	2	1	3

Station	*N*	Score					Rank				
		LN	LP3	GEV	IPZA	GPA	LN	LP3	GEV	IPZA	GPA
W1H005	70	82	8	11	13	12	5	1	2	4	3
W1H015	21	199	43	46	65	52	5	1	2	4	3
W1H017	22	6	0	2	3	3	5	1	2	3	4
W1R001	47	2 071	2.E+04	3 134	654	1 678	3	5	4	1	2
W2H006	54	7 705	1.E+04	6 452	580	3 842	4	5	3	1	2
W2H007	30	266	1 014	492	32	336	2	5	4	1	3
W2H028	31	397	381	66	85	221	5	4	1	2	3
W2R001	41	406	225	77	50	197	5	4	2	1	3
W3R001	45	5 559	2 043	523	866	1 397	5	4	1	2	3
W5H001	65	833	1 015	290	136	666	4	5	2	1	3
W5H005	69	408	728	518	14	229	3	5	4	1	2
W5H011	55	214	328	117	12	99	4	5	3	1	2
W5H016	30	7	3	3	3	2	5	4	3	2	1
W5H022	51	254	149	80	63	70	5	4	3	1	2
W5H024	42	279	155	51	63	106	5	4	1	2	3
W5R001	43	41	6	19	2	8	5	2	4	1	3
W5R002	57	108	100	20	3	36	5	4	2	1	3
W5R003	57	125	154	71	9	69	4	5	3	1	2
X1H001	113	1 739	6 808	2 068	641	951	3	5	4	1	2
X1H003	78	1 854	1 642	1 119	30	729	5	4	3	1	2
X1H012	25	98	134	16	26	51	4	5	1	2	3
X1H014	50	2 798	1 021	209	487	637	5	4	1	2	3
X1H016	49	1 363	3.E+04	2 468	144	1 014	3	5	4	1	2
X1H017	48	174	16	45	18	121	5	1	3	2	4
X1H018	48	257	24	51	46	150	5	1	3	2	4
X1H019	45	1 416	654	119	283	401	5	4	1	2	3
X1H020	36	88	34	14	20	45	5	3	1	2	4
X1R001	54	143	141	38	24	105	5	4	2	1	3
X1R003	42	186	465	141	102	229	3	5	2	1	4
X1R004	45	906	382	157	188	497	5	3	1	2	4
X2H008	71	257	36	19	38	66	5	2	1	3	4
X2H010	69	253	81	19	42	67	5	4	1	2	3
X2H011	44	103	9	66	25	14	5	1	4	3	2
X2H013	61	101	6	23	15	58	5	1	3	2	4
X2H014	59	14	4	5	1	4	5	2	4	1	3
X2H016	58	1.E+04	1.E+05	7 737	320	5 023	4	5	3	1	2
X2H017	40	2 136	7 409	2 546	47	1 743	3	5	4	1	2
X2H018	27	1 472	311	171	357	495	5	2	1	3	4
X2H022	58	3 321	739	201	431	757	5	3	1	2	4
X2H024	55	45	14	13	7	11	5	4	3	1	2
X2H025	27	2	1	2	1	1	5	3	4	2	1
X2H026	27	17	8	3	7	9	5	3	1	2	4
X2H027	27	10	6	4	4	5	5	4	2	1	3
X2H028	27	2	1	1	1	2	5	3	1	2	4
X2H031	53	397	314	48	52	78	5	4	1	2	3
X2H032	51	835	2 076	1 353	77	659	3	5	4	1	2
X2H035	37	19	6	3	5	5	5	4	1	2	3
X2H047	33	11	9	3	2	3	5	4	3	1	2
X2H072	23	582	8 244	479	76	721	3	5	2	1	4
X2R001	37	45	125	50	3	42	3	5	4	1	2
X2R002	54	471	348	143	54	153	5	4	2	1	3
X2R003	43	32	24	13	6	29	5	3	2	1	4
X2R004	51	1 117	719	52	142	239	5	4	1	2	3
X2R005	54	27	16	17	27	11	5	2	3	4	1
X3H001	72	38	81	26	12	30	4	5	2	1	3
X3H002	55	25	138	87	6	25	3	5	4	1	2

Station	*N*	Score					Rank				
		LN	LP3	GEV	IPZA	GPA	LN	LP3	GEV	IPZA	GPA
X3H006	43	792	1 948	159	79	321	4	5	2	1	3
X3H011	39	375	280	52	60	143	5	4	1	2	3
X3R001	40	17	52	24	8	17	3	5	4	1	2
X3R002	33	160	62	27	43	69	5	3	1	2	4
X4H004	40	704	218	137	161	157	5	4	1	3	2

Table A.10: Theoretical probability distribution rankings (Adjusted R^2, Eq. 4.8)

Station	*N*	Score					Rank				
		LN	LP3	GEV	IPZA	GPA	LN	LP3	GEV	IPZA	GPA
A2H006	113	0.849	0.960	0.975	0.999	0.984	5	4	3	1	2
A2H007	46	0.989	0.981	0.998	1.000	0.956	3	4	2	1	5
A2H012	114	0.939	0.818	0.976	0.999	0.981	4	5	3	1	2
A2H013	117	0.925	0.967	0.945	0.999	0.977	5	3	4	1	2
A2H023	61	0.978	0.999	0.968	1.000	0.973	3	2	5	1	4
A2H024	58	0.958	0.965	0.969	1.000	0.978	5	4	3	1	2
A2H027	57	0.938	0.033	0.989	0.999	0.835	3	5	2	1	4
A2H029	56	0.842	0.029	0.945	0.994	0.971	4	5	3	1	2
A2H032	49	0.941	0.791	0.964	0.996	0.910	3	5	2	1	4
A2H038	24	0.927	0.999	0.934	0.980	0.910	4	1	3	2	5
A2H039	23	0.976	0.980	0.936	0.996	0.969	3	2	5	1	4
A2H040	23	0.994	0.995	0.989	0.999	0.976	3	2	4	1	5
A2H042	25	0.993	0.999	0.989	1.000	0.984	3	2	4	1	5
A2H044	48	0.971	0.998	0.965	0.999	0.977	4	2	5	1	3
A2H045	47	0.967	0.992	0.975	1.000	0.972	5	2	3	1	4
A2H047	46	0.957	0.006	0.894	0.992	0.966	3	5	4	1	2
A2H049	47	0.983	0.999	0.982	1.000	0.969	3	2	4	1	5
A2H050	46	0.960	0.985	0.973	1.000	0.989	5	3	4	1	2
A2H053	46	0.954	0.995	0.962	0.998	0.964	5	2	4	1	3
A2H054	37	0.930	0.024	0.917	0.986	0.972	3	5	4	1	2
A2H056	37	0.961	0.021	0.972	0.994	0.972	4	5	2	1	3
A2H058	37	0.891	0.999	0.946	0.987	0.907	5	1	3	2	4
A2H061	35	0.991	0.999	0.979	1.000	0.932	3	2	4	1	5
A2H077	33	0.971	0.950	0.992	1.000	0.962	3	5	2	1	4
A2R001	101	0.947	0.976	0.973	1.000	0.993	5	3	4	1	2
A2R003	84	0.907	0.714	0.973	0.999	0.956	4	5	2	1	3
A2R005	84	0.880	0.985	0.970	1.000	0.855	4	2	3	1	5
A2R006	81	0.826	0.824	0.957	0.996	0.980	4	5	3	1	2
A2R007	71	0.840	0.964	0.974	0.996	0.957	5	3	2	1	4
A2R009	64	0.928	0.996	0.980	1.000	0.909	4	2	3	1	5
A2R011	58	0.962	0.940	0.989	1.000	0.985	4	5	2	1	3
A2R012	67	0.961	0.944	0.981	1.000	0.980	4	5	2	1	3
A2R014	71	0.905	0.916	0.977	0.999	0.976	5	4	2	1	3
A2R015	68	0.962	0.977	0.962	1.000	0.958	4	2	3	1	5
A3R001	84	0.898	0.800	0.961	0.999	0.917	4	5	2	1	3
A3R002	112	0.804	0.923	0.970	0.998	0.949	5	4	2	1	3
A3R003	111	0.767	0.999	0.964	0.997	0.976	5	1	4	2	3
A3R004	61	0.962	0.991	0.969	1.000	0.959	4	2	3	1	5
A4H005	55	0.872	0.964	0.895	0.988	0.977	5	3	4	1	2
A4H007	47	0.845	0.890	0.916	0.982	0.947	5	4	3	1	2
A4R001	59	0.966	0.893	0.977	1.000	0.955	3	5	2	1	4
A5H004	63	0.935	0.967	0.918	0.996	0.959	4	2	5	1	3
A5R001	56	0.927	0.978	0.939	0.997	0.986	5	3	4	1	2
A5R002	54	0.955	0.922	0.992	1.000	0.786	3	4	2	1	5

Station	*N*	Score					Rank				
		LN	LP3	GEV	IPZA	GPA	LN	LP3	GEV	IPZA	GPA
A6H010	53	0.895	0.965	0.885	0.989	0.982	4	3	5	1	2
A6H011	50	0.842	0.997	0.940	0.986	0.892	5	1	3	2	4
A6H012	52	0.939	0.962	0.888	0.992	0.988	4	3	5	1	2
A6H018	46	0.900	0.910	0.924	0.991	0.982	5	4	3	1	2
A6H020	45	0.910	0.957	0.881	0.982	0.936	4	2	5	1	3
A6H021	41	0.915	0.999	0.923	0.992	0.990	5	1	4	2	3
A6H022	21	0.971	0.997	0.955	0.997	0.991	4	2	5	1	3
A6H024	46	0.899	0.954	0.967	0.993	0.937	5	3	2	1	4
A9R001	78	0.884	0.891	0.979	0.997	0.947	5	4	2	1	3
A9R002	53	0.963	0.998	0.962	0.999	0.958	3	2	4	1	5
A9R004	60	0.897	0.815	0.975	0.995	0.962	4	5	2	1	3
B1H002	62	0.910	0.903	0.981	0.998	0.929	4	5	2	1	3
B1H004	58	0.956	0.946	0.986	1.000	0.912	3	4	2	1	5
B1H005	46	0.971	0.999	0.941	0.998	0.938	3	1	4	2	5
B1H012	41	0.947	0.972	0.980	0.999	0.970	5	3	2	1	4
B1H017	29	0.965	0.989	0.890	0.997	0.977	4	2	5	1	3
B1H018	29	0.954	0.967	0.904	0.993	0.975	4	3	5	1	2
B1H019	29	0.974	0.999	0.893	0.997	0.988	4	1	5	2	3
B1R001	113	0.862	0.921	0.977	0.999	0.990	5	4	3	1	2
B1R002	52	0.969	0.016	0.952	0.998	0.986	3	5	4	1	2
B2H007	34	0.945	0.031	0.919	0.990	0.988	3	5	4	1	2
B2R001	117	0.843	0.878	0.964	0.999	0.967	5	4	3	1	2
B3H007	39	0.950	0.962	0.992	0.997	0.901	4	3	2	1	5
B3R001	88	0.922	0.799	0.976	1.000	0.964	4	5	2	1	3
B3R002	85	0.954	0.950	0.984	1.000	0.986	4	5	3	1	2
B3R005	83	0.888	0.853	0.985	0.999	0.975	4	5	2	1	3
B4H005	59	0.981	0.999	0.985	1.000	0.985	5	2	3	1	4
B4H007	51	0.899	0.029	0.983	0.994	0.886	3	5	2	1	4
B4R001	57	0.937	0.951	0.984	1.000	0.862	4	3	2	1	5
B4R002	57	0.957	0.969	0.971	1.000	0.981	5	4	3	1	2
B4R004	62	0.955	0.997	0.993	1.000	0.951	4	2	3	1	5
B6H001	77	0.944	0.977	0.961	1.000	0.870	4	2	3	1	5
B6H002	28	0.981	0.946	0.974	1.000	0.965	2	5	3	1	4
B6H003	60	0.963	0.978	0.925	0.998	0.987	4	3	5	1	2
B6H006	60	0.959	0.996	0.889	0.994	0.931	3	1	5	2	4
B6R001	63	0.919	0.964	0.985	1.000	0.900	4	3	2	1	5
B6R003	71	0.946	0.986	0.989	1.000	0.972	5	3	2	1	4
B7H003	40	0.958	0.958	0.968	0.996	0.829	3	4	2	1	5
B7H004	43	0.960	0.968	0.946	0.998	0.969	4	3	5	1	2
B7H008	34	0.957	0.934	0.959	0.994	0.838	3	4	2	1	5
B7H010	55	0.939	0.999	0.885	0.992	0.921	3	1	5	2	4
B7H014	30	0.840	0.989	0.852	0.966	0.971	5	1	4	3	2
B7H019	29	0.881	0.968	0.908	0.984	0.961	5	2	4	1	3
B7R001	72	0.830	0.997	0.975	0.996	0.937	5	1	3	2	4
B7R003	69	0.877	0.810	0.981	0.997	0.945	4	5	2	1	3
B8H010	60	0.813	0.939	0.910	0.977	0.853	5	2	3	1	4
B8H011	41	0.822	0.991	0.856	0.960	0.897	5	1	4	2	3
B8H014	50	0.953	0.943	0.963	0.999	0.973	4	5	3	1	2
B8H017	42	0.940	0.979	0.996	0.998	0.799	4	3	2	1	5
B8H018	34	0.909	0.977	0.955	0.992	0.944	5	2	3	1	4
B8H019	21	0.871	0.902	0.810	0.964	0.900	4	2	5	1	3
B8H034	28	0.889	0.903	0.871	0.974	0.947	4	3	5	1	2
B8R001	68	0.953	0.951	0.968	1.000	0.977	4	5	3	1	2
B8R002	40	0.958	0.974	0.991	0.999	0.881	4	3	2	1	5
B8R003	48	0.937	0.998	0.957	0.998	0.946	5	1	3	2	4
B8R006	42	0.963	1.000	0.942	0.998	0.986	4	1	5	2	3

Station	***N***	**Score**					**Rank**				
		LN	**LP3**	**GEV**	**IPZA**	**GPA**	**LN**	**LP3**	**GEV**	**IPZA**	**GPA**
B8R007	34	0.927	0.980	0.962	0.988	0.855	4	2	3	1	5
B9H002	26	0.958	0.980	0.964	0.995	0.941	4	2	3	1	5
B9H003	22	0.926	0.992	0.926	0.983	0.947	5	1	4	2	3
B9H004	22	0.926	0.992	0.926	0.983	0.947	5	1	4	2	3
C1H002	112	0.977	0.922	0.986	1.000	0.927	3	5	2	1	4
C1H004	60	0.957	1.000	0.930	0.998	0.990	4	1	5	2	3
C1H006	56	0.982	0.998	0.940	0.999	0.955	3	2	5	1	4
C1H007	49	0.973	0.987	0.973	1.000	0.976	4	2	5	1	3
C1H008	45	0.967	0.947	0.921	0.997	0.980	3	4	5	1	2
C1H012	35	0.922	0.998	0.963	0.994	0.945	5	1	3	2	4
C1H015	114	0.975	0.946	0.967	1.000	0.873	2	4	3	1	5
C1H027	24	0.961	0.999	0.984	0.991	0.860	4	1	3	2	5
C2H018	80	0.968	0.955	0.962	1.000	0.946	2	4	3	1	5
C2H024	31	0.985	0.984	0.983	1.000	0.984	2	3	5	1	4
C2H070	20	0.972	0.950	0.952	0.998	0.968	2	5	4	1	3
C2H073	23	0.969	0.998	0.869	0.990	0.897	3	1	5	2	4
C2H141	27	0.991	1.000	0.965	1.000	0.992	4	2	5	1	3
C3H004	23	0.982	0.969	0.945	0.998	0.973	2	4	5	1	3
C4H002	45	0.913	0.966	0.980	0.997	0.934	5	3	2	1	4
C4H004	51	0.886	0.987	0.894	0.990	0.971	5	2	4	1	3
C5H015	34	0.948	0.990	0.903	0.992	0.992	4	3	5	1	2
C5H018	39	0.958	0.996	0.995	0.998	0.764	4	2	3	1	5
C5H022	38	0.961	0.998	0.951	0.998	0.983	4	1	5	2	3
C5H023	25	0.970	0.990	0.992	0.994	0.820	4	3	2	1	5
C6H003	40	0.927	0.054	0.908	0.994	0.984	3	5	4	1	2
C7H005	39	0.937	0.989	0.912	0.993	0.966	4	2	5	1	3
C7H006	62	0.954	0.998	0.906	0.995	0.933	3	1	5	2	4
C8H003	63	0.936	0.997	0.933	0.997	0.991	4	2	5	1	3
C8H004	32	0.978	0.984	0.960	0.999	0.969	3	2	5	1	4
C8H005	58	0.963	0.962	0.996	1.000	0.905	3	4	2	1	5
C8H011	27	0.968	0.966	0.993	0.993	0.808	3	4	1	2	5
C8H014	29	0.981	0.952	0.992	1.000	0.979	3	5	2	1	4
C8H020	44	0.933	0.933	0.988	0.999	0.954	4	5	2	1	3
C8H022	47	0.956	0.874	0.988	0.999	0.940	3	5	2	1	4
C8H026	32	0.928	0.998	0.914	0.992	0.984	4	1	5	2	3
C8H027	37	0.987	0.978	0.977	1.000	0.938	2	3	4	1	5
C8H028	33	0.976	0.986	0.996	0.997	0.914	4	3	2	1	5
C9H003	136	0.945	0.940	0.944	0.999	0.930	2	4	3	1	5
C9H009	110	0.911	0.939	0.916	0.995	0.942	5	3	4	1	2
C9H010	39	0.886	0.967	0.869	0.987	0.945	4	2	5	1	3
D1H001	106	0.870	0.972	0.969	0.998	0.972	5	2	4	1	3
D1H004	53	0.904	0.999	0.970	0.997	0.965	5	1	3	2	4
D1H011	53	0.972	0.940	0.988	1.000	0.953	3	5	2	1	4
D1H032	33	0.967	0.983	0.945	0.999	0.978	4	2	5	1	3
D1R002	24	0.983	0.935	0.997	0.999	0.848	3	4	2	1	5
D2R001	76	0.972	0.888	0.995	1.000	0.985	4	5	2	1	3
D2R002	74	0.954	0.974	0.987	1.000	0.923	4	3	2	1	5
D4H002	38	0.974	0.931	0.996	1.000	0.945	3	5	2	1	4
D4H013	55	0.956	0.985	0.963	0.999	0.990	5	3	4	1	2
D4H032	38	0.974	0.931	0.996	1.000	0.945	3	5	2	1	4
D5H003	81	0.969	0.989	0.945	0.999	0.993	4	3	5	1	2
D5H011	45	0.868	0.971	0.943	0.991	0.959	5	2	4	1	3
D5H013	33	0.917	0.921	0.908	0.987	0.950	4	3	5	1	2
D5H016	39	0.961	0.966	0.911	0.991	0.889	3	2	4	1	5
D7H002	108	0.889	0.994	0.940	0.999	0.615	4	2	3	1	5
D7H005	94	0.958	0.983	0.964	1.000	0.992	5	3	4	1	2

Station	*N*	Score					Rank				
		LN	LP3	GEV	IPZA	GPA	LN	LP3	GEV	IPZA	GPA
D7H008	44	0.996	0.886	0.899	0.997	0.629	2	4	3	1	5
E1H006	44	0.996	0.886	0.899	0.997	0.629	2	4	3	1	5
E1H013	27	0.995	1.000	0.984	1.000	0.984	3	1	5	2	4
E2H003	92	0.964	1.000	0.973	1.000	0.995	5	2	4	1	3
E2H007	48	0.978	0.044	0.834	0.999	0.969	2	5	4	1	3
G1H004	57	0.992	0.977	0.984	0.998	0.965	2	4	3	1	5
G1H008	65	0.965	0.990	0.978	1.000	0.977	5	2	3	1	4
G1H010	55	0.930	0.996	0.914	0.995	0.989	4	1	5	2	3
G1H011	55	0.992	0.996	0.977	0.999	0.984	3	2	5	1	4
G1H012	33	0.995	1.000	0.989	0.999	0.977	3	1	4	2	5
G1H016	37	0.970	0.868	0.963	0.996	0.949	2	5	3	1	4
G1H017	25	0.971	0.987	0.984	0.998	0.954	4	2	3	1	5
G1H018	40	0.993	0.985	0.997	0.999	0.963	3	4	2	1	5
G1H028	46	0.883	0.362	0.837	0.945	0.942	3	5	4	1	2
G1H029	46	0.887	0.016	0.976	0.969	0.772	3	5	1	2	4
G1H038	39	0.978	0.961	0.968	0.998	0.872	2	4	3	1	5
G1H040	40	0.924	0.023	0.737	0.960	0.987	3	5	4	2	1
G2H008	49	0.998	0.977	0.983	0.986	0.954	1	4	3	2	5
G4H008	29	0.979	0.853	0.994	1.000	0.931	3	5	2	1	4
G4H009	29	0.970	0.990	0.991	0.999	0.967	4	3	2	1	5
G4H010	29	0.988	0.872	0.996	1.000	0.970	3	5	2	1	4
G4H012	28	0.984	0.866	0.993	1.000	0.940	3	5	2	1	4
G4H013	27	0.987	0.871	0.990	0.999	0.876	3	5	2	1	4
G4H014	52	0.969	0.956	0.949	0.999	0.862	2	3	4	1	5
G4H033	42	0.859	0.975	0.917	0.974	0.889	5	1	3	2	4
H1H013	54	0.924	0.998	0.963	0.996	0.933	5	1	3	2	4
H1H016	22	0.947	0.085	0.790	0.984	0.943	2	5	4	1	3
H1H017	24	0.992	0.863	0.998	1.000	0.971	3	5	2	1	4
H1H018	50	0.996	1.000	0.993	0.999	0.990	3	1	4	2	5
H1H033	28	0.991	0.973	0.989	0.999	0.962	2	4	3	1	5
H2H005	50	0.962	0.024	0.943	0.991	0.915	2	5	3	1	4
H2H008	37	0.866	0.013	0.804	0.943	0.936	3	5	4	1	2
H3H001	21	0.967	0.996	0.945	0.997	0.975	4	2	5	1	3
H3H004	25	0.956	0.889	0.975	0.998	0.979	4	5	3	1	2
H4H005	33	0.965	0.968	0.987	0.998	0.905	4	3	2	1	5
H4H007	28	0.948	0.935	0.945	0.993	0.943	2	5	3	1	4
H4H009	25	0.985	1.000	0.968	1.000	0.983	3	1	5	2	4
H4H012	24	0.968	0.941	0.949	0.997	0.959	2	5	4	1	3
H4H013	22	0.954	0.838	0.959	0.994	0.949	3	5	2	1	4
H4H015	35	0.982	0.988	0.919	0.997	0.944	3	2	5	1	4
H6H007	29	0.996	0.984	0.998	1.000	0.982	3	4	2	1	5
H6H009	55	0.958	0.901	0.985	1.000	0.974	4	5	2	1	3
H6H010	50	0.893	0.765	0.958	0.996	0.961	4	5	3	1	2
H7H004	65	0.920	0.942	0.968	0.999	0.991	5	4	3	1	2
H7H005	59	0.998	1.000	0.987	0.974	0.904	2	1	3	4	5
H8H001	52	0.985	0.981	0.974	1.000	0.960	2	3	4	1	5
H9H002	55	0.926	0.903	0.986	0.999	0.973	4	5	2	1	3
H9H005	50	0.958	0.987	0.924	0.997	0.963	4	2	5	1	3
J1H004	33	0.977	0.998	0.938	0.999	0.976	3	2	5	1	4
J1H015	45	0.984	0.974	0.996	0.998	0.949	3	4	2	1	5
J1H016	45	0.904	0.913	0.906	0.990	0.984	5	3	4	1	2
J1R001	35	0.982	0.937	0.987	0.999	0.828	3	4	2	1	5
J1R004	38	0.922	0.878	0.982	0.996	0.909	3	5	2	1	4
J2H007	64	0.709	0.664	0.900	0.979	0.949	4	5	3	1	2
J2R001	84	0.929	0.940	0.986	1.000	0.978	5	4	2	1	3
J2R002	54	0.926	0.987	0.953	0.997	0.957	5	2	4	1	3

Station	***N***	**Score**					**Rank**				
		LN	**LP3**	**GEV**	**IPZA**	**GPA**	**LN**	**LP3**	**GEV**	**IPZA**	**GPA**
J2R003	82	0.919	0.926	0.970	0.998	0.974	5	4	3	1	2
J2R004	51	0.908	0.964	0.968	0.996	0.939	5	3	2	1	4
J2R006	73	0.847	0.999	0.944	0.995	0.984	5	1	4	2	3
J3H005	22	0.958	0.973	0.975	0.995	0.912	4	3	2	1	5
J3H012	30	0.925	0.996	0.894	0.988	0.979	4	1	5	2	3
J3H014	28	0.989	0.999	0.963	1.000	0.982	3	2	5	1	4
J3H015	53	0.962	0.960	0.939	0.998	0.952	2	3	5	1	4
J3H020	44	0.937	0.891	0.916	0.991	0.910	2	5	3	1	4
J3R001	101	0.892	0.727	0.973	0.989	0.953	4	5	2	1	3
J3R002	90	0.860	0.996	0.975	0.999	0.897	5	2	3	1	4
J4H002	46	0.805	0.976	0.759	0.960	0.889	4	1	5	2	3
J4H004	31	0.928	0.845	0.953	0.993	0.982	4	5	3	1	2
K1H002	61	0.928	0.005	0.881	0.988	0.981	3	5	4	1	2
K1H018	37	0.534	0.634	0.709	0.835	0.922	5	4	3	2	1
K3H002	58	0.985	0.996	0.995	0.999	0.961	4	2	3	1	5
K3H004	58	0.989	0.985	0.988	0.999	0.953	2	4	3	1	5
K4H001	34	0.947	0.967	0.971	0.998	0.983	5	4	3	1	2
K4H003	57	0.912	0.885	0.965	0.997	0.976	4	5	3	1	2
K6H001	58	0.930	0.897	0.921	0.990	0.900	2	5	3	1	4
K8H001	58	0.992	0.997	0.989	1.000	0.994	4	2	5	1	3
K8H002	58	0.962	0.995	0.991	1.000	0.942	4	2	3	1	5
K8H005	24	0.980	0.976	0.942	0.997	0.910	2	3	4	1	5
L1H001	30	0.995	0.965	0.996	0.999	0.819	3	4	2	1	5
L2H003	38	0.926	0.999	0.978	0.996	0.932	5	1	3	2	4
L6H001	66	0.839	0.811	0.935	0.989	0.946	4	5	3	1	2
L8H001	54	0.949	0.956	0.965	0.999	0.994	5	4	3	1	2
L8H002	49	0.900	0.995	0.938	0.996	0.983	5	2	4	1	3
L8H005	29	0.975	0.947	0.959	0.998	0.937	2	4	3	1	5
N1R001	99	0.831	0.840	0.970	0.999	0.961	5	4	2	1	3
N2H002	68	0.965	0.999	0.939	0.998	0.928	3	1	4	2	5
N2H005	20	0.993	0.877	0.997	1.000	0.922	3	5	2	1	4
N2H008	36	0.989	0.989	0.977	1.000	0.965	3	2	4	1	5
N2R001	90	0.941	0.836	0.983	1.000	0.948	4	5	2	1	3
N3H001	20	0.987	0.960	0.981	0.999	0.945	2	4	3	1	5
P3H001	35	0.897	0.799	0.919	0.985	0.961	4	5	3	1	2
P4H001	49	0.848	0.863	0.877	0.982	0.925	5	4	3	1	2
Q1H012	42	0.993	0.995	0.997	0.999	0.973	4	3	2	1	5
Q3H005	42	0.961	0.885	0.995	1.000	0.963	4	5	2	1	3
Q4H003	28	0.987	0.985	0.994	1.000	0.967	3	4	2	1	5
Q4R002	57	0.972	0.969	0.991	1.000	0.986	4	5	2	1	3
Q6H003	38	0.963	1.000	0.960	0.999	0.980	4	1	5	2	3
Q8H004	31	0.969	1.000	0.993	0.998	0.858	4	1	3	2	5
Q8H008	39	0.957	0.983	0.901	0.993	0.914	3	2	5	1	4
Q8H010	32	0.972	0.929	0.992	1.000	0.987	4	5	2	1	3
Q8R001	31	0.984	0.965	0.963	1.000	0.925	2	3	4	1	5
Q9H002	84	0.892	0.788	0.965	0.995	0.958	4	5	2	1	3
Q9H008	49	0.981	0.999	0.962	1.000	0.983	4	2	5	1	3
Q9H014	22	0.975	0.990	0.908	0.995	0.974	3	2	5	1	4
Q9H029	27	0.981	0.971	0.978	1.000	0.957	2	4	3	1	5
Q9H030	37	0.969	0.996	0.981	0.999	0.960	4	2	3	1	5
Q9R001	25	0.971	1.000	0.991	0.995	0.882	4	1	3	2	5
R1H013	37	0.917	0.930	0.961	0.995	0.967	5	4	3	1	2
R2H005	59	0.917	0.995	0.959	0.998	0.975	5	2	4	1	3
R2H012	38	0.896	0.849	0.948	0.985	0.931	4	5	2	1	3
R2H015	31	0.969	0.990	0.958	0.997	0.915	3	2	4	1	5
S3H003	30	0.937	0.999	0.943	0.994	0.983	5	1	4	2	3

Station	*N*	Score					Rank				
		LN	LP3	GEV	IPZA	GPA	LN	LP3	GEV	IPZA	GPA
S3H004	55	0.978	0.992	0.991	1.000	0.963	4	2	3	1	5
S3H006	54	0.969	0.999	0.964	1.000	0.986	4	2	5	1	3
S6H001	72	0.936	1.000	0.965	0.999	0.986	5	1	4	2	3
T1H001	34	0.846	0.955	0.851	0.970	0.973	5	3	4	2	1
T1H004	25	0.961	1.000	0.971	0.996	0.931	4	1	3	2	5
T3H005	61	0.980	0.999	0.993	1.000	0.981	5	2	3	1	4
T3H006	64	0.983	0.999	0.982	1.000	0.991	4	2	5	1	3
T3H007	43	0.924	0.770	0.965	0.992	0.943	4	5	2	1	3
T3H009	55	0.986	0.991	0.975	1.000	0.989	4	2	5	1	3
T4H001	68	0.972	0.877	0.994	0.999	0.935	3	5	2	1	4
T5H001	49	0.993	0.913	0.997	0.999	0.950	3	5	2	1	4
T5H003	60	0.946	0.997	0.981	0.999	0.977	5	2	3	1	4
T5H004	70	0.984	0.889	0.991	1.000	0.970	3	5	2	1	4
T5H005	54	0.967	0.956	0.939	0.997	0.876	2	3	4	1	5
T5H007	41	0.981	0.889	0.995	0.995	0.922	3	5	2	1	4
T5H012	49	0.918	0.904	0.935	0.995	0.986	4	5	3	1	2
U1H005	59	0.985	0.918	0.971	0.999	0.900	2	4	3	1	5
U2H002	36	0.992	1.000	0.990	1.000	0.966	3	1	4	2	5
U2H006	65	0.958	0.773	0.940	0.999	0.911	2	5	3	1	4
U2H007	65	0.962	0.923	0.957	0.998	0.706	2	4	3	1	5
U2H011	60	0.941	0.807	0.976	1.000	0.943	4	5	2	1	3
U2H012	59	0.926	0.999	0.989	0.999	0.942	5	2	3	1	4
U2H013	59	0.932	0.943	0.983	0.999	0.903	4	3	2	1	5
U2H055	29	0.965	0.913	0.963	0.995	0.931	2	5	3	1	4
U6H003	20	0.926	0.916	0.910	0.987	0.975	3	4	5	1	2
U7H001	70	0.960	0.606	0.989	0.996	0.904	3	5	2	1	4
U7H004	20	0.924	0.974	0.884	0.984	0.978	4	3	5	1	2
U7H008	33	0.991	0.821	0.953	1.000	0.906	2	5	3	1	4
U8H001	30	0.942	0.954	0.943	0.994	0.962	5	3	4	1	2
U8H003	27	0.936	0.997	0.912	0.987	0.959	4	1	5	2	3
V1H001	74	0.909	0.957	0.854	0.984	0.995	4	3	5	2	1
V1H009	65	0.986	0.999	0.972	1.000	0.991	4	2	5	1	3
V1H010	58	0.991	0.989	0.997	1.000	0.976	3	4	2	1	5
V1H029	25	0.994	0.968	0.999	0.999	0.763	3	4	2	1	5
V1H030	26	0.988	0.998	0.971	0.998	0.805	3	2	4	1	5
V1H032	20	0.982	0.960	0.886	0.999	0.985	3	4	5	1	2
V1H038	47	0.995	0.977	0.994	0.999	0.939	2	4	3	1	5
V1R001	72	0.985	0.990	0.984	1.000	0.983	3	2	4	1	5
V1R002	68	0.995	0.981	0.995	0.999	0.968	3	4	2	1	5
V1R003	28	0.982	0.993	0.997	0.998	0.916	4	3	2	1	5
V2H001	28	0.994	0.958	0.998	1.000	0.945	3	4	2	1	5
V2H002	70	0.967	0.729	0.940	0.999	0.952	2	5	4	1	3
V2H004	58	0.971	0.874	0.977	1.000	0.932	3	5	2	1	4
V2H005	46	0.983	0.833	0.930	1.000	0.866	2	5	3	1	4
V2H007	47	0.953	0.754	0.987	0.998	0.879	3	5	2	1	4
V2R001	47	0.971	0.827	0.968	0.999	0.902	2	5	3	1	4
V3H007	71	0.969	1.000	0.985	1.000	0.977	5	2	3	1	4
V3H010	59	0.989	0.979	0.959	1.000	0.991	3	4	5	1	2
V3R001	48	0.972	0.969	0.984	0.999	0.964	3	4	2	1	5
V3R003	61	0.983	0.991	0.998	1.000	0.953	4	3	2	1	5
V6H003	65	0.979	0.999	0.978	1.000	0.984	4	2	5	1	3
V6H004	65	0.991	0.981	0.994	0.999	0.971	3	4	2	1	5
V7H012	56	0.962	0.967	0.945	1.000	0.769	3	2	4	1	5
V7H016	46	0.992	0.968	0.997	0.999	0.918	3	4	2	1	5
V7H017	46	0.991	0.924	0.986	1.000	0.972	2	5	3	1	4
V7R001	66	0.964	0.974	0.980	1.000	0.880	4	3	2	1	5

Station	*N*	Score					Rank				
		LN	LP3	GEV	IPZA	GPA	LN	LP3	GEV	IPZA	GPA
W1H004	69	0.901	0.936	0.978	0.996	0.858	4	3	2	1	5
W1H005	70	0.890	0.996	0.929	0.994	0.985	5	1	4	2	3
W1H015	21	0.889	0.942	0.888	0.960	0.859	3	2	4	1	5
W1H017	22	0.960	0.999	0.956	0.995	0.974	4	1	5	2	3
W1R001	47	0.969	0.757	0.989	1.000	0.951	3	5	2	1	4
W2H006	54	0.944	0.918	0.984	1.000	0.870	3	4	2	1	5
W2H007	30	0.985	0.943	0.994	0.999	0.842	3	4	2	1	5
W2H028	31	0.965	0.966	0.975	0.999	0.958	4	3	2	1	5
W2R001	41	0.968	0.986	0.987	1.000	0.970	5	3	2	1	4
W3R001	45	0.917	0.971	0.948	0.996	0.983	5	3	4	1	2
W5H001	65	0.968	0.958	0.951	0.997	0.833	2	3	4	1	5
W5H005	69	0.945	0.897	0.955	1.000	0.898	3	5	2	1	4
W5H011	55	0.941	0.907	0.989	1.000	0.946	4	5	2	1	3
W5H016	30	0.967	0.961	0.909	0.993	0.970	3	4	5	1	2
W5H022	51	0.967	0.945	0.962	0.998	0.984	3	5	4	1	2
W5H024	42	0.962	0.955	0.979	0.999	0.978	4	5	2	1	3
W5R001	43	0.987	1.000	0.971	1.000	0.994	4	2	5	1	3
W5R002	57	0.975	0.978	0.992	1.000	0.987	5	4	2	1	3
W5R003	57	0.974	0.963	0.994	1.000	0.975	4	5	2	1	3
X1H001	113	0.972	0.884	0.990	0.999	0.955	3	5	2	1	4
X1H003	78	0.930	0.939	0.977	1.000	0.955	5	4	2	1	3
X1H012	25	0.959	0.941	0.940	0.995	0.965	3	4	5	1	2
X1H014	50	0.889	0.966	0.966	0.996	0.971	5	4	3	1	2
X1H016	49	0.957	0.822	0.983	1.000	0.916	3	5	2	1	4
X1H017	48	0.980	1.000	0.985	1.000	0.951	4	2	3	1	5
X1H018	48	0.973	0.999	0.978	1.000	0.971	4	2	3	1	5
X1H019	45	0.943	0.763	0.957	0.996	0.902	3	5	2	1	4
X1H020	36	0.960	0.988	0.932	0.996	0.944	3	2	5	1	4
X1R001	54	0.984	0.984	0.992	1.000	0.972	3	4	2	1	5
X1R003	42	0.990	0.956	0.998	1.000	0.971	3	5	2	1	4
X1R004	45	0.947	0.986	0.994	0.999	0.914	4	3	2	1	5
X2H008	71	0.932	0.998	0.979	0.999	0.980	5	2	4	1	3
X2H010	69	0.884	0.978	0.977	0.998	0.946	5	2	3	1	4
X2H011	44	0.975	0.997	0.934	0.999	0.995	4	2	5	1	3
X2H013	61	0.966	1.000	0.983	0.999	0.956	4	1	3	2	5
X2H014	59	0.984	0.999	0.983	1.000	0.991	4	2	5	1	3
X2H016	58	0.903	0.721	0.986	0.997	0.956	4	5	2	1	3
X2H017	40	0.966	0.892	0.989	1.000	0.913	3	5	2	1	4
X2H018	27	0.912	0.981	0.900	0.988	0.949	4	2	5	1	3
X2H022	58	0.877	0.974	0.976	0.997	0.950	5	3	2	1	4
X2H024	55	0.964	0.994	0.961	1.000	0.978	4	2	5	1	3
X2H025	27	0.985	0.966	0.947	0.999	0.987	3	4	5	1	2
X2H026	27	0.947	0.913	0.975	0.984	0.830	3	4	2	1	5
X2H027	27	0.972	0.940	0.961	0.996	0.937	2	4	3	1	5
X2H028	27	0.972	0.988	0.995	0.998	0.887	4	3	2	1	5
X2H031	53	0.936	0.951	0.947	0.998	0.966	5	3	4	1	2
X2H032	51	0.968	0.911	0.972	1.000	0.914	3	5	2	1	4
X2H035	37	0.928	0.984	0.950	0.995	0.982	5	2	4	1	3
X2H047	33	0.982	0.988	0.971	1.000	0.991	4	3	5	1	2
X2H072	23	0.972	0.870	0.974	0.997	0.903	3	5	2	1	4
X2R001	37	0.974	0.907	0.988	1.000	0.911	3	5	2	1	4
X2R002	54	0.924	0.938	0.987	0.999	0.866	4	3	2	1	5
X2R003	43	0.978	0.957	0.991	0.997	0.916	3	4	2	1	5
X2R004	51	0.879	0.909	0.969	0.994	0.924	5	4	2	1	3
X2R005	54	0.995	0.999	0.989	1.000	0.996	4	2	5	1	3
X3H001	72	0.979	0.937	0.997	0.999	0.964	3	5	2	1	4

Station	*N*	Score					Rank				
		LN	LP3	GEV	IPZA	GPA	LN	LP3	GEV	IPZA	GPA
X3H002	55	0.974	0.870	0.938	0.999	0.830	2	4	3	1	5
X3H006	43	0.946	0.857	0.987	1.000	0.983	4	5	2	1	3
X3H011	39	0.949	0.962	0.963	0.998	0.968	5	4	3	1	2
X3R001	40	0.991	0.944	0.993	1.000	0.979	3	5	2	1	4
X3R002	33	0.961	0.991	0.978	0.999	0.982	5	2	4	1	3
X4H004	40	0.926	0.985	0.892	0.990	0.973	4	2	5	1	3

Table A.11: Theoretical probability distribution rankings (*SBC*, Eq. 4.9)

Station	*N*	Score					Rank				
		LN	LP3	GEV	IPZA	GPA	LN	LP3	GEV	IPZA	GPA
A2H006	113	1 588	1 303	1 139	1 050	1 176	5	4	2	1	3
A2H007	46	388	419	361	320	397	3	5	2	1	4
A2H012	114	1 533	1 776	1 520	1 192	1 309	4	5	3	1	2
A2H013	117	1 416	1 288	1 189	1 059	1 094	5	4	3	1	2
A2H023	61	625	451	585	366	575	5	2	4	1	3
A2H024	58	138	125	38	-84	46	5	4	2	1	3
A2H027	57	828	1 246	692	608	697	4	5	2	1	3
A2H029	56	602	1 279	396	431	409	4	5	1	3	2
A2H032	49	529	476	376	405	431	5	4	1	2	3
A2H038	24	183	24	114	139	139	5	1	2	4	3
A2H039	23	122	87	106	99	96	5	1	4	3	2
A2H040	23	152	119	137	152	158	3	1	2	4	5
A2H042	25	177	146	163	169	174	5	1	2	3	4
A2H044	48	509	338	460	394	441	5	1	4	2	3
A2H045	47	439	345	361	264	394	5	2	3	1	4
A2H047	46	386	2 244	355	321	299	4	5	3	2	1
A2H049	47	309	120	229	100	273	5	2	3	1	4
A2H050	46	415	354	323	277	342	5	4	2	1	3
A2H053	46	369	198	289	279	291	5	1	3	2	4
A2H054	37	339	678	276	277	235	4	5	2	3	1
A2H056	37	289	1 394	218	231	226	4	5	1	3	2
A2H058	37	302	14	150	193	199	5	1	2	3	4
A2H061	35	326	210	292	153	340	4	2	3	1	5
A2H006	113	1 588	1 303	1 139	1 050	1 176	5	4	2	1	3
A2H077	33	404	433	353	305	388	4	5	2	1	3
A2R001	101	1 315	1 219	1 098	919	999	5	4	3	1	2
A2R003	84	1 036	1 410	1 026	629	873	4	5	3	1	2
A2R005	84	974	673	808	606	765	5	2	4	1	3
A2R006	81	1 116	1 120	827	761	840	4	5	2	1	3
A2R007	71	945	717	644	637	705	5	4	2	1	3
A2R009	64	888	586	811	615	780	5	1	4	2	3
A2R011	58	552	597	481	199	484	4	5	2	1	3
A2R012	67	731	770	606	246	619	4	5	2	1	3
A2R014	71	1 008	995	810	711	837	5	4	2	1	3
A2R015	68	905	856	783	587	810	5	4	2	1	3
A3R001	84	1 255	1 540	1 241	586	1 056	4	5	3	1	2
A3R002	112	1 436	1 192	1 017	855	1 005	5	4	3	1	2
A3R003	111	1 490	758	943	983	991	5	1	2	3	4
A3R004	61	801	668	677	548	722	5	2	3	1	4
A4H005	55	831	696	664	647	657	5	4	3	1	2
A4H007	47	607	543	379	395	438	5	4	1	2	3
A4R001	59	748	881	676	505	699	4	5	2	1	3
A5H004	63	703	638	587	535	559	5	4	3	1	2

Station	*N*	Score					Rank				
		LN	LP3	GEV	IPZA	GPA	LN	LP3	GEV	IPZA	GPA
A5R001	56	730	628	601	568	583	5	4	3	1	2
A5R002	54	804	910	791	564	721	4	5	3	1	2
A6H010	53	422	266	312	309	225	5	2	4	3	1
A6H011	50	662	375	396	454	460	5	1	2	3	4
A6H012	52	417	308	350	337	241	5	2	4	3	1
A6H018	46	292	283	164	140	181	5	4	2	1	3
A6H020	45	430	347	282	264	310	5	4	2	1	3
A6H021	41	283	36	202	204	150	5	1	3	4	2
A6H022	21	7	-37	-15	-13	-19	5	1	3	4	2
A6H024	46	378	266	223	184	267	5	3	2	1	4
A6R001	82	728	429	513	421	574	5	2	3	1	4
A6R002	62	730	422	558	512	616	5	1	3	2	4
A7H001	32	449	387	358	370	351	5	4	2	3	1
A7H003	42	625	529	477	497	536	5	3	1	2	4
A8R002	55	612	605	488	400	505	5	4	2	1	3
A8R003	55	606	474	400	425	469	5	4	1	2	3
A8R004	25	283	310	241	237	272	4	5	2	1	3
A9H004	73	906	1 000	793	628	835	4	5	2	1	3
A9H012	31	403	324	342	351	343	5	1	2	4	3
A9R001	78	1 157	1 143	993	672	956	5	4	3	1	2
A9R002	53	548	380	438	362	479	5	2	3	1	4
A9R004	60	959	1 090	828	634	830	4	5	2	1	3
B1H002	62	778	791	650	470	644	4	5	3	1	2
B1H004	58	412	430	360	109	370	4	5	2	1	3
B1H005	46	604	355	533	488	555	5	1	3	2	4
B1H012	41	424	388	320	318	364	5	4	2	1	3
B1H017	29	254	220	257	219	211	4	3	5	2	1
B1H018	29	341	292	301	300	286	5	2	4	3	1
B1H019	29	146	118	162	120	94	4	2	5	3	1
B1R001	113	1 691	1 584	1 287	1 170	1 264	5	4	3	1	2
B1R002	52	524	666	454	432	408	4	5	3	2	1
B2H007	34	315	648	263	266	223	4	5	2	3	1
B2R001	117	1 727	1 661	1 497	956	1 348	5	4	3	1	2
B3H007	39	414	355	277	333	376	5	3	1	2	4
B3R001	88	1 024	1 223	990	629	868	4	5	3	1	2
B3R002	85	1 229	1 241	1 047	529	1 044	4	5	3	1	2
B3R005	83	1 089	1 140	879	663	859	4	5	3	1	2
B4H005	59	389	229	290	11	305	5	2	3	1	4
B4H007	51	554	1 409	319	415	431	4	5	1	2	3
B4R001	57	484	458	433	248	404	5	4	3	1	2
B4R002	57	319	295	196	103	212	5	4	2	1	3
B4R004	62	547	374	351	323	467	5	3	2	1	4
B6H001	77	871	724	850	421	790	5	2	4	1	3
B6H002	28	239	284	219	148	244	3	5	2	1	4
B6H003	60	656	545	594	558	496	5	2	4	3	1
B6H006	60	427	208	363	337	336	5	1	4	3	2
B6R001	63	570	478	453	311	450	5	4	3	1	2
B6R003	71	915	803	699	658	778	5	4	2	1	3
B7H003	40	492	491	380	339	405	5	4	2	1	3
B7H004	43	472	461	410	364	408	5	4	3	1	2
B7H008	34	544	605	453	434	483	4	5	2	1	3
B7H010	55	824	547	692	668	698	5	1	3	2	4
B7H014	30	372	189	250	264	264	5	1	2	4	3
B7H019	29	403	317	328	342	323	5	1	3	4	2
B7R001	72	1 002	523	661	728	755	5	1	2	3	4
B7R003	69	863	982	711	494	678	4	5	3	1	2

Station	*N*	Score					Rank				
		LN	LP3	GEV	IPZA	GPA	LN	LP3	GEV	IPZA	GPA
B8H010	60	909	581	555	606	599	5	2	1	4	3
B8H011	41	627	362	411	435	424	5	1	2	4	3
B8H014	50	521	539	425	317	452	4	5	2	1	3
B8H017	42	613	550	503	510	568	5	3	1	2	4
B8H018	34	587	505	472	502	515	5	3	1	2	4
B8H019	21	268	254	222	218	228	5	4	2	1	3
B8H034	28	503	426	415	429	421	5	3	1	4	2
B8R001	68	560	567	422	255	428	4	5	2	1	3
B8R002	40	417	384	369	290	384	5	4	2	1	3
B8R003	48	583	405	437	425	502	5	1	3	2	4
B8R006	42	199	23	152	132	105	5	1	4	3	2
B8R007	34	586	476	448	501	513	5	2	1	3	4
B9H002	26	358	329	295	313	334	5	3	1	2	4
B9H003	22	292	237	250	261	250	5	1	2	4	3
B9H004	22	292	237	250	261	250	5	1	2	4	3
C1H002	112	1 313	1 542	1 247	1 135	1 266	4	5	2	1	3
C1H004	60	709	503	658	615	543	5	1	4	3	2
C1H006	56	657	549	637	562	622	5	1	4	2	3
C1H007	49	585	541	511	395	529	5	4	2	1	3
C1H008	45	512	476	487	439	424	5	3	4	2	1
C1H012	35	533	375	439	464	466	5	1	2	3	4
C1H015	114	1 366	1 517	1 263	993	1 366	4	5	2	1	3
C1H027	24	269	172	195	240	254	5	1	2	3	4
C2H018	80	1 200	1 244	1 095	815	1 120	4	5	2	1	3
C2H024	31	105	108	68	-14	90	4	5	2	1	3
C2H070	20	218	237	202	192	215	4	5	2	1	3
C2H073	23	290	198	273	268	272	5	1	4	2	3
C2H141	27	199	145	206	98	167	4	2	5	1	3
C3H004	23	181	165	176	142	160	5	3	4	1	2
C4H002	45	717	644	558	586	623	5	4	1	2	3
C4H004	51	682	565	593	584	530	5	2	4	3	1
C5H015	34	476	366	436	430	374	5	1	4	3	2
C5H018	39	567	423	492	467	519	5	1	3	2	4
C5H022	38	281	138	217	204	215	5	1	4	2	3
C5H023	25	231	192	169	199	221	5	2	1	3	4
C6H003	40	608	733	532	535	501	4	5	2	3	1
C7H005	39	437	313	386	376	349	5	1	4	3	2
C7H006	62	834	536	723	686	714	5	1	4	2	3
C8H003	63	674	401	566	545	466	5	1	4	3	2
C8H004	32	351	342	320	281	330	5	4	2	1	3
C8H005	58	721	725	621	375	681	4	5	2	1	3
C8H011	27	334	295	252	299	322	5	2	1	3	4
C8H014	29	354	394	328	244	354	4	5	2	1	3
C8H020	44	635	637	550	485	573	4	5	2	1	3
C8H022	47	782	906	750	489	744	4	5	3	1	2
C8H026	32	481	282	410	413	417	5	1	2	3	4
C8H027	37	460	490	430	272	469	3	5	2	1	4
C8H028	33	378	321	266	306	374	5	3	1	2	4
C9H003	136	2 096	2 115	1 884	1 600	1 909	4	5	2	1	3
C9H009	110	1 771	1 709	1 561	1 450	1 523	5	4	3	1	2
C9H010	39	666	592	592	582	571	5	3	4	2	1
D1H001	106	1 601	1 272	1 150	1 139	1 228	5	4	2	1	3
D1H004	53	559	237	397	426	423	5	1	2	4	3
D1H011	53	759	826	720	561	743	4	5	2	1	3

Station	*N*	Score					Rank				
		LN	LP3	GEV	IPZA	GPA	LN	LP3	GEV	IPZA	GPA
D1H032	33	394	373	370	348	347	5	4	3	2	1
D1R002	24	337	391	344	297	355	2	5	3	1	4
D2R001	76	704	885	670	543	611	4	5	3	1	2
D2R002	74	813	752	607	428	710	5	4	2	1	3
D4H002	38	223	273	155	50	216	4	5	2	1	3
D4H013	55	82	9	-22	-73	-46	5	4	3	1	2
D4H032	38	223	273	155	50	216	4	5	2	1	3
D5H003	81	832	642	751	663	594	5	2	4	3	1
D5H011	45	622	480	458	491	486	5	2	1	4	3
D5H013	33	546	543	454	442	494	5	4	2	1	3
D5H016	39	570	561	492	456	520	5	4	2	1	3
D7H002	108	2 318	1 766	2 201	1 783	2 035	5	1	4	2	3
D7H005	94	1 537	1 437	1 374	1 241	1 257	5	4	3	1	2
D7H008	44	311	603	599	394	425	1	5	4	2	3
E1H006	44	311	603	599	394	425	1	5	4	2	3
E1H013	27	268	219	271	289	271	2	1	3	5	4
E2H003	92	1 234	730	1 068	929	949	5	1	4	2	3
E2H007	48	245	500	326	164	222	3	5	4	1	2
G1H008	65	671	512	552	478	559	5	2	3	1	4
G1H010	55	247	28	174	157	67	5	1	4	3	2
G1H011	55	230	151	236	271	215	3	1	4	5	2
G1H012	33	84	33	77	136	100	3	1	2	5	4
G1H016	37	133	126	83	71	87	5	4	2	1	3
G1H017	25	35	11	-20	-3	23	5	3	1	2	4
G1H018	40	51	88	57	54	76	1	5	3	2	4
G1H028	46	646	938	554	543	488	4	5	3	2	1
G1H029	46	472	9 887	332	364	377	4	5	1	2	3
G1H038	39	367	321	294	289	346	5	3	2	1	4
G1H040	40	268	11 148	231	208	110	4	5	3	2	1
G2H008	49	66	148	129	342	166	1	3	2	5	4
G4H008	29	41	166	76	-83	62	2	5	4	1	3
G4H009	29	-12	-58	-50	-78	-17	5	2	3	1	4
G4H010	29	28	149	60	-9	64	2	5	3	1	4
G4H012	28	-15	94	21	-137	10	2	5	4	1	3
G4H013	27	28	171	89	-69	61	2	5	4	1	3
G4H014	52	517	550	474	340	523	3	5	2	1	4
G4H033	42	334	159	212	227	214	5	1	2	4	3
H1H013	54	485	218	360	368	385	5	1	2	3	4
H1H016	22	137	520	136	106	106	4	5	3	1	2
H1H017	24	12	127	52	3	60	2	5	3	1	4
H1H018	50	418	333	391	511	400	4	1	2	5	3
H1H033	28	246	244	211	175	251	4	3	2	1	5
H2H005	50	213	6 421	171	110	176	4	5	2	1	3
H2H008	37	267	3 283	189	183	141	4	5	3	2	1
H3H001	21	217	176	199	199	194	5	1	4	3	2
H3H004	25	120	164	75	73	106	4	5	2	1	3
H4H005	33	285	245	213	213	264	5	3	2	1	4
H4H007	28	208	224	143	138	183	4	5	2	1	3
H4H009	25	128	55	111	80	107	5	1	4	2	3
H4H012	24	114	140	88	65	113	4	5	2	1	3
H4H013	22	227	317	207	170	233	3	5	2	1	4
H4H015	35	237	182	228	202	217	5	1	4	2	3
H6H007	29	175	218	167	199	194	2	5	1	4	3
H6H009	55	748	837	694	482	704	4	5	2	1	3
H6H010	50	372	477	255	160	288	4	5	2	1	3

Station	*N*	Score					Rank				
		LN	LP3	GEV	IPZA	GPA	LN	LP3	GEV	IPZA	GPA
H7H004	65	588	494	405	408	394	5	4	2	3	1
H7H005	59	143	85	213	338	273	2	1	3	5	4
H8H001	52	560	578	521	296	543	4	5	2	1	3
H9H002	55	539	566	396	340	433	4	5	2	1	3
H9H005	50	609	538	557	520	527	5	3	4	1	2
J1H004	33	303	221	284	259	261	5	1	4	2	3
J1H015	45	86	55	-34	-44	81	5	3	2	1	4
J1H016	45	329	240	226	231	180	5	4	2	3	1
J1R001	35	414	503	471	272	427	2	5	4	1	3
J1R004	38	496	544	386	385	429	4	5	2	1	3
J2H007	64	488	267	199	223	144	5	4	2	3	1
J2R001	84	772	751	622	139	594	5	4	3	1	2
J2R002	54	790	628	620	627	658	5	3	1	2	4
J2R003	82	819	806	612	337	638	5	4	2	1	3
J2R004	51	599	490	439	398	487	5	4	2	1	3
J2R006	73	1 282	837	993	1 009	1 017	5	1	2	3	4
J3H005	22	241	226	190	213	232	5	3	1	2	4
J3H012	30	365	270	313	313	284	5	1	3	4	2
J3H014	28	145	93	143	74	126	5	2	4	1	3
J3H015	53	379	385	308	236	307	4	5	3	1	2
J3H020	44	419	477	343	267	372	4	5	2	1	3
J3R001	101	1 624	2 013	1 445	1 216	1 412	4	5	3	1	2
J3R002	90	1 503	920	1 254	1 090	1 233	5	1	4	2	3
J4H002	46	847	636	680	671	664	5	1	4	3	2
J4H004	31	315	374	244	230	276	4	5	2	1	3
K1H002	61	283	1 363	205	183	89	4	5	3	2	1
K1H018	37	566	432	196	203	153	5	4	2	3	1
K3H002	58	19	-138	-125	-119	1	5	1	2	3	4
K3H004	58	489	514	431	359	486	4	5	2	1	3
K4H001	34	364	343	287	296	305	5	4	1	2	3
K4H003	57	634	669	487	384	523	4	5	2	1	3
K6H001	58	730	790	599	463	652	4	5	2	1	3
K8H001	58	372	334	332	360	295	5	3	2	4	1
K8H002	58	630	450	526	253	564	5	2	3	1	4
K8H005	24	248	257	217	190	250	3	5	2	1	4
L1H001	30	324	416	389	305	378	2	5	4	1	3
L2H003	38	452	254	318	365	382	5	1	2	3	4
L6H001	66	892	766	706	721	675	5	4	2	3	1
L8H001	54	576	566	471	419	441	5	4	3	1	2
L8H002	49	549	328	423	423	415	5	1	3	4	2
L8H005	29	381	424	346	282	380	4	5	2	1	3
N1R001	99	1 620	1 604	1 371	1 048	1 287	5	4	3	1	2
N2H002	68	957	566	828	755	858	5	1	3	2	4
N2H005	20	265	381	316	228	312	2	5	4	1	3
N2H008	36	219	218	195	34	217	5	4	2	1	3
N2R001	90	1 393	1 583	1 300	1 109	1 286	4	5	3	1	2
N3H001	20	263	300	255	221	284	3	5	2	1	4
P3H001	35	470	543	382	350	416	4	5	2	1	3
P4H001	49	726	713	588	552	602	5	4	2	1	3
Q1H012	42	315	245	227	296	316	4	2	1	3	5
Q3H005	42	487	564	444	291	456	4	5	2	1	3
Q4H003	28	228	233	202	103	235	3	4	2	1	5
Q4R002	57	561	570	449	200	474	4	5	2	1	3
Q6H003	38	374	181	324	309	309	5	1	4	2	3
Q8H004	31	377	199	335	313	359	5	1	3	2	4
Q8H008	39	485	425	423	394	435	5	3	2	1	4

Station	*N*	Score					Rank				
		LN	LP3	GEV	IPZA	GPA	LN	LP3	GEV	IPZA	GPA
Q8H010	32	293	341	254	184	279	4	5	2	1	3
Q8R001	31	339	378	321	226	351	3	5	2	1	4
Q9H002	84	1 288	1 445	1 105	841	1 119	4	5	2	1	3
Q9H008	49	483	361	449	357	415	5	2	4	1	3
Q9H014	22	169	121	160	153	140	5	1	4	3	2
Q9H029	27	278	297	242	204	277	4	5	2	1	3
Q9H030	37	309	226	234	221	273	5	2	3	1	4
Q9R001	25	244	148	185	208	246	4	1	2	3	5
R1H013	37	573	563	464	473	506	5	4	1	2	3
R2H005	59	819	539	658	629	693	5	1	3	2	4
R2H012	38	352	284	244	270	254	5	4	1	3	2
R2H015	31	303	217	253	250	276	5	1	3	2	4
S3H003	30	225	60	160	172	168	5	1	2	4	3
S3H004	55	569	497	474	273	526	5	3	2	1	4
S3H006	54	539	278	456	406	426	5	1	4	2	3
S6H001	72	625	148	456	428	419	5	1	4	3	2
T1H001	34	485	431	407	406	356	5	4	3	2	1
T1H004	25	331	222	288	300	313	5	1	2	3	4
T3H005	61	737	442	592	363	664	5	2	3	1	4
T3H006	64	763	621	689	476	652	5	2	4	1	3
T3H007	43	616	590	519	536	527	5	4	1	3	2
T3H009	55	509	419	462	218	426	5	2	4	1	3
T4H001	68	873	1 102	900	741	837	3	5	4	1	2
T5H001	49	643	840	726	683	693	1	5	4	2	3
T5H003	60	542	302	383	380	416	5	1	3	2	4
T5H004	70	694	753	645	514	662	4	5	2	1	3
T5H005	54	585	618	518	370	563	4	5	2	1	3
T5H007	41	443	462	349	329	442	4	5	2	1	3
T5H012	49	613	540	505	510	457	5	4	2	3	1
U1H005	59	753	913	874	713	787	2	5	4	1	3
U2H002	36	340	229	298	270	347	4	1	3	2	5
U2H006	65	756	1 373	961	661	743	3	5	4	1	2
U2H007	65	691	817	806	312	638	3	5	4	1	2
U2H011	60	738	930	758	363	667	3	5	4	1	2
U2H012	59	716	327	557	500	603	5	1	3	2	4
U2H013	59	632	538	513	444	543	5	3	2	1	4
U2H055	29	328	313	290	288	303	5	4	2	1	3
U6H003	20	243	249	204	207	226	4	5	1	2	3
U7H001	70	416	1 041	544	430	458	1	5	4	2	3
U7H004	20	-55	-81	-81	-80	-95	5	3	2	4	1
U7H008	33	274	457	386	258	324	2	5	4	1	3
U8H001	30	445	432	376	372	414	5	4	2	1	3
U8H003	27	379	249	321	331	323	5	1	2	4	3
V1H001	74	1 104	929	995	972	757	5	2	4	3	1
V1H009	65	605	377	558	197	493	5	2	4	1	3
V1H010	58	605	620	545	563	594	4	5	1	2	3
V1H029	25	203	285	253	152	232	2	5	4	1	3
V1H030	26	289	178	260	232	279	5	1	3	2	4
V1H032	20	197	197	211	157	169	4	3	5	1	2
V1H038	47	513	600	513	530	567	1	5	2	3	4
V1R001	72	835	807	762	631	765	5	4	2	1	3
V1R002	68	679	778	664	743	720	2	5	1	4	3
V1R003	28	369	343	325	296	378	4	3	2	1	5
V2H001	28	311	385	332	285	347	2	5	3	1	4
V2H002	70	721	1 034	852	613	686	3	5	4	1	2
V2H004	58	733	902	807	597	718	3	5	4	1	2

Station	*N*	Score					Rank				
		LN	LP3	GEV	IPZA	GPA	LN	LP3	GEV	IPZA	GPA
V2H005	46	389	572	511	318	425	2	5	4	1	3
V2H007	47	363	351	262	247	315	5	4	2	1	3
V2R001	47	445	647	529	286	442	3	5	4	1	2
V3H007	71	566	318	422	268	458	5	2	3	1	4
V3H010	59	559	529	565	441	473	4	3	5	1	2
V3R001	48	562	508	466	437	507	5	4	2	1	3
V3R003	61	519	486	402	396	510	5	3	2	1	4
V6H003	65	632	365	537	351	529	5	2	4	1	3
V6H004	65	591	652	543	543	585	4	5	1	2	3
V7H012	56	569	561	633	275	558	4	3	5	1	2
V7H016	46	375	466	413	356	415	2	5	3	1	4
V7H017	46	345	469	405	350	363	1	5	4	2	3
V7R001	66	764	737	744	327	737	5	2	4	1	3
W1H004	69	922	777	636	543	646	5	4	2	1	3
W1H005	70	558	240	360	351	301	5	1	4	3	2
W1H015	21	224	164	173	186	178	5	1	2	4	3
W1H017	22	80	-37	48	58	52	5	1	2	4	3
W1R001	47	679	910	735	603	690	2	5	4	1	3
W2H006	54	913	963	901	659	843	4	5	3	1	2
W2H007	30	325	409	368	225	343	2	5	4	1	3
W2H028	31	362	363	306	285	345	4	5	2	1	3
W2R001	41	469	424	393	325	434	5	3	2	1	4
W3R001	45	745	658	615	603	654	5	4	2	1	3
W5H001	65	862	892	828	775	901	3	4	2	1	5
W5H005	69	743	827	783	297	673	3	5	4	1	2
W5H011	55	536	587	485	247	463	4	5	3	1	2
W5H016	30	117	78	94	86	65	5	2	4	3	1
W5H022	51	542	501	474	438	434	5	4	3	2	1
W5H024	42	449	411	341	352	392	5	4	1	2	3
W5R001	43	315	204	301	77	236	5	2	4	1	3
W5R002	57	489	485	388	127	413	5	4	2	1	3
W5R003	57	498	527	452	253	447	4	5	3	1	2
X1H001	113	1 545	1 855	1 618	1 420	1 450	3	5	4	1	2
X1H003	78	1 067	1 053	1 000	483	933	5	4	3	1	2
X1H012	25	230	249	189	177	217	4	5	2	1	3
X1H014	50	750	653	576	603	613	5	4	1	2	3
X1H016	49	664	957	730	468	643	3	5	4	1	2
X1H017	48	488	255	389	285	457	5	1	3	2	4
X1H018	48	522	309	428	377	461	5	1	3	2	4
X1H019	45	625	569	466	501	535	5	4	1	2	3
X1H020	36	322	256	251	233	275	5	3	2	1	4
X1R001	54	528	531	441	346	490	4	5	2	1	3
X1R003	42	433	515	433	405	443	3	5	2	1	4
X1R004	45	578	505	449	457	529	5	3	1	2	4
X2H008	71	707	439	505	495	530	5	1	3	2	4
X2H010	69	679	529	444	479	511	5	4	1	2	3
X2H011	44	413	283	399	345	293	5	1	4	3	2
X2H013	61	510	268	396	302	453	5	1	3	2	4
X2H014	59	284	143	210	-5	188	5	2	4	1	3
X2H016	58	1 027	1 311	995	720	948	4	5	3	1	2
X2H017	40	587	690	610	359	578	3	5	4	1	2
X2H018	27	389	308	320	327	348	5	1	2	3	4
X2H022	58	879	708	651	667	715	5	3	1	2	4
X2H024	55	391	269	309	243	296	5	2	4	1	3
X2H025	27	57	44	52	6	17	5	3	4	1	2
X2H026	27	149	111	72	110	119	5	3	1	2	4

Station	N	Score					Rank				
		LN	LP3	GEV	IPZA	GPA	LN	LP3	GEV	IPZA	GPA
X2H027	27	128	111	100	91	109	5	4	2	1	3
X2H028	27	29	1	-18	-15	24	5	3	1	2	4
X2H031	53	594	573	488	424	504	5	4	2	1	3
X2H032	51	639	736	695	406	623	3	5	4	1	2
X2H035	37	199	123	113	121	117	5	4	1	3	2
X2H047	33	158	144	132	75	114	5	4	3	1	2
X2H072	23	292	418	298	216	310	2	5	3	1	4
X2R001	37	261	340	275	92	260	3	5	4	1	2
X2R002	54	611	582	499	392	497	5	4	3	1	2
X2R003	43	269	250	198	127	268	5	3	2	1	4
X2R004	51	668	627	457	474	518	5	4	1	2	3
X2R005	54	359	307	344	418	290	4	2	3	5	1
X3H001	72	478	592	445	352	431	4	5	3	1	2
X3H002	55	297	490	440	146	302	2	5	4	1	3
X3H006	43	544	625	469	373	490	4	5	2	1	3
X3H011	39	444	425	354	321	397	5	4	2	1	3
X3R001	40	206	298	242	189	219	2	5	4	1	3
X3R002	33	323	265	251	258	277	5	3	1	2	4
X4H004	40	519	428	441	430	417	5	2	4	3	1

Table A.12: Probabilistic and event-based deterministic DFE results in PDR A

Catchment	T (years)	Q_{Pi} (m^3/s)	Q_{Ti} (m^3/s)									
			RM3-ARF (A)	RM3-ARF (P)	SCS	SCS-SA	SUH-ARF (A)	SUH-ARF (P)	LRH-Veld-ARF (A)	LRH-Veld-ARF (P)	LRH-T_C-ARF (A)	LRH-T_C-ARF (P)
A2H006	2	54	186	147	58	114	157	105	221	152	169	116
	5	169	272	231	125	265	264	197	372	287	284	219
	10	280	346	308	188	365	357	287	502	419	383	319
	20	403	438	404	263	509	468	395	655	576	499	439
	50	577	617	589	386	750	644	575	906	841	691	642
	100	714	812	790	498	949	810	750	1 145	1 096	874	836
	200	852	1 065	1 052	630	1 194	1 012	956	1 423	1 398	1 086	1 066
A2H007	2	65	76	25	35	44	67	67	55	8	90	14
	5	124	107	45	75	95	112	112	91	22	149	36
	10	167	132	62	112	144	152	152	124	36	203	60
	20	211	159	82	156	205	202	202	165	57	269	92
	50	268	205	116	227	301	279	279	226	90	369	147
	100	310	248	148	292	390	348	348	284	123	464	201
	200	352	301	185	367	495	434	434	354	165	579	269
A2H012	2	156	551	409	128	213	324	199	337	208	398	245
	5	383	786	644	286	374	543	392	566	408	668	482
	10	583	980	850	433	486	733	582	765	606	904	716
	20	800	1 212	1 100	609	676	955	818	992	851	1 171	1 004
	50	1 100	1 638	1 553	894	1 009	1 298	1 190	1 351	1 241	1 595	1 465
	100	1 334	2 078	2 021	1 154	1 229	1 619	1 547	1 688	1 612	1 993	1 904
	200	1 569	2 636	2 612	1 456	1 552	2 002	1 972	2 088	2 056	2 465	2 427
A2H013	2	80	198	140	87	166	208	140	226	129	249	143
	5	202	295	230	182	312	339	257	370	246	409	272
	10	309	383	315	265	441	451	365	495	357	546	394
	20	424	497	427	360	596	574	485	623	493	688	544
	50	580	737	661	506	845	760	681	828	698	913	770
	100	698	1 005	925	634	1 047	928	859	1 010	884	1 115	975
	200	816	1 355	1 270	778	1 286	1 119	1 061	1 222	1 099	1 348	1 213
A2H023	2	191	505	328	117	162	135	87	151	74	176	87
	5	343	696	503	226	275	223	161	250	150	292	174
	10	449	841	646	321	372	303	233	340	221	396	258
	20	551	995	802	431	501	397	315	444	312	518	364
	50	679	1 224	1 035	603	704	539	454	605	466	705	542

Catchment	T (years)	Q_{Pi} (m³/s)	Q_{Ti} (m³/s)									
			RM3-ARF (A)	RM3-ARF (P)	SCS	SCS-SA	SUH-ARF (A)	SUH-ARF (P)	LRH-Veld-ARF (A)	LRH-Veld-ARF (P)	LRH-T_C-ARF (A)	LRH-T_C-ARF (P)
	100	772	1 421	1 235	756	872	672	586	755	604	879	704
	200	862	1 641	1 456	929	1 075	833	747	936	771	1 090	899
A2H024	2	1	14	14	11	9	15	15	6	6	11	11
	5	2	21	21	21	17	25	25	10	10	19	19
	10	3	27	27	29	25	34	34	13	13	25	25
	20	4	35	35	39	33	43	43	17	17	32	32
	50	6	52	52	54	46	59	59	23	22	43	43
	100	7	71	71	67	57	72	72	28	28	53	53
	200	8	97	97	81	70	87	87	34	34	65	65
A2H027	2	41	92	59	46	85	88	54	103	50	108	52
	5	99	134	95	95	178	148	100	173	100	181	104
	10	158	170	128	140	265	202	146	238	149	248	155
	20	228	215	169	193	368	263	200	308	212	322	221
	50	338	302	250	279	536	364	291	426	314	445	328
	100	433	397	336	356	682	458	380	538	412	562	430
	200	534	519	449	446	855	574	485	675	531	705	554
A2H029	2	11	52	26	22	37	44	21	54	17	54	17
	5	28	79	45	47	84	74	40	91	37	90	37
	10	44	105	65	71	129	100	59	124	57	123	56
	20	61	138	91	100	182	131	81	161	82	160	82
	50	86	210	146	146	268	181	117	223	126	221	125
	100	106	293	211	188	351	227	153	280	167	278	165
	200	126	403	298	238	446	284	196	350	215	348	214
A2H032	2	24	140	83	36	71	119	67	135	56	152	63
	5	56	209	139	81	159	192	122	220	115	248	130
	10	84	272	193	121	240	254	174	291	168	328	190
	20	114	353	265	168	334	325	232	372	234	419	264
	50	156	523	415	243	483	431	326	492	342	555	386
	100	189	713	583	308	621	524	412	599	436	675	492
	200	222	961	804	383	768	631	510	722	543	814	612
A2H038	2	4	25	25	5	5	16	16	9	9	10	10
	5	8	38	38	12	13	27	27	14	14	17	17
	10	12	49	49	18	20	36	36	19	19	22	22
	20	16	63	63	25	29	46	46	24	24	29	29
	50	22	94	94	37	43	61	61	32	32	37	37
	100	27	128	128	48	56	73	73	38	39	45	45
	200	32	173	173	60	70	88	88	46	46	55	55
A2H039	2	7	12	12	6	4	7	7				
	5	14	18	18	12	9	12	12				
	10	19	23	23	17	13	16	16				
	20	24	30	30	22	18	20	20				
	50	31	44	44	31	26	27	27				
	100	36	60	60	39	32	33	33				
	200	42	81	81	48	40	39	39				
A2H040	2	64	211	101	59	66	64	32	57	17	76	22
	5	108	293	163	115	130	106	61	95	36	127	49
	10	136	356	215	163	190	144	90	129	58	172	77
	20	162	424	274	220	256	191	126	170	84	228	112
	50	192	528	364	310	363	265	183	236	129	315	172
	100	214	619	443	390	461	332	238	296	174	395	233
	200	234	724	532	481	567	414	305	369	226	493	302
A2H042	2	77	373	211	88	108	96	57	101	39	129	50
	5	130	517	331	172	200	160	105	167	82	213	104
	10	165	626	431	247	281	217	153	227	125	289	159
	20	198	744	542	333	381	287	210	300	178	382	226
	50	237	922	710	468	535	394	304	410	272	522	346
	100	265	1 077	856	589	675	493	395	513	358	653	456
	200	292	1 253	1 020	727	834	612	504	638	459	813	584
A2H044	2	150	352	251	78	137	138	92	158	91	165	95
	5	280	491	384	158	249	229	170	263	176	274	184
	10	376	601	495	229	351	311	247	357	259	372	270
	20	470	724	622	313	471	406	334	461	364	482	380
	50	591	927	829	445	674	551	481	630	528	657	551
	100	681	1 120	1 026	564	844	688	620	787	683	821	713
	200	769	1 352	1 260	700	1 043	852	784	976	870	1 019	909
A2H045	2	31	162	112	40	84	140	91	154	84	165	90
	5	72	232	176	89	177	230	167	254	163	273	175

Catchment	T (years)	Q_{Pi} (m^3/s)	Q_{Ti} (m^3/s)									
			RM3-ARF (A)	RM3-ARF (P)	SCS	SCS-SA	SUH-ARF (A)	SUH-ARF (P)	LRH-Veld-ARF (A)	LRH-Veld-ARF (P)	LRH-T_C-ARF (A)	LRH-T_C-ARF (P)
	10	109	291	233	135	266	308	240	343	237	368	255
	20	148	362	303	188	375	397	321	437	330	469	354
	50	201	496	434	274	542	531	455	587	474	630	509
	100	243	638	572	351	697	654	581	724	607	777	651
	200	284	819	748	439	870	799	727	886	762	951	818
A2H047	2	37	153	36	38	40	32	32	28		47	
	5	68	208	67	71	77	53	53	46	7	77	12
	10	89	249	94	99	110	71	71	62	13	102	21
	20	110	291	124	130	143	91	91	80	20	132	33
	50	137	351	167	176	198	123	123	107	32	178	54
	100	156	401	202	217	245	151	151	131	43	218	72
	200	174	456	240	262	296	182	182	159	57	264	94
A2H049	2	13	42	26	22	44	93	56	102	46	116	52
	5	27	64	44	53	103	151	103	168	92	191	105
	10	39	83	61	81	160	204	148	226	135	256	153
	20	51	109	83	115	230	264	198	292	189	331	214
	50	68	163	131	170	344	354	282	392	280	444	317
	100	80	224	185	220	442	437	360	485	359	550	407
	200	92	304	257	277	562	535	453	593	452	673	513
A2H050	2	23	147	59	31	39	53	28	54	11	77	17
	5	52	206	99	66	87	87	49	87	27	126	39
	10	78	253	135	98	131	117	71	117	43	170	62
	20	106	306	177	135	182	152	99	153	63	221	91
	50	144	398	248	194	265	206	141	206	96	298	138
	100	174	489	317	246	339	253	181	255	128	368	185
	200	204	599	402	307	426	310	228	312	166	450	240
A2H053	7	20	79	13	27	30	62	62	37		68	
	5	41	118	31	57	66	102	102	60	6	110	12
	10	57	152	49	84	98	134	134	79	13	145	23
	20	73	198	74	114	136	170	170	101	20	186	37
	50	96	292	124	161	193	228	228	134	34	246	62
	100	112	397	182	202	244	275	275	162	46	297	85
	200	129	534	258	248	303	329	329	194	60	356	111
A2H054	2	21	51	15	13	18	20	7	16	2	18	2
	5	42	70	26	26	37	33	14	27	5	30	6
	10	58	85	36	38	54	45	20	37	9	41	10
	20	74	101	47	51	74	59	28	49	14	54	16
	50	96	125	64	73	108	81	41	67	23	75	25
	100	113	146	78	92	138	102	54	85	31	94	35
	200	129	170	95	115	172	127	69	105	41	117	46
A2H056	2	16	92	30	16	24	35	35	30	5	43	6
	5	31	128	52	35	52	59	59	51	12	72	17
	10	42	155	71	53	79	80	80	69	20	98	28
	20	53	184	93	73	112	106	106	92	30	129	43
	50	69	228	125	107	165	145	145	125	48	177	68
	100	80	265	153	138	214	183	183	158	65	223	92
	200	92	308	184	174	272	228	228	197	87	278	123
A2H058	2	2	42	22	6	12	35	16	46	15	39	13
	5	6	62	36	17	35	58	29	76	32	65	27
	10	9	79	49	27	60	78	41	101	48	87	42
	20	12	100	67	41	93	101	57	131	69	113	59
	50	18	142	100	64	145	137	82	178	102	153	88
	100	22	188	137	86	196	170	106	221	134	191	115
	200	26	248	185	111	259	209	134	273	170	235	147
A2H061	2	63	218	149	54	111	134	75	155	83	128	69
	5	136	311	234	116	229	224	141	259	164	215	136
	10	197	389	309	173	341	303	203	350	243	291	202
	20	259	482	400	242	474	396	280	457	341	380	283
	50	344	649	564	355	692	547	407	631	504	524	419
	100	408	822	732	458	891	686	531	795	659	660	547
	200	471	1 041	944	578	1 128	854	683	997	849	828	705
A2H077	2	151	220	174	73	175	158	105	221	152	169	116
	5	316	323	275	151	303	264	197	372	287	284	219
	10	454	414	368	223	411	358	287	502	419	383	319
	20	601	528	487	309	565	468	395	655	576	499	439
	50	806	754	720	446	821	645	576	906	840	691	641
	100	966	1 002	975	571	1 031	811	751	1 145	1 096	874	836

Catchment	T (years)	Q_{Pi} (m³/s)	Q_{Ti} (m³/s)									
			RM3-ARF (A)	RM3-ARF (P)	SCS	SCS-SA	SUH-ARF (A)	SUH-ARF (P)	LRH-Veld-ARF (A)	LRH-Veld-ARF (P)	LRH-T_C-ARF (A)	LRH-T_C-ARF (P)
	200	1 129	1 326	1 310	716	1 286	1 013	957	1 423	1 397	1 086	1 065
A2R001	2	194	870	675	86	166	456	308	464	307	539	357
	5	443	1 231	1 051	225	335	762	597	775	599	902	697
	10	653	1 525	1 376	361	449	1 019	873	1 038	880	1 207	1 023
	20	873	1 869	1 762	527	612	1 315	1 208	1 336	1 219	1 553	1 418
	50	1 172	2 485	2 448	803	973	1 774	1 746	1 805	1 763	2 099	2 050
	100	1 400	3 111	3 142	1 059	1 176	2 200	2 254	2 241	2 276	2 606	2 647
	200	1 625	3 895	4 007	1 359	1 467	2 700	2 858	2 754	2 885	3 203	3 354
A2R003	2	22	238	109	54	74	157	76	127	35	205	57
	5	72	353	193	118	164	252	142	203	77	328	123
	10	122	456	274	175	250	331	203	268	119	432	191
	20	180	589	380	241	342	421	276	341	167	550	270
	50	264	865	600	341	492	554	383	447	246	721	398
	100	332	1 172	846	429	628	664	478	536	320	865	516
	200	402	1 570	1 167	527	774	790	586	639	402	1 031	649
A2R005	2	21	90	26	31	39	60	60	50	6	79	10
	5	48	134	50	66	84	98	98	81	17	128	26
	10	72	174	75	97	125	129	129	107	27	169	43
	20	98	225	108	132	174	166	166	137	42	217	66
	50	136	333	176	186	249	220	220	180	65	286	102
	100	167	453	253	234	316	266	266	219	86	347	136
	200	199	610	354	287	387	318	318	263	110	417	175
A2R006	2	44	224	164	38	94	190	113	222	135	199	121
	5	142	333	267	92	203	308	209	362	253	325	227
	10	236	431	364	142	307	405	299	477	362	428	325
	20	342	559	491	200	426	514	405	601	491	540	440
	50	493	824	754	293	626	677	568	793	690	712	619
	100	611	1 120	1 050	375	794	820	714	961	866	863	777
	200	732	1 505	1 435	468	993	980	880	1 155	1 069	1 036	959
A2R007	2	23	127	94	40	104	127	80	163	102	152	95
	5	69	190	153	85	216	209	145	268	190	250	177
	10	115	246	209	125	318	278	208	357	272	334	254
	20	166	319	281	171	433	353	283	451	370	421	346
	50	241	471	431	241	606	465	395	596	517	556	483
	100	301	642	600	302	761	566	497	726	650	677	607
	200	364	863	819	371	934	680	614	874	803	816	749
A2R009	2	114	199	134	116	189	147	91	165	87	168	88
	5	254	286	213	226	318	246	171	278	172	283	176
	10	377	360	283	323	442	336	249	379	257	386	261
	20	512	449	370	436	593	440	342	493	364	502	371
	50	707	614	530	615	839	604	500	682	538	695	548
	100	863	788	697	774	1 051	762	652	860	705	876	719
	200	1 025	1 011	912	957	1 292	954	829	1 079	909	1 099	926
A2R011	2	26	110	48	32	46	94	46	83	21	125	31
	5	63	164	85	72	108	154	86	134	46	201	69
	10	96	212	121	108	164	202	123	178	72	267	109
	20	132	276	170	150	230	259	168	228	104	343	156
	50	183	408	271	215	334	348	235	303	155	455	233
	100	222	557	384	273	426	423	296	368	204	553	306
	200	261	751	534	339	534	507	367	443	260	665	390
A2R012	2	59	337	309	46	168	423	298	429	374	261	227
	5	146	508	498	129	366	697	575	707	686	430	417
	10	223	663	677	210	462	927	834	944	973	574	592
	20	305	867	913	311	620	1 195	1 152	1 218	1 324	741	805
	50	418	1 297	1 410	479	1 011	1 616	1 670	1 642	1 872	999	1 139
	100	504	1 783	1 972	634	1 146	1 990	2 141	2 025	2 385	1 232	1 451
	200	591	2 423	2 715	817	1 471	2 434	2 701	2 479	2 981	1 508	1 814
A2R014	2	140	467	412	166	423	450	266	462	378	333	273
	5	368	698	664	371	666	736	534	754	697	545	504
	10	577	905	901	554	841	967	784	992	983	717	710
	20	806	1 174	1 210	766	1 130	1 230	1 078	1 262	1 322	912	955
	50	1 126	1 737	1 854	1 098	1 637	1 633	1 555	1 675	1 856	1 210	1 341
	100	1 377	2 365	2 576	1 390	1 905	1 985	1 979	2 034	2 330	1 469	1 683
	200	1 630	3 184	3 519	1 719	2 346	2 383	2 462	2 446	2 879	1 767	2 080
A2R015	2	135	575	501	114	282	482	329	485	388	409	327
	5	379	837	788	276	517	794	630	800	726	674	612
	10	602	1 063	1 048	429	680	1 057	914	1 063	1 040	896	876

Catchment	T (years)	Q_{Pi} (m^3/s)	Q_{Ti} (m^3/s)									
			RM3-ARF (A)	RM3-ARF (P)	SCS	SCS-SA	SUH-ARF (A)	SUH-ARF (P)	LRH-Veld-ARF (A)	LRH-Veld-ARF (P)	LRH-T_C-ARF (A)	LRH-T_C-ARF (P)
	20	844	1 344	1 375	612	910	1 361	1 255	1 365	1 416	1 151	1 193
	50	1 180	1 901	2 016	909	1 396	1 827	1 806	1 837	2 017	1 548	1 700
	100	1 439	2 505	2 712	1 179	1 681	2 247	2 318	2 264	2 576	1 908	2 171
	200	1 697	3 286	3 613	1 492	2 052	2 744	2 923	2 768	3 233	2 332	2 725
A3R001	2	41	177	135	52	136	190	124	234	153	227	149
	5	137	265	220	118	294	314	231	389	287	377	278
	10	236	343	299	177	440	418	331	515	410	500	398
	20	353	444	401	243	617	526	444	646	552	627	536
	50	531	651	612	344	871	686	614	845	765	821	743
	100	680	881	845	431	1 088	826	766	1 018	953	988	925
	200	837	1 176	1 147	527	1 332	982	936	1 212	1 164	1 177	1 130
A3R002	2	17	64	49	31	90	198	118	209	136	184	120
	5	52	96	79	74	198	322	220	344	256	303	225
	10	86	123	107	112	291	423	312	454	362	400	319
	20	123	159	144	155	396	534	419	567	486	500	428
	50	178	231	218	220	564	691	573	733	665	646	586
	100	221	311	299	274	704	820	704	873	818	769	721
	200	266	413	403	334	853	961	850	1 026	987	904	870
A3R003	2	26	111	90	16	59	225	151	286	206	228	164
	5	74	167	146	49	160	372	283	475	384	379	306
	10	120	216	197	81	248	488	399	624	542	497	432
	20	171	278	264	119	463	616	529	783	719	624	573
	50	244	405	398	178	678	796	724	1 013	985	807	785
	100	301	545	546	229	664	948	891	1 208	1 213	963	966
	200	359	724	736	286	824	1 112	1 075	1 423	1 463	1 134	1 166
A3R004	2	123	411	373	167	549	587	385	576	492	396	338
	5	327	622	608	384	940	979	775	961	927	661	637
	10	513	806	823	571	1 124	1 279	1 123	1 258	1 302	865	895
	20	713	1 040	1 100	780	1 494	1 608	1 526	1 583	1 731	1 088	1 190
	50	993	1 520	1 664	1 092	2 095	2 096	2 148	2 058	2 380	1 415	1 637
	100	1 209	2 046	2 286	1 355	2 406	2 500	2 679	2 459	2 941	1 691	2 022
	200	1 426	2 720	3 083	1 640	2 890	2 946	3 265	2 902	3 566	1 995	2 452
A4H005	2	70	267	234	82	219	277	166	297	241	181	147
	5	247	400	376	197	430	450	330	483	439	294	267
	10	419	519	509	302	588	594	479	638	618	388	376
	20	611	675	684	427	804	758	656	815	834	496	507
	50	885	1 000	1 048	625	1 175	1 020	952	1 096	1 177	667	716
	100	1 099	1 364	1 456	801	1 441	1 239	1 210	1 330	1 471	809	895
	200	1 317	1 839	1 990	1 002	1 781	1 487	1 498	1 595	1 812	970	1 102
A4H007	2	6	116	60	27	55	103	46	118	39	105	35
	5	22	178	106	72	155	175	88	201	87	179	78
	10	39	233	151	115	247	234	112	267	134	238	119
	20	59	290	199	167	363	283	164	316	177	282	157
	50	90	455	333	248	547	374	249	461	281	410	250
	100	116	623	472	320	719	459	316	563	363	501	323
	200	143	842	655	402	904	592	393	680	457	605	406
A4R001	2	85	337	301	16	65	339	224	376	315	223	187
	5	264	508	486	66	240	557	432	619	576	367	341
	10	433	661	658	119	376	740	624	823	817	488	484
	20	619	860	884	186	563	950	860	1 059	1 109	628	657
	50	880	1 276	1 354	300	904	1 265	1 236	1 406	1 542	833	914
	100	1 083	1 741	1 880	407	1 153	1 540	1 563	1 711	1 937	1 014	1 148
	200	1 287	2 346	2 569	532	1 503	1 856	1 943	2 065	2 392	1 223	1 417
A5H004	2	32	127	90	23	63	115	64	142	82	102	59
	5	91	190	148	57	161	190	116	231	156	166	112
	10	145	247	203	90	256	248	164	303	222	218	160
	20	204	321	274	128	375	314	222	387	300	278	216
	50	286	476	423	189	555	419	313	512	426	368	306
	100	349	650	591	244	726	508	394	624	537	449	386
	200	411	876	811	307	920	610	488	753	665	541	477
A5R001	2	73	164	137	52	190	249	160	289	219	182	137
	5	204	247	223	129	420	410	301	476	404	299	254
	10	323	322	303	201	641	542	430	633	573	397	360
	20	454	420	408	286	907	696	590	813	778	510	489
	50	636	623	628	422	1 332	932	834	1 081	1 095	679	688
	100	777	850	873	543	1 704	1 132	1 054	1 317	1 374	827	863
	200	919	1 147	1 195	682	2 148	1 363	1 308	1 590	1 700	999	1 068

Catchment	T (years)	Q_{Pi} (m^3/s)	Q_{Ti} (m^3/s)									
			RM3-ARF (A)	RM3-ARF (P)	SCS	SCS-SA	SUH-ARF (A)	SUH-ARF (P)	LRH-Veld-ARF (A)	LRH-Veld-ARF (P)	LRH-T_C-ARF (A)	LRH-T_C-ARF (P)
A5R002	2	76	182	161	56	256	304	196	328	271	195	161
	5	172	278	263	145	574	509	383	550	504	327	300
	10	268	364	358	228	820	683	561	739	721	439	428
	20	384	475	483	327	1 161	885	779	960	985	570	585
	50	567	707	742	485	1 715	1 182	1 125	1 278	1 378	759	818
	100	725	967	1 033	626	2 154	1 442	1 429	1 561	1 736	927	1 031
	200	897	1 306	1 414	786	2 686	1 745	1 781	1 889	2 147	1 122	1 276
A6H010	2	7	11	4	5	6	6	3	5		4	
	5	16	17	8	11	16	10	6	9	3	7	2
	10	24	22	11	17	24	14	9	11	4	9	3
	20	32	28	16	25	35	18	12	15	6	12	5
	50	43	42	25	37	53	24	17	20	9	16	7
	100	51	57	36	47	68	29	22	24	11	20	9
	200	59	77	50	59	87	34	27	30	14	24	12
A6H011	2	13	47	6	14	17	50	50	29		32	
	5	34	70	15	32	39	83	83	49	4	54	4
	10	54	91	25	49	61	109	109	64	8	71	8
	20	77	119	39	68	85	139	139	82	13	90	14
	50	111	176	67	98	125	184	184	108	23	119	25
	100	140	240	99	125	160	223	223	131	32	145	35
	200	170	324	142	155	202	269	269	159	43	175	47
A6H012	2	14	84	21	6	9	47	47	47	5	48	5
	5	29	125	43	19	32	78	78	77	13	80	14
	10	42	163	65	33	55	104	104	101	22	105	23
	20	55	212	95	49	85	132	132	128	35	133	36
	50	72	314	157	77	136	174	174	170	57	176	59
	100	86	428	227	102	184	212	212	207	76	215	79
	200	99	577	319	132	237	255	255	249	98	258	102
A6H018	2	1	18	18	2	2	18	18				
	5	4	26	26	7	6	30	30				
	10	7	34	34	12	11	40	40				
	20	10	45	45	18	16	51	51				
	50	14	66	66	27	26	68	68				
	100	17	90	90	36	35	82	82				
	200	21	121	121	46	45	99	99				
A6H020	2	2	41	4	2	3	29	9	21		23	
	5	11	62	11	7	12	49	18	35	2	37	2
	10	19	80	20	12	22	64	26	47	5	50	5
	20	29	104	31	18	35	81	36	59	8	63	9
	50	43	154	54	30	57	108	51	78	14	83	15
	100	54	210	80	40	78	131	65	95	21	101	22
	200	65	283	115	52	104	158	80	115	28	121	29
A6H021	2	5	85	85	2	1	105	105	56	55	71	71
	5	12	127	127	6	5	172	172	90	90	116	115
	10	17	166	166	10	8	228	228	120	120	153	153
	20	23	215	215	15	11	291	291	153	153	196	195
	50	31	319	319	23	18	390	390	202	202	258	258
	100	37	435	435	30	23	443	443	229	228	292	292
	200	43	586	586	38	30	498	498	257	257	328	328
A6H022	2	1	5	5	1	1	3	3				
	5	1	8	8	3	3	6	6				
	10	1	10	10	4	4	8	8				
	20	2	13	13	6	6	10	10				
	50	2	20	20	9	9	13	13				
	100	3	27	27	12	12	16	16				
	200	3	37	37	15	16	19	19				
A6H024	2	1	17	17	1	2	17	17	10	10	13	13
	5	3	26	26	5	8	29	29	17	17	21	21
	10	6	33	33	9	14	39	39	23	23	28	28
	20	9	43	43	14	23	50	50	30	30	36	36
	50	13	64	64	22	38	66	66	39	39	47	47
	100	17	88	88	29	52	80	80	47	47	57	57
	200	21	118	118	38	69	96	96	57	57	69	69
	2	27	137	99	17	39	105	57	132	78	91	54
	5	59	206	162	44	99	173	105	216	149	149	103
	10	84	267	221	70	153	226	148	283	211	195	145
	20	111	347	299	100	219	287	199	361	284	249	196

Catchment	T (years)	Q_{Pi} (m³/s)	Q_{Ti} (m³/s)									
			RM3-ARF (A)	RM3-ARF (P)	SCS	SCS-SA	SUH-ARF (A)	SUH-ARF (P)	LRH-Veld-ARF (A)	LRH-Veld-ARF (P)	LRH-T_C-ARF (A)	LRH-T_C-ARF (P)
A6R001	50	147	514	461	149	332	382	282	478	402	330	278
	100	175	701	642	194	430	463	355	582	506	402	349
	200	202	946	880	245	536	557	439	703	626	485	432
A6R002	2	92	316	310	16	80	352	324	534	517	289	280
	5	205	476	495	70	324	586	588	870	923	470	499
	10	300	620	667	131	490	769	829	1 154	1 293	624	699
	20	400	807	892	208	725	981	1 119	1 470	1 727	795	934
	50	537	1 198	1 360	340	1 224	1 307	1 571	1 972	2 429	1 067	1 314
	100	642	1 634	1 885	464	1 503	1 596	1 986	2 418	3 024	1 308	1 635
	200	747	2 204	2 572	611	1 958	1 930	2 464	2 902	3 674	1 570	1 987
A7H001	2	63	283	273	20	98	372	282	407	384	261	246
	5	149	433	444	82	340	636	561	694	722	445	463
	10	226	566	603	147	522	843	816	920	1 016	590	652
	20	310	738	811	229	748	1 076	1 113	1 177	1 369	755	878
	50	430	1 096	1 243	366	1 198	1 442	1 602	1 577	1 919	1 011	1 231
	100	524	1 494	1 727	492	1 525	1 755	2 028	1 914	2 411	1 228	1 547
	200	622	2 011	2 360	638	1 921	2 104	2 521	2 298	2 982	1 475	1 913
A7H003	2	62	265	250	11	56	351	250	366	334	244	223
	5	134	404	408	56	242	592	499	619	626	413	418
	10	205	529	554	105	372	790	730	821	886	548	591
	20	290	690	746	168	573	1 007	999	1 050	1 194	701	797
	50	423	1 024	1 144	274	907	1 350	1 444	1 411	1 682	942	1 123
	100	538	1 396	1 591	373	1 155	1 646	1 831	1 716	2 110	1 145	1 408
	200	662	1 880	2 176	490	1 485	1 975	2 276	2 059	2 606	1 374	1 739
A8R002	2	24	160	30	28	41	92	92	74	5	95	6
	5	59	249	68	71	111	160	160	126	15	163	20
	10	91	326	108	110	178	213	213	170	28	219	37
	20	127	426	162	154	254	272	272	217	47	281	61
	50	179	631	277	220	374	361	361	288	79	371	102
	100	220	858	410	278	477	437	437	350	109	452	140
	200	262	1 151	588	341	590	522	522	419	143	542	185
A8R003	2	18	154	154	19	23	67	67	57	57	79	79
	5	46	239	239	52	69	117	117	99	99	138	138
	10	72	314	314	82	114	156	156	132	132	184	184
	20	100	410	410	117	168	200	200	169	170	235	236
	50	141	607	607	170	249	265	265	224	225	312	312
	100	173	825	825	216	324	321	321	271	272	377	378
	200	206	1 106	1 106	267	404	383	383	325	325	451	452
A8R004	2	26	110	8	18	19	48	48	44		88	
	5	58	172	28	50	59	81	81	75	4	151	8
	10	88	225	50	81	99	109	109	101	9	203	18
	20	123	294	81	116	146	140	140	129	16	258	33
	50	177	436	146	171	222	187	187	171	30	344	61
	100	222	592	222	219	289	227	227	209	44	419	89
	200	271	794	326	273	361	272	272	249	60	501	121
A9H004	2	60	225	103	68	106	94	53	113	32	161	45
	5	200	350	187	160	267	163	102	195	72	276	102
	10	334	460	268	240	412	218	147	261	111	370	158
	20	481	600	376	330	572	278	200	334	159	474	226
	50	684	889	601	465	818	373	286	447	238	634	338
	100	842	1 209	857	580	1 033	452	363	543	311	770	441
	200	998	1 622	1 194	706	1 261	542	429	650	396	923	562
A9H012	2	125	300	264	45	217	295	190	372	305	242	199
	5	260	466	436	127	602	515	375	651	587	424	382
	10	371	612	594	203	951	688	550	871	830	567	541
	20	488	799	799	292	1 372	884	754	1 120	1 121	730	730
	50	648	1 183	1 224	430	2 002	1 180	1 086	1 496	1 581	975	1 030
	100	772	1 609	1 700	551	2 552	1 438	1 386	1 823	1 957	1 188	1 275
	200	896	2 158	2 319	685	3 183	1 670	1 673	2 071	2 225	1 349	1 450
A9R001	2	27	198	113	34	66	140	69	154	61	140	56
	5	122	308	197	89	182	243	131	264	131	241	119
	10	222	405	278	140	296	324	189	357	197	325	179
	20	338	529	384	199	425	417	258	455	275	414	250
	50	512	784	606	290	631	553	369	606	404	552	368
	100	654	1 067	857	370	809	671	470	740	520	673	473
	200	801	1 433	1 188	457	1 009	804	584	886	654	806	595
	2	27	80	80	28	29	36	36	31	31	61	61

Catchment	T (years)	Q_{Pi} (m^3/s)	Q_{Ti} (m^3/s)									
			RM3-ARF (A)	RM3-ARF (P)	SCS	SCS-SA	SUH-ARF (A)	SUH-ARF (P)	LRH-Veld-ARF (A)	LRH-Veld-ARF (P)	LRH-T_C-ARF (A)	LRH-T_C-ARF (P)
A9R002	5	74	124	124	64	71	63	63	53	53	106	106
	10	118	163	163	95	109	84	84	70	70	142	141
	20	166	212	212	130	153	109	109	90	90	181	181
	50	232	315	315	182	218	145	145	120	120	242	242
	100	283	428	428	227	273	174	174	146	146	294	294
	200	335	574	574	275	334	207	207	175	175	352	352
A9R004	2	55	258	211	35	136	243	159	310	228	220	162
	5	246	401	351	100	401	421	308	538	434	382	308
	10	447	527	481	161	646	563	445	720	622	512	442
	20	683	688	650	232	946	723	609	926	843	658	599
	50	1 035	1 019	999	343	1 397	966	871	1 237	1 197	879	851
	100	1 323	1 386	1 391	441	1 794	1 174	1 108	1 506	1 515	1 070	1 076
	200	1 623	1 860	1 903	549	2 237	1 409	1 296	1 748	1 788	1 242	1 270

Table A.13: Probabilistic and event-based deterministic DFE results in PDR B

Catchment	T (years)	Q_{Pi} (m^3/s)	Q_{Ti} (m^3/s)									
			RM3-ARF (A)	RM3-ARF (P)	SCS	SCS-SA	SUH-ARF (A)	SUH-ARF (P)	LRH-Veld-ARF (A)	LRH-Veld-ARF (P)	LRH-T_C-ARF (A)	LRH-T_C-ARF (P)
B1H002	2	17	65	38	19	34	59	33	70	29	73	30
	5	55	96	62	40	69	93	58	112	55	116	57
	10	93	124	85	59	99	122	81	147	80	152	83
	20	138	160	116	80	134	155	109	188	110	194	114
	50	205	235	180	112	190	204	150	245	160	254	166
	100	260	319	253	141	240	245	189	296	206	306	214
	200	317	429	350	173	295	293	234	354	257	367	266
B1H004	2	13	104	65	7	14	76	44	86	39	90	41
	5	25	150	103	21	37	123	77	138	76	144	80
	10	35	190	139	34	58	161	109	182	110	191	115
	20	45	240	184	50	86	205	148	233	151	244	158
	50	58	338	274	77	133	276	207	309	221	323	231
	100	68	446	373	102	173	336	262	375	283	393	297
	200	79	584	502	130	222	404	326	453	355	474	372
B1H005	2	121	358	302	69	131	330	227	325	247	291	222
	5	332	525	476	160	228	531	417	524	446	470	400
	10	524	675	640	242	301	693	591	682	625	612	561
	20	732	871	856	340	390	871	798	862	840	773	753
	50	1 020	1 278	1 306	493	578	1 136	1 117	1 123	1 162	1 007	1 042
	100	1 242	1 730	1 813	629	680	1 372	1 410	1 352	1 459	1 213	1 308
	200	1 465	2 318	2 479	783	835	1 639	1 749	1 617	1 802	1 450	1 616
B1H012	2	38	187	156	37	79	201	152	286	215	226	170
	5	84	273	244	80	118	321	269	457	379	361	300
	10	123	351	326	118	151	416	374	593	528	468	418
	20	165	452	434	162	198	520	490	741	695	586	550
	50	223	662	659	230	288	681	680	970	964	767	762
	100	269	896	912	289	333	823	851	1 173	1 207	927	954
	200	316	1 200	1 244	356	406	986	1 052	1 406	1 491	1 111	1 179
B1H017	2	71	122	73	41	65	95	55	104	45	111	47
	5	126	180	119	83	123	151	97	164	86	175	92
	10	164	231	163	118	177	198	136	216	123	230	131
	20	200	298	222	158	238	251	179	273	168	290	179
	50	245	437	345	219	329	326	248	354	245	377	261
	100	278	591	483	272	406	392	311	427	311	454	331
	200	309	792	667	330	496	468	384	510	387	543	411
	2	65	191	141	26	58	170	104	198	123	185	116
	5	150	278	223	60	106	267	184	312	219	293	205
	10	224	356	300	91	143	349	258	408	307	383	288
	20	303	457	401	127	192	439	349	508	415	476	389

Catchment	***T* (years)**	**Q_{Pi} (m³/s)**	**Q_{Ti} (m³/s)**									
			RM3-ARF (A)	**RM3-ARF (P)**	**SCS**	**SCS-SA**	**SUH-ARF (A)**	**SUH-ARF (P)**	**LRH-Veld-ARF (A)**	**LRH-Veld-ARF (P)**	**LRH-T_C-ARF (A)**	**LRH-T_C-ARF (P)**
B1H018	50	411	668	612	183	282	567	482	658	573	617	538
	100	494	901	849	232	344	678	603	789	717	740	673
	200	577	1 203	1 159	288	419	804	742	937	882	879	828
B1H019	2	13	46	19	4	5	27	12	31	7	35	8
	5	23	65	32	10	15	44	22	49	15	56	17
	10	31	82	44	15	25	57	31	64	23	73	26
	20	38	102	59	22	36	73	41	82	34	92	38
	50	47	141	88	33	55	97	58	109	50	123	56
	100	54	183	119	43	72	116	73	131	65	148	74
	200	60	236	160	55	93	139	91	156	84	176	95
B1R001	2	151	310	279	105	234	316	214	352	296	269	227
	5	406	456	436	219	317	508	381	565	527	432	403
	10	640	586	582	317	366	662	546	738	730	564	558
	20	895	756	775	430	463	836	743	924	962	707	736
	50	1 252	1 109	1 177	604	673	1 090	1 046	1 210	1 331	926	1 019
	100	1 530	1 503	1 629	754	755	1 314	1 324	1 464	1 665	1 120	1 274
	200	1 810	2 014	2 221	923	907	1 572	1 647	1 747	2 052	1 337	1 570
B1R002	2	55	154	131	31	84	193	128	213	163	166	127
	5	114	226	204	70	138	306	227	338	285	263	222
	10	162	290	272	105	178	398	317	442	396	345	309
	20	211	374	362	146	237	506	426	556	528	433	412
	50	277	548	549	210	342	656	589	722	724	563	565
	100	326	742	760	267	404	788	739	870	904	678	705
	200	375	993	1 036	331	502	939	912	1 037	1 111	809	866
B2H007	2	23	30	18	19	36	82	47	89	39	100	44
	5	47	46	31	44	80	135	86	148	80	166	89
	10	66	60	44	68	123	184	125	202	119	226	133
	20	87	80	60	97	176	241	173	264	168	295	188
	50	114	121	96	146	269	329	250	362	253	404	283
	100	134	168	137	192	350	413	324	454	330	508	369
	200	155	230	193	245	449	515	415	566	423	633	474
B2R001	2	80	124	97	36	79	210	139	231	156	228	154
	5	229	188	159	88	157	348	260	384	292	380	289
	10	370	246	218	139	217	472	380	523	428	517	423
	20	527	324	298	200	298	614	526	674	592	666	585
	50	751	490	468	303	467	838	761	922	856	912	847
	100	930	678	662	398	574	1 047	985	1 156	1 110	1 144	1 098
	200	1 113	930	922	511	733	1 301	1 260	1 439	1 419	1 423	1 403
B3H007	2	58	141	108	26	61	129	72	163	105	115	74
	5	110	208	172	61	123	207	131	260	191	183	134
	10	150	268	232	93	172	271	185	336	270	236	190
	20	192	347	312	132	241	339	246	424	359	297	252
	50	250	512	480	194	358	445	347	561	505	394	355
	100	295	697	669	250	451	541	437	678	636	476	447
	200	341	939	920	315	565	651	541	815	788	572	554
B3R001	2	29	162	127	19	60	150	92	208	141	140	95
	5	85	245	208	52	144	252	174	345	267	232	180
	10	137	322	286	86	218	337	250	464	384	312	258
	20	196	425	391	128	319	438	344	606	529	407	356
	50	280	644	614	200	493	603	499	831	769	559	517
	100	346	894	869	267	641	753	646	1 043	996	701	670
	200	414	1 228	1 212	348	836	934	825	1 298	1 272	873	855
B3R002	2	279	689	683	122	339	502	475	687	678	555	547
	5	711	1 018	1 075	290	518	796	830	1 093	1 192	883	963
	10	1 096	1 315	1 442	446	582	1 045	1 141	1 432	1 661	1 157	1 342
	20	1 510	1 704	1 928	633	771	1 321	1 513	1 813	2 200	1 465	1 777
	50	2 081	2 519	2 948	933	1 172	1 753	2 123	2 395	3 087	1 935	2 494
	100	2 520	3 433	4 099	1 203	1 283	2 125	2 690	2 920	3 913	2 359	3 161
	200	2 960	4 629	5 619	1 514	1 548	2 562	3 363	3 538	4 901	2 858	3 959
B3R005	2	54	277	241	37	130	320	201	313	252	194	156
	5	145	417	389	98	273	524	374	512	459	318	285
	10	230	544	530	159	369	698	544	682	653	423	405
	20	323	712	716	233	520	901	757	883	893	548	554
	50	456	1 064	1 108	354	801	1 227	1 119	1 199	1 275	744	791
	100	562	1 461	1 550	467	961	1 504	1 436	1 471	1 614	913	1 002
	200	669	1 985	2 136	598	1 215	1 830	1 804	1 791	2 014	1 111	1 250
	2	20	92	35	16	25	54	26	60	12	80	16

Catchment	T (years)	Q_{Pi} (m³/s)	Q_{Ti} (m³/s)									
			RM3-ARF (A)	RM3-ARF (P)	SCS	SCS-SA	SUH-ARF (A)	SUH-ARF (P)	LRH-Veld-ARF (A)	LRH-Veld-ARF (P)	LRH-T_C-ARF (A)	LRH-T_C-ARF (P)
B4H005	5	39	139	64	40	63	89	20	98	28	131	37
	10	53	182	93	63	101	120	72	132	45	177	59
	20	68	240	133	91	146	158	102	174	67	232	90
	50	87	362	220	138	228	215	148	237	105	317	141
	100	101	502	321	181	300	268	194	295	145	395	193
	200	115	688	460	233	389	332	249	366	194	489	259
B4H007	2	20	138	32	8	12	41	41	42	4	68	6
	5	41	207	65	27	42	66	66	69	10	112	17
	10	59	270	100	46	75	88	88	91	18	147	29
	20	78	353	148	70	116	114	114	117	29	189	47
	50	106	530	252	112	190	154	154	158	49	257	79
	100	129	730	375	152	259	191	191	195	69	317	111
	200	152	996	543	200	345	235	235	239	92	388	149
B4R001	2	7	45	5	4	6	23	23	22		34	
	5	16	66	12	10	15	36	36	34		54	
	10	23	84	21	16	25	47	47	44	4	70	7
	20	32	108	32	23	36	58	58	55	8	88	12
	50	44	158	56	35	54	76	76	73	13	115	21
	100	55	214	83	45	69	92	92	88	19	139	30
	200	65	285	121	56	88	110	110	103	26	164	41
B4R002	2	3	25	25	1	1	13	13				
	5	8	36	36	4	4	20	20				
	10	13	45	45	7	7	26	26				
	20	17	58	58	10	11	32	32				
	50	24	83	83	16	17	41	41				
	100	29	112	112	20	23	49	49				
	200	34	148	148	25	29	58	58				
B4R004	2	33	93	48	5	10	61	34	73	25	84	29
	5	64	137	81	15	31	97	60	115	49	133	56
	10	89	176	112	26	55	127	84	151	73	174	85
	20	114	227	153	39	83	161	113	191	101	221	117
	50	147	334	241	61	131	213	156	251	147	291	170
	100	173	452	339	81	173	255	195	301	191	348	221
	200	198	605	470	103	226	303	239	359	241	415	279
B6H001	2	55	199	134	12	2	90	62	120	64	121	64
	5	113	304	223	43	15	151	115	201	124	203	125
	10	162	402	312	76	31	205	165	273	182	275	184
	20	214	533	432	120	52	270	229	358	257	361	259
	50	287	812	692	197	89	377	339	501	386	504	389
	100	344	1 132	994	272	127	465	439	634	514	638	518
	200	403	1 563	1 407	365	168	568	513	785	670	791	676
B6H002	2	29	93	22	10	13	35	35	36	4	60	6
	5	68	142	46	29	43	58	58	61	10	100	16
	10	103	188	71	49	74	79	79	83	17	136	28
	20	139	249	106	74	116	104	104	108	28	179	46
	50	190	380	182	118	190	145	145	150	47	248	78
	100	229	530	272	159	261	184	184	191	66	315	109
	200	268	732	399	210	349	223	223	239	91	394	150
B6H003	2	86	89	21	49	53	34	34	35	3	57	5
	5	182	136	43	100	113	57	57	58	9	95	14
	10	260	180	66	147	171	78	78	79	16	129	26
	20	340	239	99	202	237	102	102	104	26	169	42
	50	447	364	171	291	346	143	143	145	44	235	72
	100	528	508	257	371	445	182	182	184	62	298	100
	200	607	701	376	465	561	221	221	230	85	373	138
B6H006	2	8	42	42	10	9	24	24	18	18	21	21
	5	19	63	63	22	21	39	39	30	30	35	35
	10	28	81	81	34	33	51	51	39	39	45	45
	20	38	104	104	47	46	65	65	49	49	58	58
	50	52	154	154	68	68	85	85	64	64	75	75
	100	62	209	209	87	88	102	102	77	77	91	91
	200	73	281	281	109	111	122	122	92	92	109	108
B6R001	2	8	101	101	6	5	44	44	26	26	43	43
	5	18	154	154	22	19	74	74	45	45	74	74
	10	27	204	204	40	36	101	101	61	61	102	102
	20	38	271	271	64	58	132	132	80	80	133	133
	50	53	414	414	107	99	185	185	111	111	185	184

Catchment	***T* (years)**	**Q_{Pi} (m³/s)**	**Q_{Ti} (m³/s)**									
			RM3-ARF (A)	**RM3-ARF (P)**	**SCS**	**SCS-SA**	**SUH-ARF (A)**	**SUH-ARF (P)**	**LRH-Veld-ARF (A)**	**LRH-Veld-ARF (P)**	**LRH-T_C-ARF (A)**	**LRH-T_C-ARF (P)**
	100	65	579	579	149	141	233	233	141	140	234	234
	200	77	800	800	202	194	291	291	175	175	292	292
B6R003	2	202	474	363	15	44	237	156	324	212	293	192
	5	418	721	600	68	193	395	296	540	403	488	364
	10	593	948	829	129	368	536	433	734	589	663	532
	20	774	1 248	1 139	210	604	693	604	947	822	855	742
	50	1 019	1 882	1 800	353	1 017	948	885	1 297	1 207	1 172	1 090
	100	1 206	2 605	2 562	494	1 434	1 187	1 160	1 623	1 581	1 466	1 428
	200	1 392	3 564	3 590	665	1 936	1 468	1 491	2 007	2 031	1 813	1 835
B7H003	2	6	122	7	5	6	54	54	57		65	
	5	17	195	28	23	31	98	98	102	4	117	5
	10	30	261	53	41	60	135	135	142	11	163	12
	20	46	348	89	65	100	179	179	187	21	214	24
	50	73	531	168	107	171	248	248	260	42	299	48
	100	98	737	263	146	241	312	312	328	64	376	74
	200	124	1 011	396	192	325	387	387	407	91	466	104
B7H004	2	49	163	29	23	35	61	61	64	4	107	7
	5	128	245	65	59	97	102	102	106	12	179	21
	10	199	319	103	94	162	139	139	144	24	244	40
	20	275	415	155	137	243	183	183	189	40	320	67
	50	380	614	265	211	382	257	257	266	70	448	118
	100	461	838	394	280	515	327	327	337	101	569	170
	200	541	1 136	572	363	675	397	397	425	141	717	238
B7H008	2	65	197	144	14	46	181	103	235	144	173	106
	5	169	314	249	52	183	324	209	424	293	312	216
	10	280	421	350	94	330	450	312	585	439	431	324
	20	421	561	486	146	525	593	439	778	619	574	457
	50	648	854	775	235	866	828	658	1 086	928	801	685
	100	848	1 186	1 106	319	1 190	1 042	866	1 364	1 223	1 006	902
	200	1 066	1 627	1 552	418	1 567	1 294	1 072	1 559	1 487	1 150	1 097
B7H010	2	90	217	74	72	110	125	125	122	21	148	25
	5	320	340	144	170	275	227	227	218	55	264	67
	10	543	447	214	258	422	313	313	303	94	367	114
	20	789	584	307	362	600	415	415	398	146	484	177
	50	1 136	858	498	525	886	574	574	556	234	675	284
	100	1 406	1 161	716	670	1 135	722	722	700	324	850	393
	200	1 678	1 558	1 010	833	1 424	897	897	869	431	1 055	523
B7H014	2	9	125	5	9	9	56	56	58		68	
	5	25	200	26	31	37	101	101	104	4	122	5
	10	42	268	51	54	69	139	139	144	10	169	12
	20	61	358	87	83	111	184	184	190	20	223	23
	50	88	545	167	133	182	256	256	265	40	311	47
	100	111	757	262	179	252	323	323	333	62	391	73
	200	135	1 038	395	233	333	400	400	413	89	485	104
B7H019	2	90	157	138	8	49	288	178	321	262	185	152
	5	203	250	234	42	249	521	369	583	522	337	302
	10	301	336	325	81	471	724	563	809	772	468	446
	20	407	447	447	133	773	956	799	1 071	1 071	619	619
	50	558	681	704	223	1 295	1 336	1 204	1 496	1 578	865	912
	100	678	946	999	309	1 785	1 681	1 592	1 884	2 059	1 089	1 190
	200	800	1 297	1 394	413	2 380	2 086	2 064	2 294	2 464	1 325	1 424
B7R001	2	51	117	44	4	31	63	33	79	16	97	20
	5	127	178	80	16	128	107	62	133	37	164	46
	10	196	236	118	31	240	145	91	180	61	222	75
	20	274	313	171	50	389	191	127	237	91	293	112
	50	384	478	285	84	666	268	191	332	145	410	180
	100	473	668	420	118	951	340	250	421	199	520	246
	200	563	922	606	159	1 289	414	300	511	268	632	331
B7R003	2	12	110	110	6	5	60	60	33	33	52	52
	5	41	175	175	24	23	108	108	59	59	94	94
	10	70	234	234	43	46	150	150	82	82	130	130
	20	104	312	312	67	76	198	198	109	109	172	173
	50	156	476	476	109	130	275	275	150	150	238	239
	100	198	661	661	149	183	347	347	189	189	299	300
	200	242	907	907	196	246	429	429	234	235	372	373
	2	20	218	112	35	64	159	84	186	63	192	65
	5	51	342	201	106	206	283	168	334	144	345	149

Catchment	*T* (years)	Q_{Pi} (m³/s)	Q_{Ti} (m³/s)									
			RM3-ARF (A)	RM3-ARF (P)	SCS	SCS-SA	SUH-ARF (A)	SUH-ARF (P)	LRH-Veld-ARF (A)	LRH-Veld-ARF (P)	LRH-T_C-ARF (A)	LRH-T_C-ARF (P)
B8H010	10	81	451	287	178	356	392	250	461	225	477	233
	20	115	591	401	266	544	518	352	611	331	632	342
	50	167	873	636	411	857	725	525	854	512	884	529
	100	209	1 187	902	544	1 143	910	671	1 076	689	1 113	713
	200	254	1 599	1 258	700	1 479	1 132	821	1 280	905	1 324	937
B8H011	2	22	63	42	28	80	118	55	141	73	95	49
	5	59	100	73	69	207	212	110	253	152	171	103
	10	94	134	103	107	326	295	163	349	229	235	154
	20	135	179	143	152	467	388	231	463	325	313	219
	50	197	272	229	224	689	541	346	648	488	437	329
	100	247	378	327	287	890	681	457	817	645	551	435
	200	301	519	460	360	1 122	845	592	954	835	644	563
B8H014	2	24	148	82	8	19	77	48	107	42	122	48
	5	70	237	147	33	79	140	95	194	91	221	104
	10	113	317	211	60	147	193	141	268	140	305	160
	20	159	423	298	94	236	257	197	356	203	406	232
	50	225	644	482	152	393	359	286	498	312	567	356
	100	277	895	696	207	544	448	351	611	418	697	476
	200	329	1 227	985	273	723	521	410	698	546	796	622
B8H017	2	236	393	329	49	207	393	262	442	333	302	227
	5	456	627	563	154	640	721	542	810	678	553	463
	10	634	840	788	260	1 061	995	814	1 117	1 009	763	689
	20	828	1 120	1 088	392	1 593	1 318	1 153	1 481	1 414	1 011	965
	50	1 105	1 706	1 724	610	2 482	1 842	1 734	2 069	2 105	1 413	1 437
	100	1 328	2 370	2 454	812	3 275	2 325	2 180	2 610	2 757	1 782	1 882
	200	1 562	3 250	3 434	1 047	4 222	2 726	2 603	3 042	3 215	2 077	2 194
B8H018	2	380	698	691	56	351	621	594	979	965	555	547
	5	905	1 112	1 169	213	1 191	1 119	1 180	1 766	1 910	1 001	1 083
	10	1 389	1 489	1 622	380	1 733	1 544	1 742	2 452	2 821	1 390	1 599
	20	1 934	1 981	2 225	593	2 580	2 056	2 451	3 270	3 922	1 853	2 223
	50	2 730	3 012	3 497	952	4 163	2 857	3 590	4 519	5 426	2 561	3 075
	100	3 376	4 180	4 951	1 290	5 233	3 579	4 447	5 383	6 377	3 051	3 614
	200	4 050	5 724	6 896	1 688	6 700	4 354	5 397	6 144	7 401	3 482	4 195
B8H019	2	25	63	42	2	9	121	56	139	72	95	49
	5	82	101	73	12	50	216	111	250	149	171	102
	10	138	135	103	23	99	300	165	345	224	236	153
	20	200	180	144	39	167	395	233	458	318	313	217
	50	289	275	230	65	285	550	351	640	479	437	327
	100	358	382	329	91	404	693	463	807	633	551	432
	200	429	524	463	122	550	860	599	946	820	646	560
B8H034	2	330	642	622	76	416	540	508	900	856	528	502
	5	792	1 024	1 054	263	1 184	962	1 005	1 618	1 694	949	993
	10	1 217	1 370	1 464	455	1 730	1 330	1 479	2 237	2 494	1 312	1 463
	20	1 693	1 822	2 010	697	2 516	1 769	2 071	2 982	3 491	1 750	2 048
	50	2 385	2 770	3 161	1 101	4 021	2 460	2 977	4 124	5 019	2 419	2 944
	100	2 944	3 841	4 477	1 476	5 025	3 069	3 740	5 063	5 901	2 970	3 461
	200	3 525	5 259	6 238	1 916	6 374	3 759	4 628	5 777	6 853	3 389	4 020
B8R001	2	11	95	51	4	7	49	28	71	27	79	30
	5	30	152	92	17	36	88	57	129	58	143	65
	10	46	203	132	33	70	121	83	178	89	198	99
	20	65	271	186	53	118	162	117	237	130	263	144
	50	90	412	301	88	201	225	174	331	198	367	220
	100	109	573	434	122	284	281	214	405	266	449	295
	200	128	786	614	162	382	327	250	462	347	513	385
B8R002	2	21	133	133	28	23	127	127	63	63	106	106
	5	47	213	213	82	74	226	226	114	114	190	191
	10	71	285	285	134	126	314	314	157	158	263	264
	20	98	380	380	198	191	414	414	209	209	348	349
	50	138	578	578	301	300	577	577	289	290	483	484
	100	171	803	803	396	397	726	726	365	365	608	610
	200	205	1 101	1 101	506	514	902	902	452	453	754	757
B8R003	2	24	142	142	21	16	56	56	29	29	81	81
	5	75	227	227	63	51	100	100	53	53	145	145
	10	124	303	303	103	89	139	139	73	73	201	201
	20	180	403	403	154	136	183	183	96	96	265	265
	50	260	614	614	235	213	255	255	133	133	367	367
	100	325	852	852	310	286	320	320	167	167	461	461

Catchment	T (years)	Q_{Pi} (m^3/s)	Q_{Ti} (m^3/s)									
			RM3-ARF (A)	**RM3-ARF (P)**	**SCS**	**SCS-SA**	**SUH-ARF (A)**	**SUH-ARF (P)**	**LRH-Veld-ARF (A)**	**LRH-Veld-ARF (P)**	**LRH-T_C-ARF (A)**	**LRH-T_C-ARF (P)**
	200	390	1 167	1 167	397	369	397	397	207	207	571	571
B8R006	2	4	22	22	2	1	15	15	8	8	17	18
	5	9	35	35	7	6	27	27	15	15	32	32
	10	13	47	47	13	20	37	37	20	20	44	44
	20	16	63	63	22	34	49	49	27	27	58	58
	50	21	96	96	36	49	69	69	37	38	80	80
	100	25	133	133	49	67	86	86	47	47	101	101
	200	29	182	182	65	178	102	102	59	59	125	125
B8R007	2	320	361	280	30	100	285	175	377	252	282	189
	5	675	573	481	106	355	509	355	677	511	508	383
	10	995	765	674	183	628	707	529	930	764	698	572
	20	1 360	1 016	932	280	973	924	739	1 225	1 067	918	800
	50	1 907	1 539	1 475	442	1 536	1 275	1 097	1 699	1 587	1 274	1 190
	100	2 362	2 130	2 097	591	2 048	1 597	1 434	2 128	2 073	1 595	1 555
	200	2 846	2 910	2 930	766	2 660	1 970	1 800	2 517	2 535	1 887	1 901
B9H002	2	134	59	51	10	67	140	88	167	133	88	70
	5	301	94	86	32	219	251	176	299	256	157	135
	10	449	126	118	53	378	344	262	410	371	215	195
	20	614	167	162	80	572	454	366	541	512	285	269
	50	851	253	252	124	908	629	545	750	745	395	392
	100	1 042	351	356	164	1 205	788	710	941	961	495	506
	200	1 241	479	493	210	1 559	921	884	1 079	1 111	568	584
B9H003	2	138	234	205	25	116	518	305	521	419	325	261
	5	281	369	346	98	426	917	635	920	828	574	516
	10	398	489	478	176	681	1 263	959	1 269	1 222	791	762
	20	522	645	654	274	1 015	1 643	1 376	1 647	1 680	1 027	1 048
	50	695	969	1 021	436	1 610	2 228	2 034	2 237	2 436	1 395	1 519
	100	830	1 332	1 438	586	2 071	2 759	2 660	2 772	3 130	1 729	1 952
	200	967	1 807	1 990	761	2 661	3 361	3 398	3 372	3 946	2 103	2 461
B9H004	2	138	73	58	38	168	149	83	195	137	114	80
	5	281	114	97	88	391	256	163	339	262	198	153
	10	398	150	133	130	594	346	237	456	378	266	220
	20	522	196	180	178	825	443	324	587	511	343	298
	50	695	292	277	251	1 165	593	464	790	728	461	425
	100	829	398	387	313	1 464	727	592	964	922	563	538
	200	967	535	531	380	1 792	873	738	1 162	1 146	679	669

Table A.14: Probabilistic and event-based deterministic DFE results in PDR C

Catchment	T (years)	Q_{Pi} (m^3/s)	Q_{Ti} (m^3/s)									
			RM3-ARF (A)	**RM3-ARF (P)**	**SCS**	**SCS-SA**	**SUH-ARF (A)**	**SUH-ARF (P)**	**LRH-Veld-ARF (A)**	**LRH-Veld-ARF (P)**	**LRH-T_C-ARF (A)**	**LRH-T_C-ARF (P)**
C1H002	2	91	338	306	97	229	325	223	363	309	282	241
	5	257	491	473	207	363	512	395	573	540	445	420
	10	409	628	627	302	445	659	559	739	739	575	575
	20	573	804	830	412	582	825	748	920	966	716	752
	50	799	1 169	1 249	579	831	1 060	1 042	1 185	1 317	922	1 025
	100	973	1 574	1 718	724	966	1 262	1 301	1 414	1 631	1 100	1 269
	200	1 146	2 095	2 328	885	1 149	1 492	1 602	1 673	1 986	1 301	1 545
C1H004	2	178	176	129	53	92	163	95	170	104	162	98
	5	359	259	206	110	148	260	173	273	189	259	179
	10	501	334	279	159	186	340	245	360	268	341	254
	20	645	432	376	216	253	433	334	455	366	431	347
	50	834	636	579	304	350	574	470	596	514	565	488
	100	974	863	808	380	423	691	592	722	649	684	615
	200	1 112	1 159	1 110	466	515	825	735	865	807	820	765
	2	207	182	145	56	122	170	108	209	146	176	123
	5	442	268	229	113	185	269	191	335	258	282	218

Catchment	*T* (years)	Q_{Pi} (m^3/s)	Q_{Ti} (m^3/s)									
			RM3-ARF (A)	RM3-ARF (P)	SCS	SCS-SA	SUH-ARF (A)	SUH-ARF (P)	LRH-Veld-ARF (A)	LRH-Veld-ARF (P)	LRH-T_C-ARF (A)	LRH-T_C-ARF (P)
C1H006	10	633	345	307	162	237	352	268	441	362	372	306
	20	829	445	410	218	309	448	361	550	485	464	409
	50	1 088	653	626	303	434	583	506	720	673	607	568
	100	1 282	885	870	377	518	702	637	869	845	734	713
	200	1 472	1 187	1 189	459	626	838	790	1 041	1 045	878	881
C1H007	2	135	337	316	108	288	308	273	434	390	305	274
	5	313	492	487	224	377	488	473	685	676	481	475
	10	467	630	647	324	448	632	645	885	923	622	648
	20	629	809	855	439	569	793	842	1 102	1 205	774	847
	50	850	1 181	1 289	614	810	1 027	1 156	1 435	1 653	1 008	1 162
	100	1 019	1 594	1 773	766	926	1 227	1 437	1 726	2 056	1 213	1 445
	200	1 188	2 128	2 406	934	1 070	1 457	1 757	2 056	2 516	1 445	1 769
C1H008	2	214	215	189	76	177	228	144	249	203	185	151
	5	386	317	297	157	263	368	267	402	361	299	269
	10	509	409	397	226	321	483	382	528	502	393	374
	20	626	529	529	306	414	612	521	666	667	496	497
	50	775	779	805	428	594	802	738	875	922	651	686
	100	883	1 058	1 116	535	692	971	934	1 059	1 157	789	861
	200	988	1 420	1 525	654	821	1 163	1 166	1 271	1 429	946	1 064
C1H012	2	345	621	633	176	596	524	534	736	759	467	482
	5	723	906	974	370	760	823	923	1 162	1 301	738	826
	10	1 039	1 161	1 289	538	815	1 066	1 256	1 495	1 768	949	1 123
	20	1 377	1 491	1 701	730	1 054	1 329	1 646	1 872	2 321	1 188	1 473
	50	1 848	2 178	2 559	1 024	1 475	1 731	2 274	2 450	3 209	1 555	2 037
	100	2 217	2 940	3 517	1 279	1 612	2 089	2 844	2 962	3 959	1 881	2 514
	200	2 593	3 924	4 766	1 563	1 862	2 492	3 443	3 537	4 794	2 246	3 044
C1H015	2	92	339	307	98	230	324	223	367	313	286	244
	5	277	493	474	208	363	511	385	580	546	452	425
	10	449	630	629	305	446	658	546	748	748	582	582
	20	635	806	832	415	582	822	733	932	978	725	762
	50	893	1 173	1 253	583	832	1 058	1 024	1 198	1 332	933	1 037
	100	1 090	1 579	1 724	729	968	1 261	1 281	1 431	1 649	1 114	1 284
	200	1 287	2 102	2 336	891	1 150	1 490	1 576	1 693	2 009	1 318	1 564
C1H027	2	64	222	175	60	121	190	129	241	166	213	147
	5	120	324	275	124	188	299	226	381	291	337	258
	10	164	416	369	180	240	390	317	497	407	440	361
	20	211	534	491	242	321	489	422	617	543	547	481
	50	278	780	748	339	451	633	581	801	749	709	663
	100	332	1 052	1 035	422	538	757	725	961	935	851	828
	200	389	1 405	1 410	514	653	899	892	1 142	1 149	1 012	1 018
C2H018	2	461	1 065	1 167	330	1 335	787	947	527	619	358	421
	5	1 221	1 565	1 810	695	1 713	1 257	1 692	844	1 028	573	698
	10	1 904	2 012	2 402	1 012	1 883	1 654	2 322	1 054	1 358	716	922
	20	2 635	2 591	3 175	1 375	2 245	2 070	3 070	1 284	1 788	872	1 214
	50	3 640	3 794	4 779	1 930	3 343	2 709	4 207	1 685	2 476	1 144	1 681
	100	4 408	5 132	6 568	2 412	3 563	3 267	5 217	2 041	3 095	1 386	2 102
	200	5 172	6 863	8 895	2 950	4 108	3 885	6 323	2 448	3 581	1 662	2 432
C2H024	2	3	25	14	26	42	54	29	58	23	65	26
	5	7	37	24	54	90	89	53	96	47	108	53
	10	9	49	33	79	131	121	77	131	70	147	79
	20	12	64	46	109	183	159	106	172	99	193	111
	50	16	97	73	156	264	217	153	234	150	263	169
	100	19	135	105	199	340	270	197	292	196	329	221
	200	22	185	147	248	423	334	251	363	251	408	282
C2H070	2	71	266	241	121	261	293	203	316	269	256	218
	5	171	401	388	256	407	494	388	531	503	431	408
	10	259	527	528	380	498	666	572	718	721	582	585
	20	353	694	716	526	676	866	800	930	976	754	792
	50	484	1 049	1 115	762	984	1 185	1 167	1 276	1 410	1 035	1 144
	100	586	1 453	1 573	975	1 181	1 485	1 521	1 599	1 817	1 297	1 474
	200	688	1 993	2 185	1 223	1 442	1 843	1 947	1 988	2 316	1 613	1 879
C2H073	2	106	213	197	116	358	345	263	432	382	325	287
	5	272	318	314	246	508	566	480	711	695	535	523
	10	419	410	420	355	573	739	683	930	968	699	728
	20	577	527	557	476	721	930	917	1 163	1 267	875	953
	50	792	769	836	655	1 044	1 203	1 264	1 505	1 724	1 133	1 297
	100	957	1 035	1 145	806	1 108	1 433	1 562	1 798	2 121	1 353	1 596

Catchment	T (years)	Q_{Pi} (m^3/s)	Q_{Ti} (m^3/s)									
			RM3-ARF (A)	RM3-ARF (P)	SCS	SCS-SA	SUH-ARF (A)	SUH-ARF (P)	LRH-Veld-ARF (A)	LRH-Veld-ARF (P)	LRH-T_C-ARF (A)	LRH-T_C-ARF (P)
	200	1 121	1 376	1 541	969	1 311	1 688	1 896	2 124	2 562	1 598	1 927
C2H141	2	70	340	264	117	185	273	175	271	179	277	183
	5	124	493	416	248	309	458	338	455	345	467	354
	10	161	623	552	369	407	622	497	621	508	637	521
	20	196	784	722	513	552	818	693	808	711	829	729
	50	240	1 090	1 045	745	808	1 127	1 012	1 113	1 040	1 142	1 067
	100	271	1 418	1 389	957	990	1 412	1 320	1 401	1 356	1 437	1 391
	200	301	1 841	1 834	1 204	1 243	1 759	1 695	1 753	1 742	1 798	1 786
C3H004	2	54	216	214	301	888	602	500	580	571	459	452
	5	94	333	348	634	1 258	1 016	956	981	1 054	776	834
	10	121	436	471	912	1 403	1 355	1 368	1 307	1 482	1 034	1 173
	20	147	567	629	1 219	1 750	1 732	1 855	1 670	1 965	1 321	1 554
	50	180	837	955	1 669	2 455	2 280	2 596	2 200	2 720	1 741	2 152
	100	203	1 137	1 318	2 047	2 674	2 757	3 263	2 666	3 399	2 109	2 689
	200	226	1 523	1 789	2 456	3 152	3 295	4 029	3 189	4 182	2 523	3 309
C4H002	2	245	525	526	163	407	479	475	712	714	466	468
	5	569	777	827	353	606	768	843	1 145	1 267	751	831
	10	862	1 000	1 102	518	679	1 004	1 169	1 494	1 741	980	1 141
	20	1 187	1 287	1 458	705	926	1 257	1 536	1 869	2 289	1 225	1 501
	50	1 658	1 881	2 192	988	1 263	1 634	2 108	2 441	3 141	1 601	2 059
	100	2 036	2 537	3 004	1 231	1 435	1 965	2 612	2 937	3 892	1 926	2 551
	200	2 428	3 383	4 052	1 499	1 682	2 335	3 180	3 498	4 688	2 294	3 074
C4H004	2	146	524	521	175	399	737	728	691	685	466	462
	5	325	775	820	375	558	1 184	1 276	1 108	1 213	747	817
	10	474	997	1 093	548	669	1 540	1 747	1 446	1 671	975	1 126
	20	631	1 283	1 447	743	854	1 939	2 296	1 808	2 190	1 218	1 476
	50	843	1 876	2 176	1 039	1 191	2 549	3 155	2 358	3 008	1 589	2 027
	100	1 004	2 531	2 984	1 292	1 353	3 083	3 846	2 839	3 728	1 913	2 512
	200	1 163	3 375	4 027	1 572	1 586	3 632	4 626	3 377	4 521	2 275	3 046
C5H015	2	296	350	321	247	714	433	308	489	427	383	335
	5	623	530	520	495	1 009	725	596	818	795	641	623
	10	890	696	711	716	1 207	979	878	1 106	1 142	867	895
	20	1 166	917	965	973	1 607	1 270	1 225	1 431	1 552	1 121	1 217
	50	1 537	1 386	1 505	1 381	2 337	1 740	1 798	1 969	2 254	1 543	1 766
	100	1 817	1 921	2 123	1 745	2 750	2 183	2 348	2 477	2 925	1 941	2 292
	200	2 096	2 634	2 950	2 164	3 321	2 719	3 018	3 093	3 703	2 424	2 902
C5H018	2	119	407	417	220	638	754	778	683	710	405	420
	5	235	609	659	450	886	1 240	1 381	1 119	1 274	662	754
	10	338	786	879	643	1 042	1 616	1 895	1 466	1 747	868	1 034
	20	458	1 013	1 162	855	1 273	2 037	2 489	1 839	2 294	1 089	1 358
	50	642	1 483	1 744	1 170	1 816	2 675	3 414	2 405	3 139	1 424	1 858
	100	798	2 000	2 387	1 434	2 046	3 227	4 177	2 895	3 882	1 714	2 298
	200	966	2 665	3 215	1 721	2 387	3 829	5 006	3 443	4 669	2 038	2 763
C5H022	2	9	53	53	13	11	30	30	14	14	30	30
	5	22	78	78	29	26	49	49	23	23	50	50
	10	32	101	101	43	40	64	64	30	30	65	65
	20	44	131	131	59	54	81	81	37	38	82	82
	50	59	194	194	84	79	108	108	50	50	108	109
	100	71	263	263	106	100	132	132	61	61	132	133
	200	83	354	354	131	125	157	157	73	73	159	159
C5H023	2	19	77	41	17	28	46	25	53	19	62	23
	5	36	114	70	38	66	74	46	85	38	100	45
	10	50	148	97	57	100	98	64	112	58	132	68
	20	65	191	133	79	139	124	87	143	79	169	93
	50	87	282	208	114	203	165	120	190	115	223	135
	100	105	383	291	144	259	199	149	229	148	269	174
	200	125	515	400	179	324	238	183	273	184	322	217
C6H003	2	248	287	277	90	407	468	446	448	424	285	269
	5	605	422	431	188	544	745	766	716	740	455	470
	10	921	543	573	273	641	967	1 043	929	1 010	590	642
	20	1 259	699	758	369	812	1 219	1 369	1 161	1 321	738	839
	50	1 728	1 023	1 139	517	1 165	1 609	1 875	1 520	1 811	966	1 151
	100	2 091	1 383	1 561	643	1 287	1 941	2 289	1 834	2 246	1 165	1 428
	200	2 455	1 847	2 109	784	1 502	2 296	2 755	2 193	2 723	1 394	1 730
	2	84	274	258	77	279	264	239	399	362	273	247
	5	170	403	403	165	380	423	420	639	639	437	437
	10	238	518	536	242	450	550	578	834	879	570	601

Catchment	T (years)	Q_{Pi} (m^3/s)	Q_{Ti} (m^3/s)									
			RM3-ARF (A)	**RM3-ARF (P)**	**SCS**	**SCS-SA**	**SUH-ARF (A)**	**SUH-ARF (P)**	**LRH-Veld-ARF (A)**	**LRH-Veld-ARF (P)**	**LRH-T_C-ARF (A)**	**LRH-T_C-ARF (P)**
C7H005	20	307	667	710	330	595	691	753	1 039	1 146	711	784
	50	398	977	1 068	464	835	898	1 031	1 356	1 568	927	1 072
	100	466	1 321	1 467	581	924	1 080	1 275	1 634	1 939	1 118	1 326
	200	533	1 765	1 983	711	1 109	1 287	1 553	1 949	2 364	1 332	1 616
C7H006	2	98	267	253	38	162	262	237	406	372	270	248
	5	277	392	394	94	285	418	416	648	654	431	435
	10	441	504	524	146	342	545	572	846	898	563	597
	20	618	649	693	206	448	684	746	1 055	1 171	702	778
	50	863	951	1 042	302	666	889	1 020	1 378	1 600	916	1 064
	100	1 051	1 285	1 430	387	748	1 069	1 263	1 662	1 982	1 105	1 318
	200	1 238	1 717	1 933	482	936	1 274	1 539	1 982	2 415	1 318	1 606
C8H003	2	47	144	105	29	64	118	70	147	88	139	83
	5	105	208	165	64	124	183	124	229	157	215	148
	10	155	265	220	94	180	235	172	295	217	277	204
	20	206	339	293	129	240	294	229	369	290	347	272
	50	276	491	444	182	337	378	317	470	403	442	379
	100	330	659	613	228	425	447	391	558	497	524	467
	200	383	875	832	279	519	524	475	655	605	615	569
C8H004	2	93	286	276	103	251	275	224	316	298	231	218
	5	213	421	427	213	371	443	404	508	522	372	382
	10	314	540	565	306	433	575	562	662	713	484	521
	20	422	693	743	412	569	724	783	825	920	604	673
	50	568	1 011	1 110	571	805	933	937	1 068	1 241	781	908
	100	680	1 363	1 515	707	930	1 113	1 245	1 278	1 517	935	1 110
	200	792	1 815	2 038	856	1 099	1 318	1 508	1 513	1 827	1 107	1 337
C8H005	2	152	242	162	82	104	169	114	184	96	230	120
	5	323	357	263	175	218	271	202	296	182	370	227
	10	464	458	357	253	311	355	279	387	257	484	321
	20	612	588	478	340	422	444	361	484	346	605	432
	50	815	854	726	470	582	570	487	621	482	776	602
	100	972	1 146	998	578	716	676	596	737	591	920	738
	200	1 129	1 521	1 349	696	866	794	717	865	714	1 081	892
C8H011	2	107	299	248	95	161	214	160	261	195	255	191
	5	194	442	392	202	287	344	286	422	347	413	339
	10	262	568	523	293	384	450	396	552	482	541	472
	20	336	728	692	393	508	563	519	686	635	672	621
	50	443	1 058	1 038	542	703	723	700	882	857	863	838
	100	530	1 419	1 418	667	855	857	855	1 049	1 046	1 026	1 024
	200	622	1 883	1 906	804	1 011	1 008	1 027	1 232	1 257	1 206	1 230
C8H014	2	218	501	512	152	396	492	514	521	539	356	369
	5	446	735	787	322	558	776	864	826	924	565	632
	10	632	940	1 036	466	643	1 001	1 160	1 066	1 240	728	847
	20	828	1 204	1 357	627	814	1 250	1 501	1 320	1 600	902	1 093
	50	1 099	1 747	2 017	869	1 134	1 626	2 013	1 702	2 153	1 163	1 471
	100	1 309	2 345	2 746	1 074	1 282	1 943	2 429	2 031	2 639	1 388	1 803
	200	1 522	3 111	3 683	1 298	1 505	2 273	2 875	2 398	3 168	1 639	2 165
C5H022	2	9	53	53	13	11	30	30	14	14	30	30
	5	22	78	78	29	26	49	49	23	23	50	50
	10	32	101	101	43	40	64	64	30	30	65	65
	20	44	131	131	59	54	81	81	37	38	82	82
	50	59	194	194	84	79	108	108	50	50	108	109
	100	71	263	263	106	100	132	132	61	61	132	133
	200	83	354	354	131	125	157	157	73	73	159	159
C5H023	2	19	77	41	17	28	46	25	53	19	62	23
	5	36	114	70	38	66	74	46	85	38	100	45
	10	50	148	97	57	100	98	64	112	58	132	68
	20	65	191	133	79	139	124	87	143	79	169	93
	50	87	282	208	114	203	165	120	190	115	223	135
	100	105	383	291	144	259	199	149	229	148	269	174
	200	125	515	400	179	324	238	183	273	184	322	217
C6H003	2	248	287	277	90	407	468	446	448	424	285	269
	5	605	422	431	188	544	745	766	716	740	455	470
	10	921	543	573	273	641	967	1043	929	1010	590	642
	20	1259	699	758	369	812	1219	1369	1161	1321	738	839
	50	1728	1023	1139	517	1165	1609	1875	1520	1811	966	1151
	100	2091	1383	1561	643	1287	1941	2289	1834	2246	1165	1428
	200	2455	1847	2109	784	1502	2296	2755	2193	2723	1394	1730

Catchment	*T* (years)	Q_{Pi} (m³/s)	Q_{Ti} (m³/s)									
			RM3-ARF (A)	**RM3-ARF (P)**	**SCS**	**SCS-SA**	**SUH-ARF (A)**	**SUH-ARF (P)**	**LRH-Veld-ARF (A)**	**LRH-Veld-ARF (P)**	**LRH-T_C-ARF (A)**	**LRH-T_C-ARF (P)**
C7H005	2	84	274	258	77	279	264	239	399	362	273	247
	5	170	403	403	165	380	423	420	639	639	437	437
	10	238	518	536	242	450	550	578	834	879	570	601
	20	307	667	710	330	595	691	753	1039	1146	711	784
	50	398	977	1068	464	835	898	1031	1356	1568	927	1072
	100	466	1321	1467	581	924	1080	1275	1634	1939	1118	1326
	200	533	1765	1983	711	1109	1287	1553	1949	2364	1332	1616
C7H006	2	98	267	253	38	162	262	237	406	372	270	248
	5	277	392	394	94	285	418	416	648	654	431	435
	10	441	504	524	146	342	545	572	846	898	563	597
	20	618	649	693	206	448	684	746	1055	1171	702	778
	50	863	951	1042	302	666	889	1020	1378	1600	916	1064
	100	1051	1285	1430	387	748	1069	1263	1662	1982	1105	1318
	200	1238	1717	1933	482	936	1274	1539	1982	2415	1318	1606
C8H003	2	47	144	105	29	64	118	70	147	88	139	83
	5	105	208	165	64	124	183	124	229	157	215	148
	10	155	265	220	94	180	235	172	295	217	277	204
	20	206	339	293	129	240	294	229	369	290	347	272
	50	276	491	444	182	337	378	317	470	403	442	379
	100	330	659	613	228	425	447	391	558	497	524	467
	200	383	875	832	279	519	524	475	655	605	615	569
C8H004	2	93	286	276	103	251	275	224	316	298	231	218
	5	213	421	427	213	371	443	404	508	522	372	382
	10	314	540	565	306	433	575	562	662	713	484	521
	20	422	693	743	412	569	724	783	825	920	604	673
	50	568	1011	1110	571	805	933	937	1068	1241	781	908
	100	680	1363	1515	707	930	1113	1245	1278	1517	935	1110
	200	792	1815	2038	856	1099	1318	1508	1513	1827	1107	1337
C8H005	2	152	242	162	82	104	169	114	184	96	230	120
	5	323	357	263	175	218	271	202	296	182	370	227
	10	464	458	357	253	311	355	279	387	257	484	321
	20	612	588	478	340	422	444	361	484	346	605	432
	50	815	854	726	470	582	570	487	621	482	776	602
	100	972	1146	998	578	716	676	596	737	591	920	738
	200	1129	1521	1349	696	866	794	717	865	714	1081	892
C8H011	2	107	299	248	95	161	214	160	261	195	255	191
	5	194	442	392	202	287	344	286	422	347	413	339
	10	262	568	523	293	384	450	396	552	482	541	472
	20	336	728	692	393	508	563	519	686	635	672	621
	50	443	1058	1038	542	703	723	700	882	857	863	838
	100	530	1419	1418	667	855	857	855	1049	1046	1026	1024
	200	622	1883	1906	804	1011	1008	1027	1232	1257	1206	1230
C8H014	2	218	501	512	152	396	492	514	521	539	356	369
	5	446	735	787	322	558	776	864	826	924	565	632
	10	632	940	1036	466	643	1001	1160	1066	1240	728	847
	20	828	1204	1357	627	814	1250	1501	1320	1600	902	1093
	50	1099	1747	2017	869	1134	1626	2013	1702	2153	1163	1471
	100	1309	2345	2746	1074	1282	1943	2429	2031	2639	1388	1803
	200	1522	3111	3683	1298	1505	2273	2875	2398	3168	1639	2165
C8H020	2	140	281	272	97	248	254	209	320	305	229	218
	5	337	413	421	202	370	407	376	516	532	369	381
	10	518	530	556	291	431	529	523	672	725	481	519
	20	720	681	731	392	568	665	692	836	935	598	669
	50	1 014	993	1 092	544	804	859	938	1 083	1 261	775	902
	100	1 252	1 338	1 490	674	929	1 025	1 155	1 296	1 545	927	1 105
	200	1 498	1 782	2 004	816	1 098	1 211	1 396	1 535	1 861	1 098	1 331
C8H022	2	302	642	691	187	594	1 061	1 160	724	815	469	529
	5	940	940	1 061	399	789	1 673	1 954	1 149	1 392	745	902
	10	1 569	1 204	1 396	581	808	2 162	2 641	1 481	1 874	960	1 215
	20	2 286	1 544	1 830	786	1 041	2 713	3 435	1 845	2 431	1 196	1 576
	50	3 334	2 246	2 724	1 097	1 464	3 547	4 592	2 396	3 297	1 553	2 137
	100	4 180	3 022	3 712	1 363	1 591	4 232	5 569	2 875	4 031	1 863	2 613
	200	5 056	4 018	4 985	1 657	1 835	4 974	6 332	3 413	4 811	2 212	3 118
	2	166	316	311	48	159	421	421	381	371	257	250
	5	437	464	480	116	262	668	712	609	643	411	434
	10	687	596	634	177	321	863	959	792	872	534	588
	20	962	765	833	249	419	1 084	1 240	986	1 127	665	760

Catchment	T (years)	Q_{Pi} (m^3/s)	Q_{Ti} (m^3/s)									
			RM3-ARF (A)	RM3-ARF (P)	SCS	SCS-SA	SUH-ARF (A)	SUH-ARF (P)	LRH-Veld-ARF (A)	LRH-Veld-ARF (P)	LRH-T_C-ARF (A)	LRH-T_C-ARF (P)
C8H026	50	1 351	1 117	1 244	360	624	1 416	1 678	1 281	1 525	864	1 028
	100	1 658	1 506	1 699	458	705	1 706	2 032	1 537	1 872	1 036	1 262
	200	1 971	2 007	2 285	567	840	2 011	2 431	1 824	2 263	1 230	1 526
C8H027	2	237	479	507	63	233	392	424	597	651	379	413
	5	553	703	776	160	436	618	724	944	1 101	599	699
	10	826	899	1 019	249	529	796	971	1 211	1 478	769	938
	20	1 113	1 151	1 333	352	698	987	1 253	1 504	1 913	955	1 214
	50	1 505	1 671	1 979	512	1 014	1 272	1 695	1 951	2 591	1 239	1 645
	100	1 803	2 243	2 691	651	1 168	1 520	2 084	2 337	3 152	1 484	2 002
	200	2 100	2 977	3 607	807	1 394	1 799	2 492	2 773	3 750	1 760	2 381
C8H028	2	220	497	508	150	396	443	464	521	540	354	367
	5	385	728	780	317	559	699	778	827	924	561	628
	10	501	931	1 026	459	643	901	1 045	1 064	1 239	723	842
	20	615	1 193	1 344	619	815	1 125	1 350	1 319	1 599	896	1 086
	50	763	1 731	1 999	857	1 135	1 465	1 809	1 703	2 154	1 157	1 463
	100	874	2 324	2 720	1 060	1 283	1 748	2 185	2 030	2 641	1 379	1 793
	200	985	3 083	3 649	1 281	1 506	2 048	2 580	2 398	3 164	1 629	2 149
C9H003	2	401	1 069	1 150	175	994						
	5	1 128	1 582	1 819	464	1 793						
	10	1 791	2 036	2 434	733	1 751						
	20	2 504	2 620	3 232	1 049	2 150						
	50	3 484	3 830	4 878	1 546	3 480						
	100	4 234	5 167	6 703	1 984	3 326						
	200	4 978	6 889	9 065	2 477	3 965						
C9H009	2	369	1 060	1 139	189	1 070						
	5	1 069	1 568	1 801	490	1 866						
	10	1 713	2 018	2 409	767	1 811						
	20	2 409	2 597	3 200	1 093	2 217						
	50	3 369	3 796	4 829	1 602	3 574						
	100	4 106	5 121	6 637	2 050	3 409						
	200	4 839	6 828	8 975	2 554	4 057						
C9H010	2	461	1 246	1 370	538	2 849						
	5	1 286	1 867	2 193	1 185	3 665						
	10	2 044	2 421	2 959	1 755	3 434						
	20	2 869	3 140	3 961	2 411	4 294						
	50	4 016	4 636	6 043	3 422	6 493						
	100	4 903	6 306	8 375	4 306	6 430						
	200	5 793	8 478	11 425	5 297	7 243						

Table A.15: Probabilistic and event-based deterministic DFE results in PDR D

Catchment	T (years)	Q_{Pi} (m^3/s)	Q_{Ti} (m^3/s)									
			RM3-ARF (A)	RM3-ARF (P)	SCS	SCS-SA	SUH-ARF (A)	SUH-ARF (P)	LRH-Veld-ARF (A)	LRH-Veld-ARF (P)	LRH-T_C-ARF (A)	LRH-T_C-ARF (P)
D1H001	2	81	208	184	30	79	209	159	233	190	185	151
	5	252	304	287	80	201	334	286	372	339	294	269
	10	415	388	379	125	301	428	395	479	462	379	366
	20	597	493	497	176	413	529	514	592	600	469	475
	50	854	707	735	252	591	673	692	753	804	596	636
	100	1 056	940	994	317	748	791	832	883	963	699	763
	200	1 260	1 234	1 322	387	918	915	980	1 015	1 131	804	895
D1H004	2	32	76	53	13	25	59	40	66	37	69	38
	5	68	111	85	33	68	92	68	105	67	109	70
	10	99	142	113	51	107	118	92	134	93	140	97
	20	131	181	150	71	152	147	120	166	122	174	127
	50	176	261	224	102	218	189	161	214	166	223	173
	100	211	349	306	129	278	223	193	253	204	264	213
	200	246	460	410	158	344	258	228	292	245	305	255

Catchment	T (years)	Q_{Pi} (m³/s)	Q_{Ti} (m³/s)									
			RM3-ARF (A)	RM3-ARF (P)	SCS	SCS-SA	SUH-ARF (A)	SUH-ARF (P)	LRH-Veld-ARF (A)	LRH-Veld-ARF (P)	LRH-T_C-ARF (A)	LRH-T_C-ARF (P)
D1H011	2	365	579	577	89	250	346	344	486	483	358	356
	5	894	849	890	218	477	547	590	766	826	564	608
	10	1 365	1 085	1 173	334	620	703	799	987	1 121	727	825
	20	1 873	1 388	1 539	468	804	876	1 027	1 227	1 442	904	1 061
	50	2 579	2 013	2 287	674	1 197	1 119	1 372	1 570	1 923	1 156	1 416
	100	3 127	2 700	3 110	852	1 393	1 328	1 673	1 861	2 344	1 370	1 726
	200	3 680	3 579	4 166	1 050	1 672	1 561	2 007	2 188	2 813	1 611	2 071
D1H032	2	170	215	177	18	32	105	74	135	98	126	91
	5	369	318	280	51	86	172	134	217	177	202	165
	10	534	412	376	83	139	224	186	286	246	266	229
	20	706	534	502	124	205	286	249	366	330	340	307
	50	938	790	766	191	314	382	351	489	467	454	434
	100	1 113	1 077	1 062	252	417	470	436	592	580	551	539
	200	1 287	1 453	1 451	324	530	563	535	712	711	662	661
D1R002	2	507	521	455	46	84	201	148	233	188	207	167
	5	908	749	695	116	189	324	268	378	334	335	296
	10	1 216	944	907	182	281	427	378	498	467	442	414
	20	1 544	1 160	1 146	261	398	546	508	638	626	566	555
	50	2 012	1 459	1 483	389	587	722	705	837	859	742	762
	100	2 391	1 734	1 790	504	736	874	879	1 015	1 069	900	948
	200	2 788	2 334	2 439	636	934	1 048	1 083	1 221	1 311	1 084	1 163
D2R001	2	32	107	67	25	41	73	44	80	37	90	41
	5	77	159	110	57	95	117	78	129	72	144	80
	10	117	206	151	86	144	155	109	170	103	190	115
	20	159	266	205	119	204	198	147	218	141	243	158
	50	217	393	317	171	298	261	203	286	204	319	228
	100	261	534	443	217	378	316	253	346	258	386	288
	200	306	718	608	269	469	378	311	415	318	463	355
D2R002	2	41	181	136	40	73	143	87	153	95	150	93
	5	104	269	219	89	142	232	162	247	178	242	174
	10	160	348	297	133	192	304	230	328	253	321	247
	20	221	451	400	183	263	388	312	417	343	408	336
	50	304	664	612	262	382	516	436	545	481	534	471
	100	368	901	849	331	468	621	545	660	600	646	588
	200	433	1 210	1 159	408	573	741	669	790	737	774	722
D4H002	2	13	43	35	11	44	103	71	118	85	86	62
	5	24	65	56	25	100	169	128	195	152	142	111
	10	33	83	75	37	150	223	179	255	214	187	157
	20	42	107	99	52	208	280	234	319	280	233	205
	50	54	156	148	73	290	360	316	412	379	301	277
	100	63	210	203	91	366	428	387	492	464	359	339
	200	72	279	272	111	441	503	465	579	557	423	407
D4H013	2	1	3	2	1	4	44	26	56	34	45	28
	5	1	4	3	4	18	72	47	92	63	75	51
	10	2	5	4	8	33	94	66	122	88	99	72
	20	2	7	6	12	52	120	88	151	118	123	96
	50	3	10	9	18	82	154	118	195	160	159	130
	100	4	13	12	24	108	182	145	233	196	189	159
	200	5	17	16	31	140	214	174	274	236	223	191
D4H032	2	13	44	35	10	44	103	71	118	85	86	62
	5	24	65	56	25	100	169	128	195	152	142	111
	10	33	84	75	37	150	223	179	255	214	187	157
	20	42	108	100	52	208	280	234	319	280	233	205
	50	54	158	150	73	290	360	316	412	379	301	277
	100	63	212	204	91	365	428	387	492	464	359	339
	200	72	281	275	111	441	503	465	579	557	423	407
D5H003	2	84	84	78	23	86	97	79	99	87	78	69
	5	172	132	128	67	256	174	155	179	169	141	133
	10	241	175	174	109	414	237	222	242	241	191	190
	20	311	230	235	159	623	309	302	316	326	249	257
	50	402	346	362	240	949	421	435	431	465	340	367
	100	471	475	505	312	1 247	524	552	537	592	423	467
	200	538	643	694	395	1 595	636	685	649	732	512	577
	2	55	110	94	26	90	102	74	104	82	82	65
	5	136	178	161	81	308	194	154	199	169	157	134
	10	211	238	223	134	500	269	226	274	248	217	197
	20	293	315	303	197	749	354	313	361	340	286	270

Catchment	T (years)	Q_{Pi} (m^3/s)	Q_{Ti} (m^3/s)									
			RM3-ARF (A)	RM3-ARF (P)	SCS	SCS-SA	SUH-ARF (A)	SUH-ARF (P)	LRH-Veld-ARF (A)	LRH-Veld-ARF (P)	LRH-T_C-ARF (A)	LRH-T_C-ARF (P)
D5H011	50	411	473	470	295	1 149	486	455	496	491	393	388
	100	506	650	656	381	1 498	604	579	616	625	488	495
	200	603	879	901	478	1 875	727	716	742	770	587	609
D5H013	2	105	355	348	10	62	241	226	299	290	230	223
	5	422	571	591	71	442	440	460	559	591	430	454
	10	749	761	814	144	753	617	659	763	848	587	651
	20	1 128	1 005	1 105	238	1 231	804	897	992	1 154	762	887
	50	1 685	1 508	1 708	396	2 045	1 083	1 280	1 345	1 646	1 034	1 265
	100	2 136	2 068	2 383	544	2 728	1 328	1 626	1 660	2 073	1 275	1 593
	200	2 603	2 795	3 267	716	3 538	1 606	2 004	2 000	2 561	1 537	1 968
D5H016	2	97	572	613	17	146	662	710	337	379	224	253
	5	350	924	1 042	123	969	1 223	1 414	645	773	430	515
	10	596	1 236	1 439	249	1 430	1 683	2 056	877	1 112	585	741
	20	870	1 638	1 956	414	2 248	2 236	2 857	1 146	1 549	764	1 033
	50	1 257	2 466	3 027	695	3 886	3 083	4 057	1 596	2 209	1 065	1 474
	100	1 560	3 390	4 231	957	4 767	3 803	5 155	1 977	2 773	1 319	1 850
	200	1 864	4 595	5 811	1 264	6 196	4 634	6 393	2 377	3 427	1 585	2 286
D7H002	2	2 023	1 925	2 204	2 953	2 393						
	5	4 096	2 882	3 551	5 475	2 529						
	10	5 902	3 735	4 807	7 522	2 560						
	20	7 937	4 841	6 452	9 763	3 152						
	50	10 955	7 139	9 865	13 059							
	100	13 453	9 701	13 688	15 833							
	200	16 099	13 030	18 686	18 856							
D7H005	2	1 207	1 719	1 911	2 759							
	5	2 687	2 569	3 080	5 098							
	10	3 921	3 332	4 177	7 010							
	20	5 205	4 320	5 615	9 109							
	50	6 932	6 381	8 609	12 218							
	100	8 235	8 683	11 972	14 847							
	200	9 521	11 678	16 375	17 719							
D7H008	2	55	1 827	2 065	2 810							
	5	85	2 736	3 330	5 215							
	10	103	3 548	4 511	7 171							
	20	119	4 600	6 060	9 315							
	50	141	6 788	9 274	12 473							
	100	158	9 229	12 878	15 133							
	200	176	12 402	17 593	18 036							

Table A.16: Probabilistic and event-based deterministic DFE results in PDR E

Catchment	T (years)	Q_{Pi} (m^3/s)	Q_{Ti} (m^3/s)									
			RM3-ARF (A)	RM3-ARF (P)	SCS	SCS-SA	SUH-ARF (A)	SUH-ARF (P)	LRH-Veld-ARF (A)	LRH-Veld-ARF (P)	LRH-T_C-ARF (A)	LRH-T_C-ARF (P)
E1H006	2	55	98	43	84	89	123	85	164	68	325	135
	5	85	150	76	164	179	173	127	230	113	456	223
	10	103	194	107	228	251	208	159	276	148	546	294
	20	119	250	149	296	325	242	192	321	186	636	368
	50	141	364	235	392	438	288	237	382	240	757	476
	100	158	490	332	470	523	323	273	428	285	849	564
	200	176	649	461	552	623	358	309	475	331	942	656
E1H013	2	407	258	211	119	160	304	255	504	407	624	504
	5	689	371	321	218	293	404	354	667	574	826	710
	10	871	467	421	295	391	470	426	777	696	962	862
	20	1 036	588	548	375	507	534	501	884	819	1 094	1 013
	50	1 234	836	808	486	651	616	601	1 020	984	1 262	1 217
	100	1 372	1 103	1 091	575	774	678	677	1 121	1 110	1 388	1 373

Catchment	T (years)	Q_{Pi} (m³/s)	Q_{Ti} (m³/s)									
			RM3-ARF (A)	RM3-ARF (P)	SCS	SCS-SA	SUH-ARF (A)	SUH-ARF (P)	LRH-Veld-ARF (A)	LRH-Veld-ARF (P)	LRH-T_C-ARF (A)	LRH-T_C-ARF (P)
	200	1 502	1 438	1 454	667	891	740	754	1 223	1 238	1 514	1 532
E2H003	2	366	520	601	295	498	1 653	1 586	1 924	2 238	1 467	1 706
	5	756	802	966	693	1 116	2 367	2 456	2 740	3 332	2 089	2 540
	10	1 067	1 052	1 301	1 045	1 690	2 873	3 133	3 325	4 149	2 535	3 163
	20	1 386	1 375	1 738	1 450	2 340	3 381	3 839	3 918	5 019	2 987	3 826
	50	1 809	2 044	2 650	2 072	3 325	4 098	4 842	4 754	6 250	3 624	4 765
	100	2 125	2 790	3 675	2 614	4 179	4 678	5 652	5 426	7 250	4 137	5 528
	200	2 437	3 761	5 023	3 220	5 081	5 295	6 493	6 132	8 317	4 675	6 341
E2H007	2	29	69	50	90	92	153	116	231	166	276	198
	5	46	100	78	159	167	206	163	310	238	370	284
	10	56	127	103	211	226	241	198	363	291	433	348
	20	65	161	135	265	279	275	233	415	345	495	412
	50	74	230	202	338	362	320	279	482	420	575	502
	100	81	305	274	396	428	353	316	532	477	635	570
	200	86	399	368	456	491	387	354	583	536	696	639

Table A.17: Probabilistic and event-based deterministic DFE results in PDR G

Catchment	T (years)	Q_{Pi} (m³/s)	Q_{Ti} (m³/s)									
			RM3-ARF (A)	RM3-ARF (P)	SCS	SCS-SA	SUH-ARF (A)	SUH-ARF (P)	LRH-Veld-ARF (A)	LRH-Veld-ARF (P)	LRH-T_C-ARF (A)	LRH-T_C-ARF (P)
G1H004	2	215	148	12	132	61	141	81	117		312	
	5	352	218	36	242	114	192	121	160	24	425	64
	10	435	280	62	332	159	229	152	190	38	506	102
	20	508	361	98	430	206	266	186	221	56	589	149
	50	592	528	177	573	277	317	234	264	83	701	222
	100	649	714	269	693	336	358	274	297	107	791	284
	200	702	955	397	825	404	403	317	333	132	886	352
G1H008	2	100	168	75	62	52	272	194	225	95	529	223
	5	192	238	123	121	85	354	271	294	145	690	341
	10	260	298	169	169	119	409	327	340	186	798	436
	20	329	373	228	220	157	462	384	383	229	899	537
	50	418	527	350	292	210	531	461	440	287	1 032	674
	100	485	693	486	351	256	583	520	482	332	1 133	781
	200	550	901	662	412	300	635	581	524	379	1 232	891
G1H010	2	3	8	8	9	4	12	12				
	5	6	11	11	16	8	16	16				
	10	8	14	13	21	11	19	19				
	20	11	17	17	27	14	21	21				
	50	14	24	24	35	18	24	24				
	100	17	31	31	41	22	27	27				
	200	19	41	41	47	25	29	29				
G1H011	2	23	28	28	16	9	34	34	27	27	80	80
	5	38	40	40	31	17	44	44	36	36	105	105
	10	47	51	51	42	24	51	51	41	41	122	122
	20	56	63	63	54	31	58	58	47	47	138	138
	50	65	90	90	70	41	66	66	53	53	158	158
	100	72	118	118	83	49	73	73	59	59	173	173
	200	78	153	153	96	58	79	79	64	64	188	188
G1H012	2	12	30	2	7	4	38	38	35		87	
	5	20	41	7	14	10	48	48	45		112	
	10	25	52	11	21	14	56	56	52		130	
	20	29	65	17	28	19	63	63	59	14	146	36
	50	34	92	29	38	27	73	73	68	20	169	51
	100	37	122	44	47	34	80	80	75	25	186	63

Catchment	***T* (years)**	**Q_{Pi} (m^3/s)**	**Q_{Ti} (m^3/s)**									
			RM3-ARF (A)	**RM3-ARF (P)**	**SCS**	**SCS-SA**	**SUH-ARF (A)**	**SUH-ARF (P)**	**LRH-Veld-ARF (A)**	**LRH-Veld-ARF (P)**	**LRH-T_C-ARF (A)**	**LRH-T_C-ARF (P)**
	200	40	160	64	57	42	88	88	82	31	205	77
G1H016	2	3	18	18	9	2	14	14				
	5	5	25	25	18	4	18	18				
	10	7	31	31	24	5	21	21				
	20	9	37	37	32	7	24	24				
	50	11	44	44	42	9	28	28				
	100	13	51	51	50	11	31	31				
	200	15	67	67	59	14	33	33				
G1H017	2	1	6	6	3	1	8	8				
	5	1	8	8	5	2	10	10				
	10	2	10	10	7	2	11	11				
	20	2	12	12	9	3	13	13				
	50	3	18	18	13	4	15	15				
	100	4	23	23	16	5	16	16				
	200	4	31	31	19	6	18	18				
G1H018	2	3	16	16	6	1	15	15				
	5	6	22	22	10	2	19	19				
	10	7	27	27	14	3	22	22				
	20	9	32	32	18	4	25	25				
	50	11	38	38	24	6	28	28				
	100	12	44	44	29	7	31	31				
	200	14	58	58	35	9	34	34				
G1H028	2	228	436	87	81	49	227	227	211		618	
	5	404	602	168	151	95	299	299	276	72	809	210
	10	527	736	246	206	130	347	347	320	101	937	296
	20	644	875	338	264	169	392	392	362	133	1 061	391
	50	793	1 054	472	344	221	449	449	417	179	1 222	523
	100	901	1 212	593	408	266	493	493	457	215	1 339	630
	200	1 006	1 576	831	474	311	537	537	497	253	1 456	741
G1H029	2	25	87	87	28	12	57	57	30	30	104	104
	5	45	120	120	53	24	74	74	40	40	137	137
	10	59	147	147	73	33	86	86	46	46	159	159
	20	73	174	174	94	43	97	97	52	52	179	179
	50	92	210	210	124	58	112	112	60	60	206	206
	100	108	242	242	147	70	123	123	66	66	226	226
	200	123	315	315	172	81	134	134	72	72	246	246
G1H038	2	34	67	67	95	20	62	62				
	5	71	95	95	162	35	83	83				
	10	101	118	118	213	47	98	98				
	20	133	143	143	265	59	113	113				
	50	175	176	176	339	76	132	132				
	100	207	205	205	399	90	147	147				
	200	240	271	271	461	104	163	163				
G1H040	2	11	16	3	7	4	27	15	31		63	
	5	19	23	7	14	9	36	22	41		84	
	10	24	29	10	20	13	41	27	48	15	97	31
	20	30	36	14	26	17	47	33	54	20	110	40
	50	36	51	23	35	23	54	40	63	26	128	53
	100	41	68	32	42	29	60	45	69	32	141	64
	200	45	89	45	50	35	66	51	76	37	154	76
G2H008	2	28	104	104	30	10	83	83				
	5	40	149	149	67	23	115	115				
	10	45	189	189	99	36	137	137				
	20	49	232	232	136	50	161	161				
	50	51	292	292	195	73	193	193				
	100	51	347	347	246	93	220	220				
	200	50	468	468	305	117	248	248				
G4H008	2	1	9	9	5	1	6	6				
	5	1	13	13	10	2	9	9				
	10	2	16	16	16	3	11	11				
	20	2	20	20	22	4	13	13				
	50	3	25	25	32	6	16	16				
	100	4	31	31	41	8	18	18				
	200	5	42	42	51	10	21	21				
	2	0	6	6	3	1	8	8				
	5	0	9	9	6	2	11	11				

Catchment	*T* (years)	Q_{Pi} (m^3/s)	Q_{Ti} (m^3/s)									
			RM3-ARF (A)	RM3-ARF (P)	SCS	SCS-SA	SUH-ARF (A)	SUH-ARF (P)	LRH-Veld-ARF (A)	LRH-Veld-ARF (P)	LRH-T_C-ARF (A)	LRH-T_C-ARF (P)
G4H009	10	1	12	12	10	3	13	13				
	20	1	15	15	14	5	16	16				
	50	1	23	23	21	7	19	19				
	100	1	32	32	27	9	22	22				
	200	2	43	43	34	11	26	26				
G4H010	2	1	15	15	7	2	14	14				
	5	2	22	22	16	5	20	20				
	10	3	29	29	25	8	24	24				
	20	4	38	38	35	11	28	28				
	50	5	57	57	51	17	34	34				
	100	6	79	79	66	22	40	40				
	200	7	107	107	82	28	45	45				
G4H012	2	0	4	4	3	1	4	4				
	5	1	6	6	6	1	5	5				
	10	1	7	7	9	2	6	6				
	20	1	8	8	11	3	7	7				
	50	2	10	10	15	3	8	8				
	100	2	11	11	17	4	9	9				
	200	2	15	15	20	5	9	9				
G4H013	2	1	10	10	5	1	7	7				
	5	1	15	15	10	2	10	10				
	10	2	19	19	15	4	12	12				
	20	2	24	24	21	5	15	15				
	50	3	30	30	31	8	18	18				
	100	4	4	37	39	11	21	21				
	200	4	50	50	49	13	24	24				
G4H014	2	30	103	55	48	38	162	123	182	93	325	167
	5	92	157	94	106	86	228	184	256	149	456	266
	10	149	207	133	161	132	278	233	312	196	556	349
	20	212	273	186	226	189	332	287	372	247	663	441
	50	299	414	301	333	278	409	366	460	328	820	585
	100	366	574	435	430	361	474	435	533	398	950	710
	200	433	788	620	543	458	547	512	613	478	1 094	852
G4H033	2	5	52	52	17	7	38	38	22	22	70	70
	5	11	76	76	39	17	54	54	31	31	99	99
	10	16	98	98	59	27	65	65	38	38	121	121
	20	20	123	123	84	39	78	78	45	46	144	144
	50	27	158	158	125	59	96	96	56	56	177	177
	100	32	191	191	162	77	111	111	65	65	205	205
	200	37	262	262	206	99	128	128	75	75	236	236

Table A.18: Probabilistic and event-based deterministic DFE results in PDR H

Catchment	*T* (years)	Q_{Pi} (m^3/s)	Q_{Ti} (m^3/s)									
			RM3-ARF (A)	RM3-ARF (P)	SCS	SCS-SA	SUH-ARF (A)	SUH-ARF (P)	LRH-Veld-ARF (A)	LRH-Veld-ARF (P)	LRH-T_C-ARF (A)	LRH-T_C-ARF (P)
H1H013	2	24	60	16	58	36	64	37	78	19	163	40
	5	47	86	29	96	62	84	52	103	32	214	67
	10	66	108	41	125	80	97	64	119	43	248	90
	20	84	135	58	153	99	110	76	134	55	280	115
	50	110	191	92	192	125	126	92	155	72	323	149
	100	129	251	130	222	146	138	105	170	85	354	177
	200	148	327	180	253	167	150	118	185	98	385	205
H1H016	2	16	74	74	21	6	37	37				
	5	27	103	103	38	12	49	49				
	10	34	125	125	51	16	57	57				
	20	41	149	149	65	20	64	64				
	50	49	180	180	84	27	74	74				

Catchment	T (years)	Q_{Pi} (m^3/s)	Q_{Ti} (m^3/s)									
			RM3-ARF (A)	RM3-ARF (P)	SCS	SCS-SA	SUH-ARF (A)	SUH-ARF (P)	LRH-Veld-ARF (A)	LRH-Veld-ARF (P)	LRH-T_C-ARF (A)	LRH-T_C-ARF (P)
	100	54	207	207	99	32	81	81				
	200	60	269	269	114	37	88	88				
H1H017	2	1	182	182	111	49	112	112	86	86	259	258
	5	2	255	255	193	87	149	149	114	114	343	343
	10	3	314	314	254	115	174	174	133	133	400	400
	20	4	375	375	316	143	198	198	151	151	455	455
	50	5	455	455	401	184	228	228	175	175	528	527
	100	6	525	525	467	215	252	252	193	193	581	581
	200	7	685	685	536	248	275	275	211	211	635	634
H1H018	2	229	234	57	117	61	150	86	137	31	347	78
	5	378	326	104	206	110	200	125	181	54	459	137
	10	469	401	149	274	148	232	155	210	74	534	188
	20	550	479	201	345	185	264	186	240	96	609	245
	50	643	582	277	443	240	306	228	278	127	707	324
	100	707	673	346	521	284	338	261	307	152	779	387
	200	766	881	484	602	328	370	295	336	179	853	455
H1H033	2	120	179	179	188	71	118	118	82	82	257	257
	5	209	250	250	306	118	157	157	109	109	341	342
	10	269	307	307	390	151	183	183	126	127	397	398
	20	325	367	367	476	185	208	208	144	144	452	452
	50	396	446	446	591	233	240	240	167	167	523	524
	100	446	514	514	679	268	265	265	184	184	578	578
	200	495	671	671	769	305	290	290	201	201	631	632
H2H005	2	7	107	107	36	13	46	46				
	5	12	148	148	62	23	61	61				
	10	15	181	181	81	31	70	70				
	20	17	215	215	101	39	80	80				
	50	21	259	259	128	49	91	91				
	100	23	298	298	149	57	100	100				
	200	26	387	387	171	66	109	109				
H2H008	2	7	70	70	25	7	39	39				
	5	12	97	97	43	13	51	51				
	10	16	119	119	57	18	59	59				
	20	20	141	141	71	22	67	67				
	50	24	170	170	91	29	77	77				
	100	28	195	195	106	34	84	84				
	200	31	254	254	122	39	92	92				
H3H001	2	76	114	87	56	77	201	171	305	230	385	291
	5	155	183	150	145	208	299	268	456	369	576	466
	10	218	249	212	234	337	378	350	574	485	725	613
	20	283	337	298	345	505	463	441	705	619	891	782
	50	371	527	485	532	793	591	581	898	825	1 135	1 042
	100	439	747	707	709	1 069	702	704	1 067	1 006	1 348	1 271
	200	506	1 047	1 013	919	1 389	827	844	1 257	1 213	1 588	1 533
H3H004	2	2	56	56	39	13	44	44				
	5	5	87	87	83	30	65	65				
	10	7	113	113	122	46	80	80				
	20	10	144	144	167	62	97	97				
	50	14	188	188	238	90	121	121				
	100	17	230	230	301	115	142	142				
	200	20	317	317	372	144	164	164				
H4H005	2	11	96	96	17	4	83	83				
	5	24	150	150	50	15	124	124				
	10	35	198	198	83	27	155	155				
	20	48	253	253	126	42	190	190				
	50	66	334	334	197	68	240	240				
	100	80	411	411	265	92	283	283				
	200	95	572	572	346	121	330	330				
H4H007	2	2	69	9	36	47	84	46	87		199	
	5	7	110	22	78	97	124	74	128	24	292	55
	10	11	147	38	116	138	153	96	159	38	362	86
	20	16	195	60	159	186	184	121	191	55	435	126
	50	24	298	109	226	258	229	159	237	82	541	188
	100	30	414	168	286	319	266	191	276	107	631	244
	200	37	569	252	353	389	307	227	319	135	728	308
	2	10	51	51	33	11	29	29				
	5	20	77	77	70	24	41	41				

Catchment	T (years)	Q_{Pi} (m^3/s)	Q_{Ti} (m^3/s)									
			RM3-ARF (A)	RM3-ARF (P)	SCS	SCS-SA	SUH-ARF (A)	SUH-ARF (P)	LRH-Veld-ARF (A)	LRH-Veld-ARF (P)	LRH-T_C-ARF (A)	LRH-T_C-ARF (P)
H4H009	10	27	99	99	103	36	50	50				
	20	34	124	124	140	50	60	60				
	50	44	160	160	198	72	73	73				
	100	51	193	193	249	91	85	85				
	200	58	265	265	306	113	98	98				
H4H012	2	2	30	30	23	13	27	27	21	21	57	57
	5	5	46	46	45	26	39	39	30	30	82	82
	10	8	60	60	64	37	47	47	36	36	99	99
	20	12	79	79	84	50	56	56	43	43	118	118
	50	17	119	119	115	69	69	69	53	53	145	145
	100	20	164	164	141	86	79	79	61	61	167	167
	200	24	223	223	170	103	90	90	69	69	191	191
H4H013	2	11	42	16	36	32	74	49	89	31	172	61
	5	35	63	28	72	67	103	73	124	52	240	101
	10	59	83	41	102	99	124	92	150	71	290	137
	20	88	108	58	138	133	147	114	177	92	343	178
	50	131	162	95	192	188	179	145	216	123	419	238
	100	167	223	138	241	238	206	172	249	150	483	290
	200	205	304	198	295	295	236	201	285	181	551	349
H4H015	2	15	45	45	43	38	28	28	25	25	68	68
	5	32	68	68	86	81	41	41	37	36	99	99
	10	46	88	88	124	121	51	51	45	45	122	122
	20	60	111	111	167	162	61	61	54	54	145	145
	50	78	144	144	234	231	75	75	67	67	180	180
	100	92	175	175	293	292	87	87	77	77	209	209
	200	106	240	240	360	362	100	100	89	89	242	242
H6H007	2	45	163	163	120	45	98	98				
	5	80	227	227	209	80	129	129				
	10	103	279	279	276	106	150	150				
	20	126	334	334	346	135	171	171				
	50	154	406	406	444	175	199	199				
	100	175	470	470	522	206	220	220				
	200	194	616	616	604	241	241	241				
H6H009	2	132	202	200	65	166	442	448	739	733	559	555
	5	377	307	315	151	314	618	646	1 040	1 071	788	811
	10	606	402	423	230	443	750	798	1 262	1 329	955	1 006
	20	860	528	566	324	614	889	960	1 496	1 609	1 133	1 218
	50	1 218	794	869	476	905	1 089	1 197	1 837	2 020	1 391	1 530
	100	1 500	1 096	1 216	615	1 124	1 258	1 389	2 120	2 365	1 605	1 791
	200	1 786	1 498	1 680	778	1 404	1 433	1 592	2 433	2 748	1 842	2 081
H6H010	2	2	46	46	19	9	30	30				
	5	8	64	64	35	17	39	39				
	10	14	78	78	47	24	45	45				
	20	20	92	92	60	31	51	51				
	50	29	111	111	77	41	58	58				
	100	37	127	127	92	49	64	64				
	200	44	165	165	106	57	69	69				
H7H004	2	15	39	5	14	19	31	18	33		68	
	5	34	61	13	36	53	47	29	50		102	
	10	51	81	21	57	87	59	39	62	15	128	31
	20	70	104	32	82	130	73	50	76	22	157	45
	50	95	139	49	125	201	93	67	98	33	201	67
	100	114	172	66	165	270	110	82	116	42	238	87
	200	134	241	97	213	348	130	98	136	53	280	108
H7H005	2	20	43	43	37	15	28	28				
	5	31	67	67	83	37	41	41				
	10	36	89	89	127	58	52	52				
	20	41	114	114	180	83	64	64				
	50	45	153	153	266	125	82	82				
	100	48	190	190	346	164	98	98				
	200	50	267	267	440	209	116	116				
H8H001	2	136	132	101	79	114	300	253	417	314	519	391
	5	297	214	175	198	288	451	402	624	507	777	631
	10	431	290	249	312	464	568	524	788	669	981	833
	20	569	392	348	451	676	693	658	962	850	1 198	1 058
	50	755	610	560	681	1 032	883	861	1 222	1 118	1 521	1 391
	100	895	862	807	894	1 357	1 045	1 034	1 447	1 350	1 801	1 681

Catchment	*T* (years)	Q_{Pi} (m^3/s)	Q_{Ti} (m^3/s)									
			RM3-ARF (A)	RM3-ARF (P)	SCS	SCS-SA	SUH-ARF (A)	SUH-ARF (P)	LRH-Veld-ARF (A)	LRH-Veld-ARF (P)	LRH-T_C-ARF (A)	LRH-T_C-ARF (P)
	200	1 033	1 203	1 144	1 144	1 736	1 228	1 230	1 698	1 609	2 114	2 004
H9H002	2	24	96	96	26	14	68	68	61	61	205	205
	5	55	155	155	74	43	101	101	92	92	311	311
	10	83	210	210	123	75	127	127	116	116	391	390
	20	113	284	284	184	115	156	156	141	141	477	477
	50	154	441	441	287	184	198	198	180	179	605	604
	100	187	623	623	385	249	234	234	212	212	716	716
	200	219	870	870	502	326	274	274	250	249	841	840
H9H005	2	116	72	33	39	31	133	93	149	64	295	126
	5	282	117	61	105	89	199	150	223	113	442	223
	10	425	159	91	171	152	251	197	280	157	554	310
	20	577	214	131	253	225	307	250	342	205	677	405
	50	784	333	218	391	356	389	330	436	279	862	551
	100	941	470	320	519	475	460	398	515	342	1 018	677
	200	1 097	656	458	672	621	540	474	602	413	1 191	818

Table A.19: Probabilistic and event-based deterministic DFE results in PDR J

Catchment	*T* (years)	Q_{Pi} (m^3/s)	Q_{Ti} (m^3/s)									
			RM3-ARF (A)	RM3-ARF (P)	SCS	SCS-SA	SUH-ARF (A)	SUH-ARF (P)	LRH-Veld-ARF (A)	LRH-Veld-ARF (P)	LRH-T_C-ARF (A)	LRH-T_C-ARF (P)
J1H004	2	46	297	258	10	25	914	748	830	717	937	810
	5	99	480	445	65	139	1 372	1 196	1 243	1 147	1 404	1 296
	10	143	646	622	131	285	1 711	1 549	1 548	1 488	1 748	1 681
	20	188	862	858	218	494	2 062	1 935	1 868	1 857	2 110	2 099
	50	248	1 315	1 356	372	827	2 564	2 505	2 328	2 405	2 631	2 717
	100	294	1 827	1 927	520	1 177	2 982	2 990	2 709	2 863	3 060	3 235
	200	339	2 505	2 692	698	1 570	3 436	3 523	3 112	3 356	3 516	3 792
J1H015	2	3	79	79	20	5	37	37				
	5	6	110	110	37	11	48	48				
	10	7	134	134	50	15	56	56				
	20	9	159	159	64	19	63	63				
	50	10	192	192	83	25	73	73				
	100	12	221	221	98	30	80	80				
	200	13	287	287	113	35	87	87				
J1H016	2	4	30	30	22	13	46	46	46	46	121	121
	5	10	45	45	42	26	64	64	63	63	166	166
	10	15	58	58	59	37	76	76	75	75	198	198
	20	20	74	74	78	49	88	88	87	87	230	230
	50	27	109	109	106	67	105	105	103	103	275	275
	100	33	147	147	129	83	119	119	117	117	310	310
	200	38	197	197	155	101	133	133	131	131	348	347
J1R001	2	85	121	92	44	70	160	134	190	138	228	166
	5	161	195	159	123	215	251	223	299	235	359	281
	10	225	264	225	201	358	323	298	385	319	462	383
	20	297	356	315	298	555	406	388	482	417	578	500
	50	405	551	509	461	857	534	530	634	575	760	690
	100	496	775	737	612	1 160	645	656	766	721	919	865
	200	593	1 078	1 050	792	1 505	773	804	917	887	1 099	1 064
J1R004	2	44	59	29	36	48	126	91	143	67	259	122
	5	105	95	54	95	140	188	147	214	117	388	211
	10	162	129	79	153	231	237	192	269	161	487	291
	20	227	174	113	225	344	290	242	329	210	595	379
	50	324	271	187	344	539	368	318	417	283	756	512
	100	404	382	273	455	718	434	383	494	346	895	626
	200	489	533	391	586	928	509	454	578	417	1 046	755
	2	1	31	31	11	8	10	10	4	4	9	9

Catchment	*T* (years)	Q_{Pi} (m^3/s)	Q_{Ti} (m^3/s)									
			RM3-ARF (A)	RM3-ARF (P)	SCS	SCS-SA	SUH-ARF (A)	SUH-ARF (P)	LRH-Veld-ARF (A)	LRH-Veld-ARF (P)	LRH-T_C-ARF (A)	LRH-T_C-ARF (P)
J2H007	5	3	49	49	30	24	18	18	8	8	17	17
	10	4	64	64	47	41	25	25	12	12	24	24
	20	6	82	82	69	61	34	34	16	16	33	33
	50	8	108	108	104	94	48	48	23	23	47	47
	100	10	132	132	136	123	62	62	29	29	60	59
	200	11	183	183	174	159	78	78	37	37	75	75
J2R001	2	11	98	35	42	42	40	40	28		45	
	5	30	154	68	107	119	76	76	53	13	84	21
	10	48	203	99	170	197	107	107	76	24	121	37
	20	67	260	138	248	291	145	145	103	37	162	58
	50	94	345	198	376	446	211	211	148	61	234	97
	100	115	425	256	495	599	269	269	193	85	305	134
	200	136	592	368	635	771	341	341	244	113	385	178
J2R002	2	115	203	164	39	129	134	101	159	113	152	108
	5	314	328	283	117	422	252	214	300	235	286	225
	10	498	440	395	194	729	352	317	418	351	399	335
	20	701	586	543	286	1 098	469	445	557	492	532	470
	50	986	889	854	434	1 678	655	655	777	728	742	695
	100	1 210	1 231	1 206	568	2 225	811	834	964	935	921	893
	200	1 437	1 679	1 675	720	2 854	994	1 044	1 182	1 176	1 128	1 123
J2R003	5	7	96	32	27	27	84	84	88		198	
	10	26	150	62	74	83	126	126	134	52	299	116
	20	46	199	92	121	142	158	158	168	74	376	165
	50	68	254	128	179	216	193	193	205	100	458	223
	100	100	336	185	275	343	246	246	260	139	581	310
	200	125	414	239	365	459	290	290	307	172	686	386
	2	150	577	345	471	594	339	339	359	209	804	467
J2R004	5	10	58	58	34	26	33	33	12	12	34	34
	10	34	93	93	88	74	61	61	22	22	65	65
	20	59	124	124	137	122	86	86	31	31	90	90
	50	87	164	164	192	175	113	113	41	41	119	120
	100	129	246	246	277	256	153	153	56	56	163	163
	200	163	338	338	350	329	189	189	69	69	199	200
	2	199	457	457	430	405	229	229	83	83	241	242
J2R006	5	252	620	622	109	270	1 891	1 647	1 637	1 645	1 590	1 598
	10	757	1 002	1 068	380	313	2 847	2 724	2 460	2 632	2 389	2 556
	20	1 240	1 349	1 490	662	1 695	3 544	3 573	3 065	3 404	2 977	3 307
	50	1 778	1 804	2 052	1 015	2 565	4 275	4 508	3 698	4 235	3 592	4 114
	100	2 546	2 754	3 233	1 602	4 105	5 330	5 884	4 607	5 460	4 475	5 304
	200	3 153	3 832	4 582	2 148	5 566	6 204	7 050	5 369	6 491	5 215	6 305
	2	3 772	5 260	6 383	2 788	7 162	7 152	8 314	6 194	7 592	6 016	7 374
J3H005	5	43	58	18	64	63	17	9	14	3	39	8
	10	89	95	37	150	160	29	18	25	7	69	18
	20	128	130	58	232	253	41	26	35	11	95	30
	50	172	177	86	332	368	54	37	47	17	126	45
	100	235	279	148	499	559	78	56	66	27	179	72
	200	287	399	222	655	742	101	74	85	37	229	99
	2	341	564	326	841	955	129	97	108	49	291	132
J3H012	5	65	125	79	12	20	185	144	184	107	264	153
	10	151	202	142	53	98	293	246	292	191	418	273
	20	225	274	204	100	196	384	335	379	267	543	382
	50	304	369	289	163	330	488	440	477	355	683	508
	100	413	574	471	276	580	646	605	633	495	906	708
	200	496	809	683	387	841	787	753	773	624	1 106	893
	2	580	1 128	971	523	1 147	954	926	930	773	1 331	1 106
J3H014	5	15	104	28	48	39	64	64	38		69	
	10	28	162	58	122	108	109	109	64	16	117	29
	20	38	214	88	193	174	147	147	87	26	159	47
	50	48	275	125	280	258	192	192	113	39	205	70
	100	61	363	183	423	398	266	266	155	60	282	109
	200	70	448	238	555	528	332	332	195	81	354	147
	2	79	624	345	709	683	411	411	241	104	438	189
J3H015	5	7	77	77	11	5	25	25	11	11	29	29
	10	19	121	121	38	23	45	45	20	20	52	52
	20	29	160	160	67	45	63	63	28	28	73	73
	50	41	205	205	105	73	84	84	38	38	98	98
	100	57	271	271	171	122	119	119	54	54	138	138

Catchment	T (years)	Q_{Pi} (m^3/s)	Q_{Ti} (m^3/s)									
			RM3-ARF (A)	RM3-ARF (P)	SCS	SCS-SA	SUH-ARF (A)	SUH-ARF (P)	LRH-Veld-ARF (A)	LRH-Veld-ARF (P)	LRH-T_C-ARF (A)	LRH-T_C-ARF (P)
	200	69	334	334	234	171	153	153	68	68	176	175
	2	81	466	466	311	230	191	191	86	86	221	221
J3H020	5	7	23	23	10	8	16	16	7	7	15	15
	10	28	37	37	28	28	30	30	13	13	28	28
	20	50	50	50	47	49	42	42	19	19	40	40
	50	74	68	68	70	76	57	57	26	26	55	55
	100	108	105	105	110	122	82	82	37	37	78	78
	200	135	149	149	147	166	105	105	48	48	101	101
	2	162	207	207	191	218	133	133	61	61	130	129
J3R001	5	18	174	150	57	160	258	221	520	444	580	495
	10	292	282	258	165	493	394	359	795	721	887	805
	20	587	384	364	276	840	503	476	1 015	958	1 132	1 069
	50	929	521	509	417	1 286	624	608	1 258	1 224	1 404	1 365
	100	1 424	816	819	659	2 064	810	814	1 633	1 638	1 821	1 827
	200	1 819	1 159	1 181	891	2 825	974	996	1 964	2 006	2 190	2 237
	2	2 221	1 627	1 677	1 171	3 722	1 164	1 206	2 348	2 431	2 618	2 712
J3R002	5	196	226	216	20	99	592	301	876	837	745	712
	10	487	365	369	92	410	882	819	1 308	1 323	1 113	1 125
	20	757	495	517	175	823	1 109	1 079	1 642	1 720	1 397	1 462
	50	1 060	669	716	287	1 352	1 356	1 367	2 008	2 163	1 708	1 840
	100	1 498	1 038	1 141	488	2 348	1 725	1 806	2 555	2 820	2 173	2 398
	200	1 851	1 465	1 633	686	3 327	2 035	2 177	3 014	3 380	2 563	2 875
	5	2 216	2 042	2 301	930	4 532	2 383	2 590	3 529	4 009	3 001	3 410
J4H002	2	150	1 071	1 248	268	826	2 534	2 852	1 788	2 100	1 650	1 938
	5	613	1 732	2 128	888	2 020	3 811	4 550	2 666	3 310	2 460	3 054
	10	1 072	2 342	2 971	1 536	3 117	4 762	5 913	3 339	4 294	3 080	3 962
	20	1 583	3 150	4 099	2 360	4 798	5 790	7 412	4 060	5 378	3 746	4 962
	50	2 305	4 858	6 496	3 760	7 428	7 296	9 636	5 130	6 981	4 733	6 442
	100	2 868	6 816	9 260	5 084	1 891	8 575	11 531	6 033	8 348	5 566	7 703
	200	3 435	9 444	12 989	6 664	2 470	9 974	13 647	7 019	9 875	6 476	9 111
J4H004	2	12	75	25	53	65	79	51	87	28	175	55
	5	34	117	49	121	156	118	82	131	51	261	103
	10	56	155	72	185	245	149	109	165	73	329	146
	20	80	199	100	260	347	182	138	201	98	401	197
	50	115	263	145	381	520	231	183	256	136	511	271
	100	144	324	187	490	674	273	221	302	169	602	336
	200	173	452	269	617	850	321	263	353	204	705	408

Table A.20: Probabilistic and event-based deterministic DFE results in PDR K

Catchment	T (years)	Q_{Pi} (m^3/s)	Q_{Ti} (m^3/s)									
			RM3-ARF (A)	RM3-ARF (P)	SCS	SCS-SA	SUH-ARF (A)	SUH-ARF (P)	LRH-Veld-ARF (A)	LRH-Veld-ARF (P)	LRH-T_C-ARF (A)	LRH-T_C-ARF (P)
K1H002	2	4		9	12	5	3	3				
	5	7	14	14	29	11	4	4				
	10	9	19	19	45	18	6	6				
	20	10	26	26	64	26	7	7				
	50	13	41	41	97	40	10	10				
	100	14	59	59	127	53	13	13				
	200	16	84	84	163	68	16	16				
K1H018	2	3	7	7	10	4	2	2				
	5	8	11	11	24	11	4	4				
	10	11	15	15	38	18	5	5				
	20	14	20	20	55	26	6	6				
	50	20	31	31	83	39	8	8				
	100	24	45	45	109	52	11	11				
	200	29	64	64	141	68	13	13				
	2	1	5	5	5	2	4	4				

Catchment	T (years)	Q_{Pi} (m^3/s)	Q_{Ti} (m^3/s)									
			RM3-ARF (A)	RM3-ARF (P)	SCS	SCS-SA	SUH-ARF (A)	SUH-ARF (P)	LRH-Veld-ARF (A)	LRH-Veld-ARF (P)	LRH-T_C-ARF (A)	LRH-T_C-ARF (P)
K3H002	5	2	8	8	13	5	6	6				
	10	3	10	10	20	7	8	8				
	20	4	13	13	28	11	10	10				
	50	5	18	18	43	16	12	12				
	100	5	23	23	56	21	15	15				
	200	6	32	32	72	28	18	18				
K3H004	2	51	76	76	50	27	16	16	11	11	40	40
	5	103	119	119	115	66	26	26	17	17	64	64
	10	140	159	159	178	105	34	34	23	23	85	84
	20	178	206	206	255	152	44	44	29	29	108	108
	50	231	278	278	383	234	60	60	40	40	147	146
	100	274	348	348	503	308	75	75	49	49	182	182
	200	320	493	493	646	399	94	94	61	61	224	224
K4H001	2	56	111	38	40	32	35	21	37	11	93	27
	5	126	175	74	101	87	56	37	59	21	149	54
	10	178	233	110	162	15	73	51	78	32	195	80
	20	233	302	155	239	216	94	68	99	45	249	113
	50	312	407	227	370	341	128	97	134	66	336	166
	100	377	510	298	495	458	160	124	166	86	415	216
	200	447	722	436	646	604	198	156	204	110	511	275
K4H003	2	23	85	15	27	19	8	3	6		19	
	5	73	133	35	72	54	15	7	12	1	38	4
	10	112	178	56	119	93	21	11	17	3	54	8
	20	155	230	83	178	144	29	17	23	4	75	14
	50	219	310	127	281	231	43	26	34	8	109	26
	100	275	388	170	380	315	56	36	45	12	144	39
	200	338	549	253	501	418	74	48	58	17	187	55
K6H001	2	24	123	64	26	27	13	8	16	5	33	11
	5	113	193	114	72	82	25	17	30	12	62	26
	10	183	257	163	120	141	35	26	42	20	88	42
	20	259	331	222	180	216	48	37	57	30	120	64
	50	373	444	314	285	348	70	57	84	49	175	101
	100	472	552	403	386	474	92	76	109	66	227	138
	200	583	778	581	508	629	119	101	141	89	293	185
K8H001	2	53	55	55	29	15	4	4	3	3	10	10
	5	84	87	87	70	40	8	8	5	5	18	18
	10	104	116	116	109	65	11	11	7	7	26	26
	20	122	150	150	158	96	15	15	10	10	36	36
	50	144	200	200	240	147	22	22	14	14	53	53
	100	160	250	250	317	196	28	28	19	19	69	69
	200	176	352	352	409	255	37	37	24	24	89	89
K8H002	41	41	71	71	33	16	5	5	3	3	12	12
	105	105	112	112	82	42	10	10	6	6	23	23
	156	156	150	150	130	68	14	14	8	8	33	33
	212	212	194	194	191	103	19	19	11	11	45	45
	297	297	260	260	293	159	28	28	17	17	66	67
	372	372	325	325	390	215	36	36	22	22	87	87
	456	456	459	459	507	281	47	47	28	28	112	113
K8H005	28	28	88	46	50	52	80	58	96	47	163	79
	87	87	142	84	116	128	125	96	148	83	251	140
	132	132	195	123	179	201	161	129	191	114	324	193
	180	180	266	177	257	293	203	167	240	152	406	257
	251	251	420	295	387	445	269	229	315	212	534	359
	311	311	600	435	508	589	323	285	384	266	650	450
	377	377	848	629	652	762	381	341	464	329	787	557

Table A.21: Probabilistic and event-based deterministic DFE results in PDR L

Catchment	***T* (years)**	**Q_{Pi} (m³/s)**	**Q_{Ti} (m³/s)**									
			RM3-ARF (A)	**RM3-ARF (P)**	**SCS**	**SCS-SA**	**SUH-ARF (A)**	**SUH-ARF (P)**	**LRH-Veld-ARF (A)**	**LRH-Veld-ARF (P)**	**LRH-T_C-ARF (A)**	**LRH-T_C-ARF (P)**
L1H001	2	137	188	171	113	247	165	129	170	146	144	124
	5	277	300	289	284	624	304	263	315	295	267	249
	10	392	399	398	437	997	420	386	434	431	368	365
	20	514	527	539	611	1 391	551	535	570	592	483	501
	50	685	790	833	876	2 015	752	769	777	847	658	718
	100	819	1 083	1 161	1 103	2 534	925	975	959	1 072	812	908
	200	955	1 463	1 591	1 354	3 126	1 122	1 204	1 156	1 319	979	1 117
L2H003	2	48	159	110	59	106	158	91	178	98	147	80
	5	102	246	188	146	272	277	180	313	199	258	164
	10	149	324	261	224	435	377	259	419	299	346	247
	20	200	423	358	315	625	483	355	540	413	445	340
	50	272	629	557	455	901	647	507	730	598	602	492
	100	331	858	781	577	1 154	793	639	894	767	737	632
	200	390	1 156	1 072	713	1 444	959	791	1 068	950	881	783
L6H001	2	105	86	71	22	57	90	66	105	77	96	70
	5	218	139	122	70	205	169	136	197	159	180	145
	10	310	186	169	117	347	234	201	272	235	248	215
	20	406	247	233	175	534	309	279	362	327	330	298
	50	537	375	365	270	839	431	411	505	481	462	439
	100	637	519	514	356	1 107	543	528	631	621	577	567
	200	738	710	713	455	1 440	663	662	772	778	705	711
L8H001	2	48	47	47	58	22	4	4				
	5	114	74	74	127	51	7	7				
	10	172	98	98	191	78	10	10				
	20	233	126	126	266	109	14	14				
	50	317	167	167	386	161	20	20				
	100	382	207	207	496	208	26	26				
	200	447	290	290	623	263	34	34				
L8H002	2	28	73	10	56	42	8	3	5		16	
	5	71	115	26	123	98	15	7	10		30	
	10	110	152	43	184	150	20	11	14	2	43	5
	20	153	194	64	256	210	28	16	19	3	58	9
	50	213	257	97	370	308	39	24	27	6	82	17
	100	259	317	129	473	396	51	32	35	8	106	25
	200	306	441	189	591	499	65	42	44	12	135	35
L8H005	2	96	461	394	361	901	162	131	319	256	386	309
	5	292	746	679	770	1 982	285	249	560	488	676	590
	10	480	1 013	957	1 138	2 961	392	361	772	708	932	856
	20	689	1 371	1 333	1 567	4 106	523	502	1 030	986	1 244	1 190
	50	985	2 136	2 138	2 247	5 961	735	738	1 447	1 448	1 747	1 749
	100	1 219	3 022	3 075	2 858	7 622	894	911	1 764	1 795	2 131	2 168
	200	1 457	4 224	4 351	3 561	9 580	1 041	1 074	2 056	2 117	2 483	2 557

Table A.22: Probabilistic and event-based deterministic DFE results in PDR N

Catchment	***T* (years)**	**Q_{Pi} (m³/s)**	**Q_{Ti} (m³/s)**									
			RM3-ARF (A)	**RM3-ARF (P)**	**SCS**	**SCS-SA**	**SUH-ARF (A)**	**SUH-ARF (P)**	**LRH-Veld-ARF (A)**	**LRH-Veld-ARF (P)**	**LRH-T_C-ARF (A)**	**LRH-T_C-ARF (P)**
N1R001	2	106	326	282	31	91	271	203	351	276	258	203
	5	333	510	473	114	331	481	405	623	552	458	406
	10	558	673	651	200	576	658	593	853	808	628	595
	20	813	884	885	306	902	856	813	1109	1111	816	818
	50	1 185	1 322	1 370	480	1440	1168	1164	1504	1591	1107	1171
	100	1 484	1 810	1 915	638	1897	1434	1469	1837	2007	1352	1477
	200	1 793	2 447	2 629	821	2473	1741	1821	2218	2489	1633	1832

N2H002	2	151	438	435	40	174	451	376	479	474	327	324
	5	436	686	723	156	605	809	773	848	921	580	629
	10	699	906	991	278	943	1084	1118	1144	1319	782	901
	20	985	1 192	1 341	429	1430	1407	1542	1483	1791	1014	1224
	50	1 382	1 784	2 067	679	2252	1896	2228	2014	2534	1376	1731
	100	1 688	2 445	2 881	908	2895	2340	2827	2461	3193	1682	2182
	200	1 994	3 308	3 949	1173	3706	2817	3521	2974	3961	2033	2707
N2H005	2	450	429	434	35	178	380	387	498	507	325	331
	5	894	672	721	140	655	676	746	875	978	571	638
	10	1 268	889	987	250	1027	913	1069	1187	1401	775	915
	20	1 679	1 170	1 335	389	1516	1184	1456	1541	1909	1006	1246
	50	2 276	1 753	2 057	618	2437	1605	2051	2092	2689	1365	1755
	100	2 761	2 404	2 866	830	3133	1972	2593	2561	3399	1671	2218
	200	3 269	3 254	3 928	1075	4033	2385	3223	3106	4226	2027	2758
N2H008	2	16	47	32	3	7	50	32	54	30	45	25
	5	33	73	55	13	31	90	64	97	61	81	51
	10	47	97	77	24	59	121	93	132	91	110	76
	20	61	127	105	38	98	158	128	172	126	143	105
	50	80	191	164	61	160	217	183	236	183	196	152
	100	94	261	230	82	221	267	230	290	236	241	196
	200	108	354	316	107	289	322	284	349	294	291	244
N2R001	2	235	501	510	48	198	445	453	568	587	367	379
	5	808	785	850	180	567	793	877	997	1128	645	729
	10	1 363	1 039	1 165	318	823	1070	1264	1353	1626	875	1051
	20	1 978	1 368	1 577	489	1166	1391	1734	1764	2221	1140	1436
	50	2 848	2 049	2 432	771	1839	1897	2467	2395	3141	1548	2030
	100	3 529	2 811	3 390	1029	2165	2323	3122	2938	3980	1900	2573
	200	4 215	3 806	4 647	1329	2715	2812	3888	3569	4947	2308	3198
N3H001	2	222	132	110	55	165	154	105	211	157	131	97
	5	507	206	184	134	432	267	210	368	309	228	191
	10	760	271	253	206	666	364	306	501	447	309	276
	20	1 038	355	342	288	954	474	422	651	614	403	379
	50	1 435	530	527	416	1390	636	605	877	871	542	538
	100	1 752	724	734	527	1772	777	761	1070	1093	661	676
	200	2 078	977	1 004	651	2206	936	943	1289	1348	797	834

Table A.23: Probabilistic and event-based deterministic DFE results in PDR P

Catchment	***T* (years)**	**Q_{Pi} (m^3/s)**	**Q_{Ti} (m^3/s)**									
			RM3-ARF (A)	**RM3-ARF (P)**	**SCS**	**SCS-SA**	**SUH-ARF (A)**	**SUH-ARF (P)**	**LRH-Veld-ARF (A)**	**LRH-Veld-ARF (P)**	**LRH-T_C-ARF (A)**	**LRH-T_C-ARF (P)**
P3H001	2	27	85	71	5	19	75	56	126	93	76	56
	5	107	139	122	24	92	138	114	233	190	140	114
	10	190	190	172	48	186	198	172	332	285	200	172
	20	284	258	240	80	324	269	243	452	404	272	244
	50	421	403	386	139	578	393	370	660	616	398	371
	100	532	573	557	198	838	513	493	861	823	519	496
	200	645	804	791	272	1 172	653	622	1 072	1 055	646	636
P4H001	2	47	124	99	31	85	86	60	132	92	85	59
	5	200	202	171	88	259	159	123	243	189	156	121
	10	354	275	243	146	439	227	186	347	284	223	183
	20	527	373	340	220	676	308	266	472	406	303	261
	50	773	585	548	346	1 078	450	405	689	619	443	398
	100	966	831	792	465	1 467	587	543	897	831	577	534
	200	1 161	1 166	1 125	609	1 931	754	714	1 154	1 094	742	704

Table A.24: Probabilistic and event-based deterministic DFE results in PDR Q

Catchment	*T* (years)	Q_{Pi} (m³/s)	Q_{Ti} (m³/s)									
			RM3-ARF (A)	RM3-ARF (P)	SCS	SCS-SA	SUH-ARF (A)	SUH-ARF (P)	LRH-Veld-ARF (A)	LRH-Veld-ARF (P)	LRH-T_C-ARF (A)	LRH-T_C-ARF (P)
Q1H012	2	76	129	156	15	40	177	116	225	165	158	116
	5	130	232	205	48	122	293	213	367	304	258	213
	10	167	297	274	79	203	378	293	477	418	335	293
	20	201	380	362	114	302	469	385	596	548	418	385
	50	243	610	600	217	572	715	621	910	886	638	622
	100	273	735	737	217	584	715	640	910	913	638	641
	200	302	970	987	269	718	838	770	1 054	1 083	740	760
Q3H005	2	109	443	456	47	130	484	376	496	473	321	306
	5	227	688	708	160	369	823	725	832	871	539	564
	10	325	891	949	271	565	1 068	1 024	1 086	1 199	703	776
	20	429	1 150	1 260	404	795	1 339	1 366	1 366	1 576	884	1 020
	50	573	1 683	1 899	616	1 252	1 745	1 905	1 776	2 161	1 149	1 398
	100	686	2 268	2 606	802	1 507	2 086	2 377	2 129	2 648	1 378	1 714
	200	801	3 018	3 518	1 012	1 887	2 464	2 883	2 505	3 189	1 621	2 064
Q4H003	2	35	82	95	34	89	131	89	176	138	112	88
	5	68	143	130	79	213	219	167	290	251	184	159
	10	95	184	174	118	323	284	229	378	344	240	218
	20	123	236	229	161	452	356	302	475	452	301	287
	50	161	343	343	226	636	461	415	620	618	393	392
	100	190	461	468	280	795	551	513	735	752	466	477
	200	220	610	628	339	965	650	612	857	897	543	569
Q4R002	2	80	330	400	43	51	355	241	335	246	287	211
	5	159	594	531	129	163	580	449	549	458	472	394
	10	222	762	713	210	265	759	627	713	641	612	551
	20	286	975	947	303	387	946	835	895	852	769	732
	50	371	1 411	1 424	447	568	1 218	1 138	1 148	1 167	986	1 002
	100	435	1 887	1 947	570	729	1 446	1 398	1 360	1 434	1 168	1 232
	200	499	2 491	2 616	706	905	1 686	1 665	1 587	1 709	1 363	1 468
Q6H003	2	62	95	132	25	43	122	81	147	86	120	70
	5	125	203	160	74	131	212	156	253	173	207	141
	10	174	266	221	122	217	284	223	340	253	278	207
	20	224	348	301	178	328	366	305	440	346	360	283
	50	291	518	466	269	505	495	428	596	499	487	408
	100	342	707	651	351	666	606	536	724	638	592	522
	200	392	953	893	444	840	726	659	869	784	711	641
Q8H004	2	53	95	164	62	53	132	73	153	61	141	56
	5	105	253	166	152	214	231	144	268	133	247	123
	10	152	332	234	234	336	311	207	357	205	329	189
	20	205	433	325	330	477	398	284	460	291	424	268
	50	286	645	512	478	707	535	405	620	425	572	392
	100	354	880	722	609	910	658	517	764	550	705	507
	200	428	1 187	997	755	1 129	800	636	917	694	845	639
Q8H008	2	49	135	158	25	71	160	114	245	189	157	121
	5	156	242	221	74	220	272	218	416	359	267	230
	10	258	317	301	121	360	367	315	561	514	360	330
	20	369	415	405	178	542	475	431	729	701	467	450
	50	526	617	621	270	828	636	614	970	981	622	629
	100	647	843	864	352	1 088	774	770	1 184	1 230	759	788
	200	768	1 137	1 180	446	1 389	934	951	1 428	1 517	915	972
Q8H010	2	35	95	165	62	83	132	73	153	60	141	56
	5	74	254	166	153	214	230	143	268	132	247	122
	10	107	333	235	236	336	311	206	357	204	329	188
	20	142	435	326	332	478	398	283	460	290	424	267
	50	191	648	513	482	708	534	404	620	424	572	391
	100	229	884	724	613	912	658	516	764	548	704	505
	200	267	1 192	1 000	760	1 130	799	634	916	692	845	638
Q8R001	2	79	119	131	50	169	164	73	224	192	128	109
	5	208	201	194	120	430	281	222	382	359	218	205
	10	323	264	262	183	657	378	321	515	510	294	291
	20	446	345	352	256	936	488	442	668	690	381	394
	50	617	513	537	369	1 359	658	634	890	956	508	546
	100	749	700	744	468	1 730	799	797	1 086	1 194	620	682
	200	880	945	1 014	580	2 151	962	984	1 310	1 467	748	838
	2	54	133	163	68	118	196	73	191	136	172	122
	5	297	248	217	161	293	335	256	319	257	287	231

Catchment	T (years)	Q_{Pi} (m^3/s)	Q_{Ti} (m^3/s)									
			RM3-ARF (A)	RM3-ARF (P)	SCS	SCS-SA	SUH-ARF (A)	SUH-ARF (P)	LRH-Veld-ARF (A)	LRH-Veld-ARF (P)	LRH-T_C-ARF (A)	LRH-T_C-ARF (P)
Q9H002	10	548	324	295	245	448	446	365	429	367	386	330
	20	835	423	397	342	627	573	497	555	499	500	449
	50	1 248	629	609	494	924	774	697	739	703	665	633
	100	1 575	858	847	628	1 177	951	873	900	881	810	793
	200	1 909	1 158	1 158	779	1 464	1 139	1 076	1 087	1 087	978	978
Q9H014	2	20	40	131	74	48	243	73	50		85	
	5	42	200	78	166	111	415	415	87	18	148	30
	10	59	262	116	246	171	563	563	116	31	197	53
	20	76	343	168	337	236	727	727	149	47	254	79
	50	99	510	274	478	341	972	972	200	74	341	125
	100	116	697	394	599	429	1 187	1 187	247	99	419	168
	200	133	940	553	735	529	1 437	1 437	300	126	510	215
Q9H029	2	52	167	208	88	160	208	73	217	152	186	130
	5	121	317	272	193	358	347	264	364	283	312	243
	10	181	414	370	286	536	467	378	491	406	421	349
	20	245	542	500	394	749	604	514	629	554	539	475
	50	335	809	770	561	1 074	813	725	844	781	723	669
	100	405	1 108	1 075	709	1 360	995	917	1 038	987	890	846
	200	475	1 501	1 476	875	1 693	1 205	1 141	1 265	1 229	1 084	1 053
Q9H030	2	29	41	128	61	41	213	73	50		85	
	5	59	196	79	141	98	365	365	87	19	148	32
	10	82	256	117	212	154	494	494	116	32	198	55
	20	106	335	168	294	216	638	638	149	48	253	82
	50	138	499	274	421	314	851	851	201	76	341	130
	100	163	682	393	532	399	1 043	1 043	247	102	420	174
	200	187	920	551	656	495	1 263	1 263	300	130	510	221
Q9R001	2	89	52	138	48	48	174	73	76	15	121	23
	5	156	210	96	110	115	295	295	129	37	206	58
	10	204	275	140	168	181	395	395	173	58	276	92
	20	250	360	200	236	257	513	513	225	87	358	139
	50	311	540	324	344	380	703	703	308	134	491	213
	100	357	742	465	440	493	862	862	378	177	602	282
	200	404	1 007	652	550	619	1 047	1 047	459	229	731	364

Table A.25: Probabilistic and event-based deterministic DFE results in PDR R

Catchment	T (years)	Q_{Pi} (m^3/s)	Q_{Ti} (m^3/s)									
			RM3-ARF (A)	RM3-ARF (P)	SCS	SCS-SA	SUH-ARF (A)	SUH-ARF (P)	LRH-Veld-ARF (A)	LRH-Veld-ARF (P)	LRH-T_C-ARF (A)	LRH-T_C-ARF (P)
R1H013	2	181	192	168	79	199	246	186	250	203	176	143
	5	465	294	273	184	471	422	352	429	380	302	268
	10	730	390	374	283	729	576	512	587	550	414	387
	20	1 028	516	508	402	1 037	754	703	768	750	541	528
	50	1 459	785	794	597	1 543	1 043	1 024	1 063	1 084	749	764
	100	1 805	1 092	1 122	777	2 011	1 320	1 333	1 344	1 403	947	989
	200	2 163	1 504	1 562	988	2 566	1 642	1 690	1 683	1 785	1 186	1 257
R2H005	2	104	154	99	67	98	188	119	161	78	169	82
	5	284	241	171	158	240	336	235	287	163	301	171
	10	450	324	242	247	384	469	342	400	250	419	262
	20	633	434	339	355	562	625	480	772	791	559	380
	50	891	672	549	536	860	894	722	762	550	799	577
	100	1 093	946	793	704	1 130	1 157	958	987	738	1 035	774
	200	1 297	1 319	1 126	904	1 466	1 466	1 232	1 245	973	1 306	1 020
R2H012	2	12	27	27	11	8	34	34				
	5	25	41	41	25	20	57	57				
	10	35	54	54	39	31	76	76				
	20	46	71	71	54	45	100	100				
	50	61	107	107	79	67	136	136				

Catchment	***T* (years)**	**Q_{Pi} (m^3/s)**	**Q_{Ti} (m^3/s)**									
			RM3-ARF (A)	**RM3-ARF (P)**	**SCS**	**SCS-SA**	**SUH-ARF (A)**	**SUH-ARF (P)**	**LRH-Veld-ARF (A)**	**LRH-Veld-ARF (P)**	**LRH-T_C-ARF (A)**	**LRH-T_C-ARF (P)**
	100	73	148	148	102	86	168	168				
	200	85	201	201	127	109	206	206				
R2H015	2	42	53	38	19	48	60	40	74	44	56	33
	5	87	85	65	48	129	109	79	136	88	103	67
	10	123	115	92	76	214	154	116	191	134	145	102
	20	160	155	128	112	320	208	164	258	191	196	145
	50	211	242	207	172	499	302	248	375	291	285	221
	100	249	343	299	229	671	392	327	485	391	369	298
	200	288	480	425	297	876	500	417	619	510	471	388

Table A.26: Probabilistic and event-based deterministic DFE results in PDR S

Catchment	***T* (years)**	**Q_{Pi} (m^3/s)**	**Q_{Ti} (m^3/s)**									
			RM3-ARF (A)	**RM3-ARF (P)**	**SCS**	**SCS-SA**	**SUH-ARF (A)**	**SUH-ARF (P)**	**LRH-Veld-ARF (A)**	**LRH-Veld-ARF (P)**	**LRH-T_C-ARF (A)**	**LRH-T_C-ARF (P)**
S3H003	2	6	64	39	26	34	62	32	54	25	56	26
	5	14	96	66	59	77	105	61	91	49	95	51
	10	21	125	91	86	116	140	85	120	73	126	76
	20	29	162	124	118	160	176	114	153	99	160	104
	50	39	239	191	166	229	234	160	204	141	213	147
	100	48	324	266	207	292	284	200	248	178	260	187
	200	56	435	364	253	358	342	243	295	222	308	232
S3H004	2	63	138	117	52	136	145	99	160	120	127	95
	5	141	209	189	116	297	241	189	265	225	210	178
	10	208	272	255	172	440	320	270	352	317	280	251
	20	278	353	341	234	601	409	365	450	426	357	338
	50	373	521	519	330	850	542	514	597	595	474	472
	100	446	707	717	412	1 076	653	639	719	736	570	584
	200	519	948	974	504	1 316	778	779	857	896	680	710
S3H006	2	60	285	250	132	101	216	176	278	224	258	208
	5	126	414	387	256	203	338	305	435	390	404	362
	10	179	526	511	356	292	434	416	557	531	517	494
	20	234	668	669	463	377	536	540	688	690	640	641
	50	307	959	990	618	511	677	713	869	914	808	850
	100	362	1 276	1 340	744	620	792	858	1 017	1 098	946	1 021
	200	417	1 678	1 785	879	734	916	1 013	1 176	1 299	1 093	1 207
S6H001	2	18	55	19	52	38	62	26	35	6	46	8
	5	39	85	36	108	85	107	53	60	15	81	20
	10	58	114	54	160	127	148	79	83	25	112	33
	20	77	153	78	222	177	200	113	112	38	151	51
	50	103	236	131	323	261	283	169	160	62	215	83
	100	123	333	193	416	341	363	226	205	86	275	115
	200	142	464	279	525	432	463	296	261	116	350	156

Table A.27: Probabilistic and event-based deterministic DFE results in PDR T

Catchment	T (years)	Q_{Pi} (m^3/s)	Q_{Ti} (m^3/s)									
			RM3-ARF (A)	RM3-ARF (P)	SCS	SCS-SA	SUH-ARF (A)	SUH-ARF (P)	LRH-Veld-ARF (A)	LRH-Veld-ARF (P)	LRH-T_C-ARF (A)	LRH-T_C-ARF (P)
T1H001	2	130	218	173	71	129	223	150	229	160	205	143
	5	297	321	274	148	272	353	266	369	284	330	254
	10	441	413	367	215	393	461	372	486	398	435	356
	20	592	532	488	292	539	584	495	606	530	542	474
	50	798	780	739	409	749	763	676	789	725	706	648
	100	956	1 055	1 018	510	936	913	838	951	897	851	802
	200	1 113	1 411	1 381	624	1 145	1 085	1 020	1 134	1 095	1 015	979
T1H004	2	325	451	474	228	480	395	339	456	495	360	391
	5	615	683	753	485	778	663	631	770	899	607	709
	10	837	898	1 018	719	995	897	907	1 039	1 269	820	1 001
	20	1 064	1 184	1 371	999	1 331	1 172	1 244	1 353	1 705	1 068	1 345
	50	1 370	1 792	2 120	1 448	1 949	1 602	1 789	1 857	2 436	1 465	1 922
	100	1 604	2 487	2 978	1 858	2 342	2 012	2 312	2 333	3 135	1 840	2 474
	200	1 840	3 418	4 129	2 337	2 911	2 506	2 947	2 911	3 968	2 297	3 131
T3H005	2	298	276	250	107	210	390	277	316	270	241	206
	5	570	412	395	233	381	635	507	519	485	396	370
	10	776	536	531	349	515	849	722	693	682	528	520
	20	982	700	712	487	715	1 095	975	887	911	676	695
	50	1 251	1 044	1 092	707	1 023	1 471	1 381	1 190	1 278	907	975
	100	1 453	1 434	1 522	905	1 282	1 808	1 757	1 471	1 616	1 121	1 232
	200	1 651	1 949	2 092	1 135	1 588	2 208	2 203	1 798	2 018	1 370	1 539
T3H006	2	409	422	390	144	268	554	383	432	381	343	303
	5	761	629	617	322	460	907	720	711	689	565	547
	10	1 018	819	831	486	586	1 211	1 041	945	968	750	769
	20	1 270	1 069	1 116	683	812	1 557	1 431	1 213	1 296	963	1 029
	50	1 593	1 595	1 713	997	1 174	2 104	2 038	1 626	1 823	1 291	1 448
	100	1 829	2 190	2 389	1 282	1 445	2 579	2 605	2 006	2 310	1 593	1 834
	200	2 058	2 977	3 286	1 613	1 783	3 145	3 277	2 456	2 887	1 950	2 293
T3H007	2	313	533	514	162	239	428	395	520	491	394	372
	5	601	794	810	365	406	694	700	845	872	641	662
	10	823	1 032	1 089	551	517	920	979	1 117	1 220	847	925
	20	1 051	1 346	1 459	773	701	1 182	1 319	1 434	1 626	1 087	1 233
	50	1 359	2 005	2 234	1 129	1 032	1 581	1 844	1 916	2 277	1 453	1 727
	100	1 594	2 750	3 110	1 451	1 255	1 940	2 335	2 357	2 881	1 787	2 184
	200	1 830	3 733	4 270	1 823	1 550	2 367	2 914	2 881	3 603	2 184	2 732
T3H009	2	103	104	80	44	62	99	55	92	61	73	48
	5	192	155	127	88	128	159	97	149	108	118	85
	10	257	200	170	124	185	210	136	198	151	156	120
	20	321	258	226	166	249	268	183	248	202	196	160
	50	403	381	344	229	346	351	254	327	278	258	219
	100	463	518	475	284	432	425	317	397	346	314	274
	200	522	696	647	345	527	511	390	479	425	378	336
T4H001	2	89	292	202	85	110	290	149	228	126	241	134
	5	264	447	338	198	257	501	290	399	253	422	268
	10	428	596	474	311	404	708	437	559	387	592	410
	20	611	795	660	456	593	963	632	755	564	799	597
	50	868	1 223	1 059	709	928	1 397	982	1 105	876	1 171	928
	100	1 070	1 723	1 527	956	1 252	1 844	1 346	1 468	1 202	1 555	1 273
	200	1 275	2 413	2 177	1 261	1 646	2 429	1 803	1 892	1 616	2 004	1 712
T5H001	2	545	485	438	184	308	364	310	420	355	352	298
	5	1 179	728	699	392	502	606	569	697	653	584	547
	10	1 706	952	948	583	641	813	809	935	929	783	778
	20	2 257	1 251	1 282	811	858	1 050	1 095	1 210	1 258	1 014	1 054
	50	3 004	1 883	1 987	1 178	1 272	1 432	1 566	1 647	1 796	1 380	1 505
	100	3 572	2 605	2 795	1 513	1 529	1 790	2 009	2 061	2 309	1 727	1 934
	200	4 139	3 569	3 876	1 905	1 911	2 222	2 548	2 554	2 929	2 140	2 454
T5H003	2	30	95	50	45	42	85	37	66	23	74	26
	5	61	141	84	86	85	137	67	106	46	120	52
	10	86	183	116	122	122	181	95	142	68	160	76
	20	111	238	159	162	163	233	130	181	94	205	106
	50	146	354	250	225	227	312	182	241	139	272	157
	100	172	485	353	278	282	380	230	296	179	333	202
	200	199	656	488	339	347	461	286	359	224	405	253
	2	89	285	163	70	58	189	113	158	63	210	84
	5	174	423	273	156	129	307	201	254	126	339	168

Catchment	T (years)	Q_{Pi} (m^3/s)	Q_{Ti} (m^3/s)									
			RM3-ARF (A)	RM3-ARF (P)	SCS	SCS-SA	SUH-ARF (A)	SUH-ARF (P)	LRH-Veld-ARF (A)	LRH-Veld-ARF (P)	LRH-T_C-ARF (A)	LRH-T_C-ARF (P)
T5H004	10	240	549	379	234	199	410	286	337	185	450	246
	20	307	714	520	326	274	520	393	434	257	580	343
	50	395	1 062	815	472	398	693	556	576	379	768	506
	100	462	1 452	1 149	603	513	850	704	704	487	940	651
	200	528	1 966	1 591	754	642	1 034	878	855	610	1 141	814
T5H005	2	25	104	24	72	47	79	29	53	4	85	7
	5	92	153	49	134	92	130	56	86	13	138	21
	10	156	198	73	187	130	177	84	116	23	186	37
	20	227	257	106	248	173	226	116	152	36	244	58
	50	327	378	175	343	242	308	169	205	59	329	95
	100	405	514	252	427	304	384	219	255	81	409	130
	200	483	694	356	522	373	476	280	315	108	505	172
T5H007	2	244	484	435	162	192	350	305	413	350	347	294
	5	410	725	695	352	346	581	557	688	642	578	540
	10	518	948	942	528	463	780	790	922	912	775	767
	20	618	1 245	1 273	740	631	1 004	1 061	1 190	1 233	1 001	1 037
	50	742	1 873	1 973	1 082	936	1 370	1 516	1 618	1 760	1 361	1 480
	100	832	2 589	2 773	1 395	1 156	1 711	1 941	2 022	2 260	1 700	1 900
	200	918	3 544	3 843	1 761	1 441	2 121	2 461	2 504	2 863	2 106	2 408
T5H012	2	81	78	65	47	117	81	53	123	91	73	54
	5	181	125	110	107	276	147	105	222	181	132	107
	10	266	172	156	167	438	213	161	321	274	190	163
	20	356	238	221	245	646	298	236	453	401	269	238
	50	479	385	367	383	1 019	460	381	696	643	413	381
	100	574	564	545	520	1 387	628	533	901	869	534	516
	200	668	819	799	690	1 861	803	718	1 089	1 063	646	631

Table A.28: Probabilistic and event-based deterministic DFE results in PDR U

Catchment	T (years)	Q_{Pi} (m^3/s)	Q_{Ti} (m^3/s)									
			RM3-ARF (A)	RM3-ARF (P)	SCS	SCS-SA	SUH-ARF (A)	SUH-ARF (P)	LRH-Veld-ARF (A)	LRH-Veld-ARF (P)	LRH-T_C-ARF (A)	LRH-T_C-ARF (P)
U1H005	2	311	466	375	279	217	415	269	373	264	366	259
	5	626	694	601	534	338	676	492	612	484	600	475
	10	880	903	817	752	452	899	706	814	694	799	681
	20	1 146	1 178	1 103	1 003	591	1 162	951	1 037	935	1 018	918
	50	1 510	1 757	1 702	1 387	821	1 551	1 350	1 396	1 327	1 370	1 302
	100	1 791	2 411	2 382	1 723	1 006	1 907	1 719	1 723	1 689	1 691	1 658
	200	2 075	3 274	3 282	2 102	1 219	2 329	2 158	2 113	2 120	2 074	2 080
U2H002	2	150	558	519	310	370	426	319	410	367	296	265
	5	275	854	844	648	554	752	623	723	709	522	512
	10	365	1 135	1 161	972	752	1 062	935	1 021	1 058	736	763
	20	452	1 509	1 588	1 372	1 004	1 449	1 364	1 394	1 511	1 005	1 089
	50	564	2 298	2 491	2 048	1 553	2 126	2 140	2 046	2 331	1 475	1 681
	100	646	3 214	3 544	2 691	1 919	2 820	2 956	2 716	3 180	1 959	2 293
	200	725	4 475	5 001	3 470	2 418	3 702	3 999	3 563	4 262	2 570	3 074
U2H006	2	25	153	68	77	72	173		122	32	143	38
	5	70	233	121	158	140	290	114	204	70	239	83
	10	117	309	175	234	209	397	171	282	113	330	132
	20	172	410	251	324	288	530	246	371	167	435	196
	50	255	628	416	471	419	735	369	517	269	606	316
	100	325	879	612	606	542	934	494	658	370	771	434
	200	399	1 218	883	764	682	1 179	653	834	495	977	580
U2H007	2	21	132	89	64	84	142	69	119	63	115	61
	5	42	201	148	129	158	237	128	203	123	194	118
	10	60	266	206	188	234	326	189	279	182	268	175
	20	81	354	285	260	319	434	269	365	261	350	251
	50	112	541	456	374	460	602	399	511	389	490	373

Catchment	T (years)	Q_{Pi} (m³/s)	Q_{Ti} (m³/s)									
			RM3-ARF (A)	RM3-ARF (P)	SCS	SCS-SA	SUH-ARF (A)	SUH-ARF (P)	LRH-Veld-ARF (A)	LRH-Veld-ARF (P)	LRH-T_C-ARF (A)	LRH-T_C-ARF (P)
	100	139	757	655	479	569	765	529	653	515	626	494
	200	168	1 050	927	602	743	966	693	826	675	792	647
U2H011	2	52	108	56	71	70	49		63	21	55	18
	5	125	157	92	134	136	82	42	105	44	92	38
	10	193	200	126	189	196	112	61	140	67	122	58
	20	270	253	168	253	264	144	83	182	96	159	84
	50	381	357	251	353	368	198	121	251	143	219	125
	100	471	470	341	442	466	248	156	313	189	273	164
	200	565	617	458	545	573	307	199	390	243	340	212
U2H012	2	48	170	107	101	120	149	74	149	70	143	67
	5	113	269	187	217	241	265	148	267	149	255	143
	10	171	366	271	329	362	379	226	380	235	364	224
	20	234	501	388	471	514	523	329	525	351	502	336
	50	325	799	650	714	779	780	522	787	564	753	539
	100	397	1 157	968	949	1 039	1 049	724	1 061	793	1 015	758
	200	471	1 660	1 420	1 237	1 349	1 404	989	1 402	1 097	1 341	1 050
U2H013	2	38	154	89	73	81	144	66	113	45	129	52
	5	76	231	148	142	154	233	120	184	91	211	104
	10	107	301	206	202	219	311	172	247	133	283	153
	20	140	394	284	271	295	405	234	319	187	365	214
	50	186	590	448	378	417	546	333	429	280	491	320
	100	222	812	636	473	520	673	428	531	359	607	411
	200	259	1 106	886	581	638	824	541	652	455	746	521
U2H055	2	149	372	335	205	362	385	280	351	296	267	225
	5	272	577	551	427	536	673	546	614	570	466	433
	10	361	775	767	638	681	943	816	858	844	652	641
	20	450	1 045	1 065	896	934	1 268	1 161	1 158	1 192	879	905
	50	566	1 634	1 718	1 330	1 417	1 839	1 786	1 680	1 820	1 276	1 382
	100	652	2 329	2 492	1 740	1 711	2 412	2 427	2 208	2 467	1 677	1 874
	200	738	3 290	3 572	2 234	2 170	3 144	3 229	2 864	3 265	2 176	2 480
U6H003	2	33	105	77	73	114	82	45	105	63	74	45
	5	92	167	131	157	245	147	88	187	129	132	91
	10	148	227	187	239	377	207	134	266	196	187	138
	20	212	311	265	344	549	287	195	367	286	259	202
	50	305	498	440	526	835	428	309	551	452	388	319
	100	379	722	650	702	1 119	577	430	744	629	525	444
	200	456	1 037	949	918	1 465	773	590	998	862	704	608
U7H001	2	1	32	32	20	10	20	20				
	5	6	50	50	43	23	36	36				
	10	11	66	66	64	34	50	50				
	20	17	89	89	90	49	67	67				
	50	26	139	139	133	74	96	96				
	100	34	197	197	174	98	124	124				
	200	41	278	278	224	127	160	160				
U7H008	2	66	57	22	91	79	31	11	38	8	32	7
	5	114	88	40	168	150	56	23	69	19	59	17
	10	147	118	59	237	215	81	36	100	33	85	28
	20	181	159	85	321	291	113	53	140	53	119	45
	50	227	244	141	458	419	172	86	214	90	183	77
	100	263	343	207	587	536	236	121	292	130	250	111
	200	300	482	299	742	676	320	166	389	184	333	157
U8H001	2	121	121	77	154	256	93	51	130	63	98	48
	5	349	193	134	294	499	165	100	234	132	177	100
	10	569	262	192	418	718	235	151	331	203	250	153
	20	819	357	273	564	976	321	218	456	296	344	224
	50	1 182	564	450	799	1 397	476	339	676	470	511	355
	100	1 474	809	662	1 014	1 779	631	445	830	648	627	489
	200	1 776	1 150	958	1 269	2 230	789	552	983	819	743	618
U8H003	2	126	148	114	162	322	128	80	176	117	119	79
	5	289	232	192	327	670	229	158	319	234	216	159
	10	432	314	270	482	996	331	242	457	359	309	243
	20	587	427	378	674	1 409	460	354	642	527	434	357
	50	805	668	612	997	2 114	702	569	979	847	663	573
	100	976	955	889	1 306	2 772	955	778	1 208	1 125	817	762
	200	1 151	1 357	1 281	1 680	3 587	1 181	950	1 453	1 372	983	929

Table A.29: Probabilistic and event-based deterministic DFE results in PDR V

Catchment	*T* (years)	Q_{Pi} (m³/s)	Q_{Ti} (m³/s)									
			RM3-ARF (A)	RM3-ARF (P)	SCS	SCS-SA	SUH-ARF (A)	SUH-ARF (P)	LRH-Veld-ARF (A)	LRH-Veld-ARF (P)	LRH-T_C-ARF (A)	LRH-T_C-ARF (P)
V1H001	2	435	529	513	379	590	331	269	413	393	243	232
	5	866	780	796	690	777	526	477	660	682	390	403
	10	1 200	1 001	1 052	935	930	684	665	864	934	510	551
	20	1 536	1 283	1 384	1 199	1 162	861	883	1 070	1 206	632	712
	50	1 977	1 867	2 069	1 579	1 567	1 105	1 203	1 380	1 629	815	961
	100	2 304	2 508	2 824	1 890	1 786	1 313	1 483	1 647	1 994	972	1 177
	200	2 624	3 330	3 763	2 224	2 068	1 546	1 803	1 940	2 361	1 145	1 394
V1H009	2	111	86	40	63	76	58	20	61	17	56	16
	5	208	127	68	116	141	94	36	97	35	90	33
	10	279	163	96	159	193	123	51	125	54	116	50
	20	348	210	131	206	253	153	68	155	75	144	69
	50	437	306	206	275	338	197	95	202	109	188	101
	100	502	413	290	332	406	235	120	242	138	225	128
	200	564	550	400	394	487	279	146	285	172	265	160
V1H010	2	224	346	236	199	256	175	89	190	102	170	91
	5	419	511	382	367	404	281	158	302	191	270	171
	10	564	656	519	502	516	362	219	391	271	349	241
	20	707	844	698	649	656	452	292	490	361	437	323
	50	891	1 234	1 069	865	880	587	409	635	507	567	453
	100	1 027	1 665	1 483	1 043	1 045	703	508	759	632	677	564
	200	1 159	2 220	2 023	1 238	1 227	829	622	899	774	803	691
V1H029	2	14	54	54	25	20	37	37				
	5	25	79	79	50	40	59	59				
	10	34	102	102	69	56	77	77				
	20	45	130	130	91	73	96	96				
	50	62	189	189	122	71	122	122				
	100	78	254	254	148	122	145	145				
	200	95	337	337	176	145	170	170				
V1H030	2	10	55	55	38	33	29	29	14	14	20	20
	5	20	81	81	69	60	47	47	22	22	32	32
	10	32	103	103	93	82	61	61	29	29	41	41
	20	49	132	132	118	105	76	76	36	36	51	51
	50	76	192	192	155	138	97	97	46	46	65	65
	100	102	258	258	185	165	114	114	54	54	78	78
	200	130	342	342	216	194	134	134	64	64	91	91
V1H032	2	187	142	142	99	70	78	20	34	34	59	59
	5	320	210	210	180	129	126	126	54	54	95	95
	10	406	269	269	243	175	164	164	70	70	123	123
	20	486	345	345	311	223	205	205	86	86	152	152
	50	582	501	501	408	294	261	261	111	111	195	195
	100	649	672	672	487	350	310	310	131	131	232	232
	200	713	892	892	571	414	362	362	154	154	272	272
V1R038	2	329	440	336	238	370	279	150	297	193	238	155
	5	651	648	536	437	552	444	272	470	350	375	279
	10	899	829	720	596	693	570	377	606	484	484	386
	20	1 148	1 062	961	766	890	708	501	758	644	605	514
	50	1 474	1 541	1 458	1 011	1 173	915	694	969	889	774	710
	100	1 715	2 067	2 009	1 211	1 378	1 083	862	1 147	1 097	917	877
	200	1 950	2 741	2 723	1 426	1 623	1 265	1 050	1 347	1 334	1 077	1 066
V1R001	2	306	515	459	415	482	336	233	365	304	249	208
	5	606	759	719	748	694	535	413	580	532	397	364
	10	838	973	956	1 009	877	694	576	756	734	517	502
	20	1 072	1 247	1 263	1 289	1 093	871	758	943	961	645	657
	50	1 377	1 812	1 894	1 690	1 452	1 117	1 033	1 210	1 299	828	889
	100	1 603	2 433	2 591	2 015	1 684	1 324	1 273	1 438	1 593	984	1 089
	200	1 825	3 228	3 491	2 363	1 952	1 557	1 541	1 693	1 922	1 158	1 315
V1R002	2	296	710	518	573	613	415	216	372	225	350	212
	5	545	1 048	836	1 026	834	663	391	589	415	554	390
	10	725	1 344	1 132	1 381	1 034	853	547	763	579	718	545
	20	899	1 723	1 516	1 759	1 283	1 064	732	954	776	897	730
	50	1 120	2 506	2 306	2 301	1 689	1 381	1 012	1 226	1 076	1 153	1 012
	100	1 280	3 365	3 180	2 740	1 945	1 632	1 252	1 458	1 331	1 371	1 252
	200	1 434	4 467	4 224	3 210	2 269	1 915	1 522	1 716	1 566	1 614	1 473
	2	594	593	393	507	532	361	172	320	164	318	163
	5	1 041	875	642	896	771	577	306	505	311	502	309

Catchment	T (years)	Q_{Pi} (m^3/s)	Q_{Ti} (m^3/s)									
			RM3-ARF (A)	RM3-ARF (P)	SCS	SCS-SA	SUH-ARF (A)	SUH-ARF (P)	LRH-Veld-ARF (A)	LRH-Veld-ARF (P)	LRH-T_C-ARF (A)	LRH-T_C-ARF (P)
V1R003	10	1 357	1 122	874	1 197	977	740	425	653	441	649	438
	20	1 669	1 438	1 176	1 517	1 229	920	570	815	590	809	586
	50	2 081	2 090	1 797	1 972	1 607	1 189	796	1 045	826	1 038	820
	100	2 395	2 804	2 484	2 339	1 859	1 405	986	1 239	1 023	1 232	1 016
	200	2 711	3 720	3 374	2 729	2 161	1 647	1 201	1 458	1 245	1 449	1 238
V2H001	2	232	256	227	136	183	289	201	272	226	204	169
	5	459	379	357	267	278	467	361	441	400	330	300
	10	639	491	479	378	359	615	507	583	559	437	419
	20	824	636	639	506	466	785	679	739	745	554	558
	50	1 075	941	974	700	657	1 035	949	979	1 033	734	774
	100	1 266	1 282	1 351	869	791	1 260	1 195	1 190	1 296	892	971
	200	1 457	1 729	1 848	1 058	945	1 517	1 486	1 436	1 602	1 076	1 200
V2H002	2	71	274	214	139	108	274	183	225	152	207	139
	5	141	408	341	268	189	440	326	366	274	336	252
	10	198	529	462	378	258	584	462	489	390	449	358
	20	258	688	622	504	339	754	626	618	529	568	485
	50	340	1 022	956	697	471	1 000	878	824	740	756	679
	100	404	1 398	1 332	864	580	1 222	1 110	1 011	936	928	859
	200	468	1 893	1 829	1 053	708	1 482	1 390	1 231	1 164	1 130	1 069
V2H004	2	132	216	192	125	155	263	183	247	205	181	150
	5	299	321	301	243	255	425	326	400	361	293	264
	10	446	415	403	343	336	561	457	528	503	387	368
	20	605	538	537	456	446	713	608	669	665	490	487
	50	831	796	816	629	615	941	854	884	921	647	674
	100	1 010	1 084	1 130	778	739	1 143	1 076	1 075	1 151	787	843
	200	1 193	1 460	1 543	944	897	1 379	1 337	1 298	1 420	950	1 040
V2H005	2	55	131	84	56	78	138	88	103	50	104	50
	5	96	195	137	109	142	222	157	168	95	168	95
	10	124	253	187	154	201	293	220	224	136	224	136
	20	153	329	254	206	270	377	299	285	187	286	188
	50	191	489	394	286	375	505	419	379	270	380	271
	100	220	669	552	355	470	616	527	465	342	466	343
	200	250	906	762	434	569	747	655	565	427	567	428
V2H007	2	11	70	37	28	34	81	48	51	18	51	18
	5	20	103	62	56	69	130	84	81	36	83	36
	10	28	134	86	79	98	171	117	108	53	109	53
	20	36	173	117	105	131	218	156	138	72	140	73
	50	47	256	182	146	182	291	220	181	105	184	106
	100	55	349	255	181	224	352	278	220	135	223	137
	200	64	470	351	220	274	423	343	265	167	269	169
V2R001	2	28	85	18	34	29	122	122	58		83	
	5	57	125	38	69	60	201	201	94	13	134	18
	10	82	162	58	100	88	261	261	123	23	176	33
	20	110	210	86	135	120	332	332	158	37	225	52
	50	149	311	144	190	171	444	444	212	61	301	87
	100	181	424	213	238	215	545	545	256	84	364	120
	200	215	571	305	292	267	652	652	307	112	437	159
V3H007	2	35	102	39	51	65	54	35	59	12	63	13
	5	66	149	67	92	119	84	61	93	25	99	27
	10	90	190	95	125	164	109	82	119	40	127	42
	20	114	243	133	160	214	135	107	148	56	157	60
	50	146	353	210	211	282	173	143	190	83	202	88
	100	169	474	297	254	342	206	174	225	107	239	114
	200	192	629	412	300	405	241	208	264	135	281	144
V3H010	2	210	514	470	171	461	468	351	502	436	340	295
	5	361	752	733	351	592	739	633	792	761	536	515
	10	461	962	975	502	694	953	880	1 021	1 046	691	708
	20	552	1 231	1 291	670	875	1 184	1 167	1 272	1 375	861	931
	50	662	1 787	1 943	922	1 217	1 528	1 605	1 638	1 870	1 109	1 266
	100	740	2 399	2 668	1 134	1 337	1 813	1 983	1 946	2 311	1 318	1 565
	200	813	3 184	3 607	1 367	1 585	2 132	2 409	2 292	2 813	1 552	1 905
V3R001	2	215	269	176	159	207	198	142	202	102	185	94
	5	398	395	286	295	332	314	250	322	192	295	176
	10	532	506	388	403	440	406	342	416	273	381	250
	20	666	647	522	520	566	505	447	516	368	473	337
	50	840	940	799	689	750	648	603	663	514	607	471
	100	969	1 260	1 108	828	894	768	736	786	641	721	587

Catchment	T (years)	Q_{Pi} (m^3/s)	Q_{Ti} (m^3/s)									
			RM3-ARF (A)	RM3-ARF (P)	SCS	SCS-SA	SUH-ARF (A)	SUH-ARF (P)	LRH-Veld-ARF (A)	LRH-Veld-ARF (P)	LRH-T_C-ARF (A)	LRH-T_C-ARF (P)
	200	1 097	1 671	1 509	977	1 052	899	885	924	784	847	719
V3R003	2	74	258	160	151	174	181	138	179	83	198	91
	5	134	375	258	272	270	281	236	283	154	312	170
	10	176	480	351	371	355	365	325	367	220	405	243
	20	218	615	475	478	458	460	420	454	301	501	332
	50	271	896	732	636	608	591	568	587	427	648	471
	100	311	1 207	1 020	768	739	705	698	703	537	776	592
	200	349	1 609	1 400	912	875	834	846	834	665	921	734
V6H003	2	92	161	77	100	143	105	68	113	34	102	30
	5	178	236	131	180	261	168	119	179	70	162	63
	10	244	302	182	243	357	214	160	230	103	208	93
	20	309	387	249	311	462	266	207	286	143	258	130
	50	394	562	389	408	603	342	282	366	205	331	185
	100	457	753	545	487	727	405	348	434	261	392	236
	200	519	999	750	571	850	473	418	509	324	460	293
V6H004	2	98	204	138	55	115	154	74	167	90	132	71
	5	195	297	221	111	220	242	131	259	163	205	129
	10	270	380	297	157	316	309	181	332	226	262	179
	20	345	485	398	209	424	383	240	412	300	326	237
	50	444	704	607	287	576	492	332	528	418	417	330
	100	517	945	839	352	712	582	412	627	519	496	410
	200	589	1 254	1 142	424	856	683	503	738	634	584	502
V7H012	2	48	72	48	44	78	45	21	53	27	42	21
	5	87	107	77	82	145	73	38	86	51	68	40
	10	116	138	104	114	202	95	53	112	73	88	57
	20	147	178	141	150	264	120	71	141	97	112	77
	50	191	263	216	204	360	158	99	186	136	148	108
	100	226	358	301	250	446	192	124	225	171	178	136
	200	262	481	412	300	535	229	153	270	211	214	167
V7H016	2	49	122	39	65	62	109	57	56	8	74	11
	5	97	182	73	123	118	177	100	90	20	120	27
	10	135	236	106	173	166	234	140	119	33	158	43
	20	174	307	151	229	222	299	190	153	49	203	65
	50	226	456	245	314	307	402	271	203	75	270	100
	100	265	624	352	388	378	490	342	248	100	330	132
	200	304	844	494	471	458	592	425	301	129	400	171
V7H017	2	63	433	171	149	123	105	67	87	19	124	26
	5	110	624	296	279	228	171	119	141	41	201	59
	10	143	789	415	389	321	224	164	184	66	263	94
	20	174	974	553	514	424	284	219	234	95	334	136
	50	215	1 233	756	704	602	380	305	313	145	447	207
	100	244	1 473	943	868	720	464	382	381	188	544	269
	200	274	1 995	1 318	1 052	874	562	475	461	240	660	342
V7R001	2	128	412	310	137	203	155	105	163	104	158	100
	5	248	593	482	261	324	251	185	263	189	253	183
	10	341	749	635	366	427	328	256	344	265	333	256
	20	437	923	811	486	562	417	340	439	357	424	344
	50	567	1 167	1 063	668	774	555	472	582	502	562	485
	100	667	1 392	1 294	826	943	676	593	711	632	686	611
	200	768	1 882	1 775	1 002	1 139	818	732	863	784	833	757

Table A.30: Probabilistic and event-based deterministic DFE results in PDR W

Catchment	T (years)	Q_{Pi} (m^3/s)	Q_{Ti} (m^3/s)									
			RM3-ARF (A)	RM3-ARF (P)	SCS	SCS-SA	SUH-ARF (A)	SUH-ARF (P)	LRH-Veld-ARF (A)	LRH-Veld-ARF (P)	LRH-T_C-ARF (A)	LRH-T_C-ARF (P)
W1H004	2	4	21	2	40	27	17	17	14		14	
	5	16	34	6	78	55	31	31	27	1	26	1
	10	28	47	11	113	80	44	44	38	3	37	3
	20	44	65	17	156	111	62	62	53	6	52	6
	50	69	105	33	226	163	93	93	81	13	78	13
	100	91	154	53	293	211	127	127	110	20	106	20
	200	114	222	81	373	269	171	171	149	30	144	29
W1H005	2	5	41		44	38	42	42				
	5	12	63	6	87	78	72	72	55		55	
	10	19	84	13	127	114	98	98	75	4	75	4
	20	26	112	23	174	159	131	131	101	8	101	8
	50	36	174	46	250	233	187	187	143	17	144	17
	100	44	246	75	321	299	241	241	186	28	186	29
	200	52	345	118	403	379	311	311	239	43	239	44
W1H015	2	20	14	14	38	17	11	11				
	5	40	24	24	75	34	22	22				
	10	56	34	34	111	50	34	34				
	20	74	47	47	154	70	49	49				
	50	99	76	76	227	102	80	80				
	100	119	111	111	296	133	113	113				
	200	140	161	161	381	170	159	159				
W1H017	2	2	2	2	6	1	5	5				
	5	4	3	3	11	1	8	8				
	10	6	4	4	15	1	11	11				
	20	8	6	6	20	2	15	15				
	50	10	8	8	26	3	20	20				
	100	12	10	10	32	3	24	24				
	200	13	14	14	38	4	29	29				
W1R001	2	271	301	241	255	473	233	154	336	236	225	158
	5	705	469	403	507	947	403	297	582	457	390	306
	10	1 109	630	566	738	1 369	563	444	809	684	542	458
	20	1 558	850	791	1 017	1 876	759	632	1 095	974	733	653
	50	2 204	1 328	1 284	1 472	2 721	1 097	977	1 594	1 508	1 067	1 010
	100	2 720	1 890	1 869	1 894	3 501	1 437	1 331	2 090	2 053	1 400	1 375
	200	3 249	2 664	2 686	2 393	4 404	1 865	1 697	2 465	2 484	1 651	1 664
W2H006	2	376	307	236	224	377	253	142	323	212	230	151
	5	859	474	394	456	660	432	275	549	410	392	293
	10	1 309	634	553	670	936	596	410	762	612	544	436
	20	1 825	849	772	928	1 295	801	585	1 014	873	724	623
	50	2 599	1 315	1 250	1 350	1 875	1 136	896	1 453	1 336	1 036	953
	100	3 240	1 859	1 815	1 740	2 386	1 469	1 211	1 880	1 808	1 341	1 290
	200	3 918	2 602	2 599	2 201	3 003	1 884	1 610	2 411	2 408	1 720	1 718
W2H007	2	44	60	5	39	41	51	51	38		43	
	5	86	93	16	81	88	87	87	66	4	75	4
	10	123	125	29	121	134	120	120	90	8	102	9
	20	166	167	47	169	188	160	160	120	15	137	18
	50	232	259	88	248	281	228	228	170	31	194	35
	100	288	366	139	321	368	292	292	219	48	250	54
	200	349	512	213	408	468	374	374	281	70	321	80
W2H028	2	62	162	41	83	71	91	30	80	8	91	10
	5	148	250	85	174	158	157	60	139	23	157	26
	10	225	334	132	260	239	217	91	190	42	214	48
	20	311	448	199	364	338	288	130	253	71	286	80
	50	432	695	349	537	501	413	202	361	123	408	139
	100	528	982	531	698	658	529	275	466	176	526	199
	200	626	1 376	789	890	843	678	372	600	247	677	279
W2R001	2	77	124	56	113	139	113	41	119	32	113	31
	5	173	191	101	223	275	193	78	202	73	191	69
	10	256	254	147	322	398	263	116	276	116	261	110
	20	344	339	211	440	543	349	166	366	174	347	164
	50	468	522	351	631	783	492	252	517	276	489	261
	100	564	735	518	804	994	629	341	665	380	629	360
	200	662	1 025	751	1 008	1 254	803	453	847	513	801	485
	2	239	164	138	125	255	121	85	182	138	111	84
	5	725	279	249	297	621	240	183	359	299	220	183

Catchment	T (years)	Q_{Pi} (m³/s)	Q_{Ti} (m³/s)									
			RM3-ARF (A)	RM3-ARF (P)	SCS	SCS-SA	SUH-ARF (A)	SUH-ARF (P)	LRH-Veld-ARF (A)	LRH-Veld-ARF (P)	LRH-T_C-ARF (A)	LRH-T_C-ARF (P)
W3R001	10	1 194	396	365	472	989	364	292	543	478	332	292
	20	1 719	561	532	699	1 484	530	447	800	731	489	447
	50	2 474	934	909	1 099	2 356	854	752	1 269	1 234	775	754
	100	3 074	1 392	1 377	1 492	3 228	1 183	1 025	1 570	1 552	959	949
	200	3 688	2 057	2 057	1 984	4 307	1 456	1 340	1 932	1 933	1 181	1 181
W5H001	2	278	15	15	9	7	14	14	7	7	8	8
	5	721	23	23	19	15	24	24	12	12	14	14
	10	1 114	31	31	28	22	33	33	16	16	20	20
	20	1 532	41	41	40	32	44	44	21	21	26	26
	50	2 101	62	62	59	47	62	62	30	30	36	36
	100	2 533	87	87	76	62	77	77	37	37	45	45
	200	2 960	121	121	96	79	97	97	47	47	56	56
W5H005	2	40	116	91	75	129	130	72	174	118	112	76
	5	84	177	149	152	231	216	133	287	219	184	141
	10	122	233	204	220	325	291	192	389	316	249	202
	20	163	308	280	302	440	381	269	506	436	324	279
	50	221	467	441	431	597	523	397	701	639	449	410
	100	268	650	629	547	796	659	523	885	839	567	538
	200	315	895	883	682	990	824	679	1 105	1 081	708	693
W5H011	2	17	129	101	78	140	142	94	198	134	159	108
	5	40	190	159	148	197	227	168	318	238	256	192
	10	61	245	215	207	249	299	237	416	336	335	271
	20	84	317	288	274	326	379	317	523	449	422	363
	50	117	468	442	376	451	496	443	691	630	558	508
	100	143	636	615	464	536	601	561	840	797	678	642
	200	170	856	845	562	636	724	699	1 015	992	818	800
W5H016	2	3	8	8	5	3	11	11				
	5	5	12	12	11	7	19	19				
	10	8	16	16	17	11	26	26				
	20	10	21	21	24	16	35	35				
	50	13	32	32	35	24	48	48				
	100	15	45	45	46	31	61	61				
	200	17	62	62	58	40	76	76				
W5H022	2	108	227	195	180	288	276	170	307	239	201	157
	5	206	342	312	348	442	452	315	504	436	330	285
	10	279	447	425	494	571	607	455	676	623	443	408
	20	353	587	577	663	750	788	627	875	852	573	558
	50	448	882	899	925	1 059	1 069	919	1 189	1 227	779	804
	100	519	1 218	1 271	1 158	1 274	1 332	1 205	1 484	1 589	972	1 041
	200	589	1 665	1 770	1 423	1 558	1 644	1 560	1 830	2 017	1 199	1 321
W5H024	2	56	202	161	134	283	212	133	285	199	220	154
	5	118	302	260	258	401	349	245	471	368	363	283
	10	169	395	355	365	515	469	350	626	527	482	406
	20	224	518	482	489	678	603	483	805	719	621	554
	50	298	777	753	682	948	816	705	1 096	1 041	845	803
	100	356	1 071	1 064	852	1 144	1 015	919	1 367	1 352	1 054	1 043
	200	415	1 462	1 482	1 046	1 379	1 252	1 179	1 677	1 712	1 293	1 320
W5R001	2	52	67	36	53	65	62	0	70	25	57	20
	5	95	101	61	104	129	102	43	114	51	94	42
	10	125	133	86	148	185	135	62	151	76	125	63
	20	154	174	119	200	250	174	85	195	108	162	89
	50	191	261	190	280	348	236	125	265	161	219	133
	100	218	360	273	351	438	293	161	329	213	272	176
	200	244	492	385	432	541	359	207	406	274	335	226
W5R002	2	35	91	71	60	116	91	56	130	86	90	60
	5	73	135	112	115	195	148	100	211	155	146	107
	10	104	175	151	161	260	196	141	277	220	191	152
	20	136	228	204	214	347	249	190	352	295	244	204
	50	179	339	315	295	480	333	269	471	418	326	289
	100	212	465	441	366	589	408	343	581	534	402	369
	200	244	630	609	446	716	496	431	706	672	488	464
W5R003	2	39	109	76	80	132	113	57	126	70	98	55
	5	78	162	122	154	220	183	105	204	131	159	102
	10	108	211	167	219	300	242	149	270	188	210	146
	20	140	275	228	292	405	309	204	346	257	268	200
	50	183	410	356	406	559	415	293	463	371	359	288
	100	216	562	503	506	698	509	377	571	478	443	371

Catchment	*T* (years)	Q_{Pi} (m^3/s)	Q_{Ti} (m^3/s)									
			RM3-ARF (A)	RM3-ARF (P)	SCS	SCS-SA	SUH-ARF (A)	SUH-ARF (P)	LRH-Veld-ARF (A)	LRH-Veld-ARF (P)	LRH-T_C-ARF (A)	LRH-T_C-ARF (P)
	200	249	763	700	619	850	620	479	700	607	543	471

Table A.31: Probabilistic and event-based deterministic DFE results in PDR X

Catchment	*T* (years)	Q_{Pi} (m^3/s)	Q_{Ti} (m^3/s)									
			RM3-ARF (A)	RM3-ARF (P)	SCS	SCS-SA	SUH-ARF (A)	SUH-ARF (P)	LRH-Veld-ARF (A)	LRH-Veld-ARF (P)	LRH-T_C-ARF (A)	LRH-T_C-ARF (P)
X1H001	2	184	495	455	130	362	393	283	495	432	359	314
	5	516	730	714	279	583	631	507	795	767	577	556
	10	822	942	958	414	698	829	725	1 041	1 068	755	774
	20	1 155	1 220	1 281	570	952	1 048	986	1 317	1 424	955	1 033
	50	1 618	1 803	1 961	817	1 377	1 387	1 410	1 745	1 998	1 266	1 449
	100	1 978	2 457	2 729	1 035	1 627	1 691	1 802	2 129	2 534	1 544	1 838
	200	2 338	3 311	3 746	1 284	1 953	2 042	2 271	2 580	3 147	1 871	2 282
X1H003	2	167	600	583	100	275	414	386	686	657	418	401
	5	369	913	939	252	547	688	705	1 146	1 200	699	732
	10	542	1 201	1 280	400	748	928	1 005	1 546	1 710	943	1 043
	20	729	1 583	1 738	583	1 021	1 208	1 384	2 021	2 356	1 233	1 437
	50	989	2 392	2 710	885	1 596	1 672	2 026	2 809	3 412	1 713	2 081
	100	1 194	3 313	3 828	1 165	1 946	2 101	2 609	3 492	4 343	2 130	2 649
	200	1 401	4 540	5 331	1 496	2 473	2 587	3 206	4 294	5 042	2 619	3 075
X1H012	2	11	221	63	5	6	90	31	96	12	85	11
	5	32	328	119	18	28	149	60	160	32	143	28
	10	51	423	176	34	51	204	88	218	55	195	49
	20	73	532	246	55	94	267	124	287	86	257	77
	50	104	693	358	93	166	374	189	403	141	360	126
	100	128	846	466	131	237	475	252	512	198	457	177
	200	154	1 169	680	177	330	598	325	627	269	560	240
X1H014	2	161	375	266	65	158	272	161	354	208	305	179
	5	391	576	447	167	408	462	309	602	403	518	346
	10	598	765	626	269	667	629	457	822	598	707	514
	20	826	1 016	870	396	990	835	647	1 092	848	939	729
	50	1 148	1 553	1 395	611	1 523	1 171	980	1 532	1 287	1 317	1 106
	100	1 402	2 170	2 008	814	2 035	1 469	1 271	1 836	1 699	1 578	1 461
	200	1 662	3 000	2 847	1 057	2 654	1 782	1 527	2 115	2 007	1 819	1 725
X1H016	2	55	187	102	23	40	128	77	143	53	169	63
	5	153	278	172	61	102	207	138	232	107	275	127
	10	254	362	241	98	161	276	198	308	160	366	190
	20	373	472	335	144	239	354	267	397	226	472	268
	50	556	704	533	220	364	473	382	531	342	631	406
	100	710	966	762	290	478	583	490	652	448	775	532
	200	874	1 312	1 070	372	615	712	621	796	573	946	681
X1H017	2	74	244	207	53	126	262	176	280	215	233	179
	5	155	355	322	119	214	414	314	443	378	369	315
	10	220	455	430	178	259	539	439	575	525	479	437
	20	288	584	572	246	350	678	589	721	698	601	582
	50	380	853	867	351	517	877	813	932	958	776	798
	100	449	1 152	1 198	444	588	1 049	1 016	1 118	1 191	931	992
	200	517	1 537	1 630	548	724	1 244	1 251	1 328	1 458	1 106	1 215
X1H018	2	98	261	223	72	180	261	178	301	234	251	195
	5	204	382	349	154	277	417	320	480	414	401	345
	10	289	491	467	227	341	544	451	627	577	523	481
	20	377	632	623	311	446	687	607	787	770	656	642
	50	494	927	948	441	644	896	846	1 027	1 064	856	887
	100	583	1 256	1 314	556	758	1 078	1 065	1 239	1 335	1 033	1 113
	200	671	1 683	1 795	685	922	1 287	1 320	1 480	1 646	1 234	1 372
	2	65	121	41	34	41	55	19	65	11	63	11
	5	168	182	76	75	93	91	37	109	26	104	25

Catchment	T (years)	Q_{Pi} (m^3/s)	Q_{Ti} (m^3/s)									
			RM3-ARF (A)	**RM3-ARF (P)**	**SCS**	**SCS-SA**	**SUH-ARF (A)**	**SUH-ARF (P)**	**LRH-Veld-ARF (A)**	**LRH-Veld-ARF (P)**	**LRH-T_C-ARF (A)**	**LRH-T_C-ARF (P)**
X1H019	10	263	239	113	114	141	123	55	145	43	138	41
	20	369	314	163	160	202	158	76	187	66	179	63
	50	522	474	270	236	302	216	112	256	106	245	102
	100	644	656	397	305	393	270	146	318	144	304	138
	200	769	899	571	386	501	332	189	393	191	376	183
X1H020	2	9	68	68	13	12	35	35	20	20	29	29
	5	27	104	104	34	31	61	61	34	34	50	50
	10	43	138	138	54	50	84	84	47	47	69	69
	20	61	183	183	79	74	111	111	61	61	90	90
	50	87	280	280	122	116	154	154	84	84	125	125
	100	106	391	391	162	157	194	194	107	107	158	158
	200	126	540	540	210	206	243	243	133	133	198	197
X1R001	2	85	233	184	53	105	234	154	261	180	240	165
	5	175	347	295	121	189	377	279	427	327	391	300
	10	247	451	401	183	251	501	401	571	469	523	430
	20	321	588	543	257	338	645	546	725	641	664	587
	50	419	876	844	376	508	866	779	971	914	890	838
	100	493	1 201	1 187	483	617	1 061	999	1 196	1 174	1 096	1 077
	200	566	1 630	1 646	608	772	1 291	1 265	1 461	1 486	1 339	1 362
X1R003	2	162	285	249	78	212	268	189	332	268	264	213
	5	319	420	392	172	336	435	333	538	481	428	382
	10	441	543	527	256	421	570	460	708	674	563	536
	20	564	703	706	355	554	727	608	895	899	711	715
	50	728	1 040	1 082	512	818	958	858	1 183	1 262	941	1 004
	100	851	1 417	1 508	651	974	1 167	1 100	1 444	1 595	1 148	1 268
	200	973	1 910	2 071	811	1 191	1 407	1 387	1 743	1 989	1 386	1 582
X1R004	2	169	311	203	40	83	197	120	250	127	240	122
	5	332	481	347	112	241	335	229	427	255	410	244
	10	461	639	489	186	405	458	335	582	382	559	367
	20	597	850	684	281	613	605	471	771	545	740	524
	50	784	1 300	1 104	442	973	851	706	1 083	833	1 040	800
	100	930	1 817	1 595	595	1 319	1 081	899	1 381	1 117	1 326	1 073
	200	1 079	2 511	2 266	780	1 726	1 324	1 122	1 609	1 453	1 545	1 395
X2H008	2	36	129	33	31	39	55	23	53	6	74	8
	5	77	198	68	75	97	93	46	90	16	125	22
	10	111	262	104	117	157	126	67	122	28	169	38
	20	146	347	155	169	230	165	95	161	45	223	62
	50	194	530	266	257	353	230	144	224	76	310	106
	100	231	741	400	339	472	291	192	283	107	392	148
	200	268	1 025	585	436	613	366	251	357	146	494	202
X2H010	2	23	126	11	44	48	55	55	50		79	
	5	50	192	34	96	108	92	92	84	5	134	8
	10	72	255	60	146	168	125	125	113	11	181	17
	20	96	338	98	206	239	164	164	149	20	239	32
	50	128	516	181	304	357	229	229	207	39	331	63
	100	153	721	282	395	469	292	292	263	60	420	96
	200	178	997	425	501	598	366	366	331	85	529	136
X2H011	2	81	127	54	2	3	98	48	89	22	126	30
	5	156	185	94	9	16	154	85	140	46	197	65
	10	212	236	132	18	30	199	119	182	71	255	99
	20	268	304	184	30	50	250	160	228	102	320	144
	50	340	443	291	50	83	328	224	300	151	422	212
	100	393	599	414	68	115	393	279	358	196	503	276
	200	445	799	575	90	151	463	342	423	251	594	352
X2H013	2	46	289	210	19	41	177	104	222	130	195	115
	5	86	430	340	57	115	286	196	359	246	316	217
	10	114	556	464	96	178	376	280	471	353	416	311
	20	143	722	630	145	266	479	381	601	482	530	425
	50	180	1 068	978	225	408	634	545	795	692	701	610
	100	207	1 455	1 374	300	534	771	693	966	881	852	777
	200	234	1 962	1 899	387	688	927	868	1 164	1 104	1 027	974
X2H014	2	10	137	52	2	5	78	36	106	21	94	19
	5	19	210	95	15	31	130	68	178	50	158	44
	10	26	277	141	31	67	176	100	240	82	213	73
	20	33	367	203	54	117	231	140	316	124	281	110
	50	42	559	339	96	215	320	209	437	198	388	176
	100	49	780	499	139	315	404	278	553	272	491	241

Catchment	*T* (years)	Q_{Pi} (m³/s)	Q_{Ti} (m³/s)									
			RM3-ARF (A)	RM3-ARF (P)	SCS	SCS-SA	SUH-ARF (A)	SUH-ARF (P)	LRH-Veld-ARF (A)	LRH-Veld-ARF (P)	LRH-T_C-ARF (A)	LRH-T_C-ARF (P)
	200	56	1 076	721	193	443	507	362	694	364	616	323
X2H016	2	245	842	799	357	837	611	504	864	797	568	523
	5	904	1 305	1 321	806	1 402	1 054	948	1 474	1 503	968	987
	10	1 585	1 735	1 828	1 225	1 796	1 440	1 383	2 021	2 194	1 327	1 441
	20	2 381	2 307	2 514	1 728	2 124	1 900	1 940	2 674	3 080	1 757	2 023
	50	3 570	3 521	3 980	2 542	3 729	2 660	2 913	3 780	4 573	2 483	3 003
	100	4 545	4 913	5 680	3 285	4 456	3 393	3 891	4 753	5 903	3 122	3 877
	200	5 563	6 777	7 985	4 149	5 530	4 230	5 048	5 870	6 916	3 855	4 542
X2H017	2	248	993	904	201	351	883	640	1 022	884	744	643
	5	547	1 518	1 482	511	813	1 477	1 185	1 720	1 656	1 251	1 205
	10	817	2 009	2 050	821	1 237	2 009	1 724	2 340	2 415	1 702	1 756
	20	1 121	2 665	2 821	1 210	1 798	2 644	2 399	3 092	3 396	2 249	2 470
	50	1 568	4 065	4 478	1 866	2 772	3 724	3 708	4 341	5 057	3 158	3 678
	100	1 934	5 677	6 409	2 489	3 637	4 710	4 959	5 485	6 432	3 989	4 678
	200	2 319	7 844	9 039	3 235	4 685	5 893	6 369	6 559	7 559	4 771	5 498
X2H018	2	67	83	59	40	125	138	68	173	99	116	66
	5	197	131	101	98	313	246	139	305	202	205	135
	10	324	176	142	154	492	341	208	424	302	284	202
	20	469	236	199	221	723	454	296	563	430	378	288
	50	679	362	319	330	1 088	635	446	796	648	534	435
	100	849	506	459	429	1 417	810	594	1 011	864	678	579
	200	1 025	699	649	545	1 813	1 015	775	1 260	1 127	845	756
X2H022	2	93	423	305	145	183	217	127	282	166	267	158
	5	242	648	510	322	400	364	247	472	323	447	306
	10	382	858	713	489	605	497	365	646	478	612	453
	20	541	1 140	992	692	855	654	519	846	681	802	645
	50	771	1 740	1 591	1 024	1 264	911	780	1 182	1 024	1 120	970
	100	957	2 432	2 293	1 331	1 639	1 160	1 043	1 503	1 368	1 425	1 297
	200	1 150	3 362	3 252	1 693	2 074	1 456	1 366	1 891	1 791	1 793	1 697
X2H024	2	11	80	1	30	32	66	66	40		53	
	5	26	122	12	67	74	113	113	68		90	
	10	38	162	26	101	113	152	152	91	5	121	6
	20	51	215	46	143	164	199	199	120	10	160	13
	50	69	328	91	212	244	278	278	167	21	223	28
	100	82	459	146	276	320	351	351	211	35	281	46
	200	95	635	225	351	411	441	441	266	51	354	68
X2H025	2	3	74	74	18	14	24	24				
	5	5	108	108	40	33	42	42				
	10	7	138	138	61	52	57	57				
	20	9	172	172	86	73	74	74				
	50	11	221	221	125	109	100	100				
	100	12	267	267	162	142	124	124				
	200	13	365	365	204	181	152	152				
X2H026	2	3	51	51	18	14	19	19				
	5	6	75	75	39	31	33	33				
	10	8	97	97	59	47	45	45				
	20	10	122	122	82	66	59	59				
	50	13	158	158	121	99	82	82				
	100	15	193	193	156	129	103	103				
	200	18	267	267	197	164	130	130				
X2H027	2	7	128	128	36	47	49	49	47	47	52	52
	5	12	191	191	80	111	85	85	81	81	90	90
	10	16	247	247	122	171	114	114	109	109	122	122
	20	20	312	312	172	245	151	151	144	144	161	160
	50	25	406	406	255	367	210	210	201	201	223	223
	100	29	495	495	332	483	266	266	254	254	283	283
	200	32	685	685	422	621	334	334	320	320	356	356
X2H028	2	0	97	97	3	1	91	91				
	5	1	142	142	7	3	149	149				
	10	1	180	180	11	4	199	199				
	20	2	223	223	16	6	252	252				
	50	2	283	283	24	9	304	304				
	100	3	339	339	31	12	346	346				
	200	3	460	460	40	16	391	391				
X2H031	2	32	150	56	43	66	64	31	72	14	101	20
	5	94	229	104	97	154	108	60	121	33	169	47
	10	151	303	153	147	238	147	88	163	55	229	78

Catchment	*T* (years)	Q_{Pi} (m³/s)	Q_{Ti} (m³/s)									
			RM3-ARF (A)	RM3-ARF (P)	SCS	SCS-SA	SUH-ARF (A)	SUH-ARF (P)	LRH-Veld-ARF (A)	LRH-Veld-ARF (P)	LRH-T_C-ARF (A)	LRH-T_C-ARF (P)
	20	213	403	222	209	342	194	125	216	84	303	119
	50	301	615	371	311	515	270	186	299	135	420	189
	100	370	859	548	405	676	342	248	380	186	533	262
	200	439	1 187	794	517	864	431	324	478	250	671	351
X2H032	2	135	588	504	64	125	485	336	519	407	393	308
	5	278	888	820	192	314	806	641	861	759	652	575
	10	397	1 165	1 126	324	432	1 080	939	1 159	1 098	877	831
	20	527	1 532	1 539	493	636	1 404	1 312	1 507	1 520	1 141	1 151
	50	711	2 309	2 421	781	1 019	1 922	1 936	2 056	2 218	1 557	1 680
	100	858	3 196	3 438	1 057	1 272	2 399	2 550	2 569	2 894	1 945	2 191
	200	1 010	4 376	4 811	1 388	1 658	2 971	3 280	3 189	3 713	2 415	2 812
X2H035	2	2	30	30	26	15	31	31				
	5	5	45	45	55	33	52	52				
	10	8	60	60	82	50	71	71				
	20	10	80	80	115	70	93	93				
	50	14	121	121	168	104	129	129				
	100	17	170	170	216	135	164	164				
	200	20	235	235	272	171	205	205				
X2H047	2	8	63	12	6	7	35	35	35		49	
	5	15	93	25	15	22	57	57	56	6	77	9
	10	21	119	39	24	35	74	74	72	12	100	16
	20	28	153	58	35	51	92	92	91	19	126	26
	50	36	224	97	53	78	121	121	119	31	165	43
	100	42	303	143	69	102	146	146	143	43	199	60
	200	49	405	205	87	131	174	174	170	57	236	79
X2H072	2	35	103	51	49	98	95	37	109	34	87	27
	5	111	154	88	106	216	162	72	184	75	146	60
	10	193	199	122	159	327	221	106	253	117	201	93
	20	291	256	168	222	458	292	149	331	170	264	135
	50	443	368	259	323	678	406	224	464	265	369	211
	100	572	492	361	415	878	515	299	591	357	470	284
	200	710	655	497	523	1 107	648	390	742	475	591	378
X2R001	2	13	81	35	38	56	62	24	75	20	57	15
	5	25	124	63	80	121	105	45	126	43	96	33
	10	35	164	91	119	182	142	66	172	68	130	52
	20	45	217	129	165	256	187	92	225	99	171	75
	50	59	332	213	241	375	261	138	317	156	240	118
	100	70	464	311	309	487	331	182	402	211	305	160
	200	82	642	447	390	618	416	239	499	282	379	214
X2R002	2	10	86	16	39	44	54	54	59	4	54	3
	5	27	132	35	83	95	91	91	98	11	89	10
	10	43	175	56	124	146	123	123	133	21	122	19
	20	63	232	86	173	204	163	163	175	36	160	33
	50	92	355	151	251	301	226	226	244	64	223	58
	100	117	496	229	323	391	286	286	311	91	284	83
	200	143	686	339	408	496	361	361	391	126	356	115
X2R003	2	19	73	73	49	39	62	62	43	44	57	57
	5	33	112	112	104	85	106	106	74	74	97	97
	10	43	148	148	154	130	143	143	99	100	130	131
	20	52	197	197	215	183	188	188	131	131	171	172
	50	63	300	300	313	269	261	261	182	182	238	239
	100	72	420	420	403	350	330	330	230	230	301	302
	200	80	581	581	508	444	415	415	289	289	379	380
X2R004	2	20	130	75	25	57	111	49	134	57	98	41
	5	54	198	128	61	142	185	92	226	113	166	83
	10	88	262	180	97	225	252	134	307	169	225	124
	20	128	348	253	140	334	330	187	404	243	296	178
	50	187	532	408	213	511	461	281	567	370	416	271
	100	235	743	591	282	682	587	373	721	498	529	365
	200	286	1 027	842	364	886	738	476	863	657	633	481
X2R005	2	78	300	155	41	56	179		161	55	205	70
	5	134	442	264	99	127	290	170	258	111	328	141
	10	170	569	369	153	190	377	240	336	169	428	215
	20	202	734	510	217	267	475	324	425	237	542	301

Catchment	*T* (years)	Q_{Pi} (m^3/s)	Q_{Ti} (m^3/s)									
			RM3-ARF (A)	RM3-ARF (P)	SCS	SCS-SA	SUH-ARF (A)	SUH-ARF (P)	LRH-Veld-ARF (A)	LRH-Veld-ARF (P)	LRH-T_C-ARF (A)	LRH-T_C-ARF (P)
	50	242	1 078	805	319	393	629	457	564	349	718	445
	100	269	1 461	1 141	409	504	761	575	675	455	860	580
	200	295	1 958	1 587	512	625	905	713	803	579	1 023	737
X3H001	2	15	277	277	10	12	67	67	43	43	102	103
	5	31	411	411	39	50	112	112	73	73	174	174
	10	44	530	530	71	94	153	153	98	98	235	235
	20	58	667	667	115	154	200	200	128	129	308	309
	50	76	868	868	192	264	280	280	179	179	429	430
	100	90	1 060	1 060	268	374	356	356	226	226	542	543
	200	103	1 466	1 466	363	514	448	448	284	284	681	682
X3H002	2	4	58	58	33	27	27	27	16	16	39	39
	5	8	88	88	72	60	45	45	27	27	66	66
	10	11	117	117	108	91	61	61	37	37	90	90
	20	14	155	155	152	131	80	80	48	48	118	118
	50	19	236	236	224	194	111	111	67	67	164	164
	100	23	330	330	290	253	141	141	85	85	207	207
	200	27	456	456	367	323	177	177	106	106	260	260
X3H006	2	98	285	169	28	61	189	124	231	101	244	107
	5	238	436	290	87	182	317	231	387	205	409	216
	10	364	577	411	150	316	430	334	525	307	555	324
	20	501	766	578	232	490	566	468	691	443	730	469
	50	695	1 170	937	374	786	794	698	970	678	1 026	716
	100	848	1 635	1 360	512	1 082	1 009	879	1 233	916	1 303	968
	200	1 004	2 261	1 939	680	1 441	1 249	1 047	1 504	1 210	1 590	1 279
X3H011	2	27	145	55	20	40	125	55	153	32	143	30
	5	78	222	102	57	115	210	105	259	75	242	70
	10	126	294	150	95	197	285	154	350	121	328	113
	20	180	390	216	144	302	376	218	463	181	432	169
	50	258	596	361	228	487	527	328	649	291	607	272
	100	320	833	532	309	669	672	422	827	400	773	374
	200	383	1 152	770	407	887	818	519	955	542	893	507
X3R001	2	17	55	9	6	10	46	46	53	3	49	3
	5	30	85	21	17	34	77	77	88	9	81	9
	10	40	112	34	29	61	104	104	120	18	110	16
	20	49	149	53	45	97	137	137	157	30	144	28
	50	61	228	93	73	158	191	191	220	54	202	50
	100	70	318	142	100	219	242	242	280	77	257	71
	200	79	440	210	132	295	304	304	352	108	323	99
X3R002	2	43	147	53	18	35	132	57	150	29	142	27
	5	89	225	99	53	106	220	108	253	69	239	65
	10	126	298	147	89	183	300	159	342	113	324	107
	20	166	396	213	135	283	394	224	452	169	427	160
	50	220	604	357	216	460	553	338	634	273	599	258
	100	262	845	528	294	636	704	436	807	377	763	356
	200	304	1 168	765	388	846	879	536	936	511	886	484
X4H004	2	66	162	112	51	162	232	114	267	147	193	106
	5	179	258	195	133	434	415	234	472	304	343	221
	10	283	346	277	212	702	576	353	656	459	476	334
	20	395	463	388	309	1 025	766	504	873	658	634	478
	50	551	711	625	466	1 544	1 074	766	1 234	1 002	896	728
	100	672	993	901	611	2 032	1 368	1 023	1 568	1 341	1 138	973
	200	794	1 372	1 278	780	2 601	1 715	1 338	1 937	1 755	1 406	1 274

Table A.32: GOF ranking of event-based deterministic DFE methods in PDR A

GOF statistics	**RM3-ARF (A)**	**RM3-ARF (P)**	**SCS**	**SCS-SA**	**SUH-ARF (A)**	**SUH-ARF (P)**	**LRH-Veld-ARF (A)**	**LRH-Veld-ARF (P)**	**LRH-T_C-ARF (A)**	**LRH-T_C-ARF (P)**
r^2 Eq. (2.8)	0.81	0.80	0.83	0.75	0.74	0.69	0.73	0.66	0.79	0.76
r^2 ranking	2	3	1	6	7	9	8	10	4	5
MARE Eq. (2.9) %	213.58	148.16	43.10	104.41	179.77	137.43	174.84	133.75	166.74	111.15
MARE ranking	10	6	1	2	9	5	8	4	7	3
NSE Eq. (2.10)	-0.49	-0.49	0.81	-0.05	-0.07	-0.15	-0.49	-1.07	0.35	0.30
NSE ranking	7	9	1	4	5	6	8	10	2	3
RMSE Eq. (2.11)	412.02	412.86	147.83	346.02	349.62	363.04	422.43	501.75	278.82	291.33
RMSE ranking	7	8	1	4	5	6	9	10	2	3
SE Eq. (2.12) m^3/s	253.61	278.06	112.30	264.82	266.36	307.73	300.86	402.22	204.27	246.63
SE ranking	4	7	1	5	6	9	8	10	2	3
Sum of rankings	30	33	5	21	32	35	41	44	17	17
Overall Ranking	**5**	**7**	**1**	**4**	**6**	**8**	**9**	**10**	**2**	**2**

Table A.33: GOF ranking of event-based deterministic DFE methods in PDR B

GOF statistics	**RM3-ARF (A)**	**RM3-ARF (P)**	**SCS**	**SCS-SA**	**SUH-ARF (A)**	**SUH-ARF (P)**	**LRH-Veld-ARF (A)**	**LRH-Veld-ARF (P)**	**LRH-T_C-ARF (A)**	**LRH-T_C-ARF (P)**
r^2 Eq. (2.8)	0.81	0.83	0.83	0.76	0.76	0.81	0.82	0.81	0.84	0.83
r^2 ranking	7	3	4	10	9	8	5	6	1	2
MARE Eq. (2.9) %	202.75	130.61	49.02	64.87	124.32	93.20	139.44	94.24	142.77	86.11
MARE ranking	10	7	1	2	6	4	8	5	9	3
NSE Eq. (2.10)	0.51	0.39	0.50	0.40	0.67	0.68	0.34	-0.05	0.81	0.79
NSE ranking	5	8	6	7	4	3	9	10	1	2
RMSE Eq. (2.11)	419.59	466.57	422.13	462.80	344.17	341.20	493.45	625.17	264.26	280.94
RMSE ranking	5	8	6	7	4	3	9	10	1	2
SE Eq. (2.12) m^3/s	337.78	374.58	111.72	425.38	316.40	321.77	376.28	463.82	219.37	274.42
SE ranking	6	7	1	9	4	5	8	10	2	3
Sum of rankings	33	33	18	35	27	23	39	41	14	12
Overall Ranking	**6**	**6**	**3**	**8**	**5**	**4**	**9**	**10**	**2**	**1**

Table A.34: GOF ranking of event-based deterministic DFE methods in PDR C

GOF statistics	**RM3-ARF (A)**	**RM3-ARF (P)**	**SCS**	**SCS-SA**	**SUH-ARF (A)**	**SUH-ARF (P)**	**LRH-Veld-ARF (A)**	**LRH-Veld-ARF (P)**	**LRH-T_C-ARF (A)**	**LRH-T_C-ARF (P)**
r^2 Eq. (2.8)	0.84	0.85	0.65	0.65	0.59	0.65	0.46	0.50	0.40	0.47
r^2 ranking	2	1	4	5	6	3	9	7	10	8
MARE Eq. (2.9) %	110.34	109.56	84.65	132.39	163.94	153.16	183.90	176.53	153.80	134.60
MARE ranking	3	2	1	4	8	6	10	9	7	5
NSE Eq. (2.10)	0.68	0.22	0.55	0.60	-0.07	-0.29	-0.19	-0.46	-0.07	-0.08
NSE ranking	1	4	3	2	6	9	8	10	5	7
RMSE Eq. (2.11)	610.80	949.01	716.70	674.50	1159.40	1270.25	1219.42	1355.70	1156.83	1162.23
RMSE ranking	1	4	3	2	6	9	8	10	5	7
SE Eq. (2.12) m^3/s	508.02	653.37	410.28	636.89	552.95	697.32	591.38	783.56	410.55	533.51
SE ranking	3	8	1	7	5	9	6	10	2	4
Sum of rankings	10	19	12	20	31	36	41	46	29	31
Overall Ranking	**1**	**3**	**2**	**4**	**6**	**8**	**9**	**10**	**5**	**6**

Table A.35: GOF ranking of event-based deterministic DFE methods in PDR D

GOF statistics	**RM3-ARF (A)**	**RM3-ARF (P)**	**SCS**	**SCS-SA**	**SUH-ARF (A)**	**SUH-ARF (P)**	**LRH-Veld-ARF (A)**	**LRH-Veld-ARF (P)**	**LRH-T_C-ARF (A)**	**LRH-T_C-ARF (P)**
r^2 Eq. (2.8)	0.58	0.57	0.55	0.36	0.34	0.31	0.76	0.70	0.81	0.77
r^2 ranking	5	6	7	8	9	10	3	4	1	2
MARE Eq. (2.9) %	341.59	416.85	520.64	254.91	533.73	397.50	644.57	493.47	520.00	393.55
MARE ranking	2	5	8	1	9	4	10	6	7	3
NSE Eq. (2.10)	0.52	0.12	-0.35	-0.13	-0.20	-0.22	-0.16	-0.16	-0.17	-0.16
NSE ranking	1	2	10	3	8	9	4	5	7	6
RMSE Eq. (2.11)	1825.44	2470.73	3055.98	3012.28	3166.71	3204.02	3120.74	3120.87	3132.70	3122.92
RMSE ranking	1	2	4	3	9	10	5	6	8	7
SE Eq. (2.12) m^3/s	1691.06	2388.94	2956.87	845.43	586.23	815.97	248.78	376.08	156.85	233.79
SE ranking	8	9	10	7	5	6	3	4	1	2
Sum of rankings	17	24	39	22	40	39	25	25	24	20
Overall Ranking	**1**	**4**	**8**	**3**	**10**	**8**	**6**	**6**	**4**	**2**

Table A.36: GOF ranking of event-based deterministic DFE methods in PDR E

GOF statistics	**RM3-ARF (A)**	**RM3-ARF (P)**	**SCS**	**SCS-SA**	**SUH-ARF (A)**	**SUH-ARF (P)**	**LRH-Veld-ARF (A)**	**LRH-Veld-ARF (P)**	**LRH-T_C-ARF (A)**	**LRH-T_C-ARF (P)**
r^2 Eq. (2.8)	0.84	0.81	0.72	0.73	0.68	0.69	0.73	0.72	0.81	0.78
r^2 ranking	1	2	7	6	10	9	5	8	3	4
MARE Eq. (2.9) %	98.25	74.97	134.76	158.60	169.68	148.28	247.35	209.40	327.83	247.97
MARE ranking	2	1	3	5	6	4	8	7	10	9
NSE Eq. (2.10)	0.74	0.19	0.66	-0.29	-1.46	-3.00	-2.82	-7.31	-0.72	-2.82
NSE ranking	1	3	2	4	6	9	8	10	5	7
RMSE Eq. (2.11)	358.81	632.90	407.23	795.14	1099.24	1402.87	1370.51	2021.45	919.62	1369.90
RMSE ranking	1	3	2	4	6	9	8	10	5	7
SE Eq. (2.12) m^3/s	348.99	519.81	418.41	670.65	867.91	1036.66	900.98	1278.75	536.42	819.75
SE ranking	1	3	2	5	7	9	8	10	4	6
Sum of rankings	6	12	16	24	35	40	37	45	27	33
Overall Ranking	1	2	3	4	7	9	8	10	5	6

Table A.37: GOF ranking of event-based deterministic DFE methods in PDR G

GOF statistics	**RM3-ARF (A)**	**RM3-ARF (P)**	**SCS**	**SCS-SA**	**SUH-ARF (A)**	**SUH-ARF (P)**	**LRH-Veld-ARF (A)**	**LRH-Veld-ARF (P)**	**LRH-T_C-ARF (A)**	**LRH-T_C-ARF (P)**
r^2 Eq. (2.8)	0.89	0.61	0.71	0.76	0.75	0.75	0.64	0.31	0.83	0.46
r^2 ranking	1	8	6	3	4	5	7	10	2	9
MARE Eq. (2.9) %	436.12	434.99	336.09	83.15	342.47	337.03	198.80	206.99	393.29	328.84
MARE ranking	10	9	5	1	7	6	2	3	8	4
NSE Eq. (2.10)	0.65	0.61	0.70	0.52	0.74	0.71	0.68	0.31	-0.10	0.53
NSE ranking	5	6	3	8	1	2	4	9	10	7
RMSE Eq. (2.11)	116.19	122.01	107.12	135.33	100.45	105.04	165.52	257.59	305.20	212.65
RMSE ranking	4	5	3	6	1	2	7	9	10	8
SE Eq. (2.12) m^3/s	85.03	92.08	81.79	44.27	73.79	67.05	100.87	92.94	162.16	169.44
SE ranking	5	6	4	1	3	2	8	7	9	10
Sum of rankings	25	34	21	19	16	17	28	38	39	38
Overall Ranking	**5**	**7**	**4**	**3**	**1**	**2**	**6**	**8**	**10**	**8**

Table A.38: GOF ranking of event-based deterministic DFE methods in PDR H

GOF statistics	**RM3-ARF (A)**	**RM3-ARF (P)**	**SCS**	**SCS-SA**	**SUH-ARF (A)**	**SUH-ARF (P)**	**LRH-Veld-ARF (A)**	**LRH-Veld-ARF (P)**	**LRH-T_C-ARF (A)**	**LRH-T_C-ARF (P)**
r^2 Eq. (2.8)	0.61	0.53	0.50	0.64	0.78	0.75	0.69	0.65	0.70	0.64
r^2 ranking	8	9	10	6	1	2	4	5	3	7
MARE Eq. (2.9) %	842.19	788.00	627.48	303.76	473.82	444.81	573.36	487.47	1499.44	1280.42
MARE ranking	8	7	6	1	3	2	5	4	10	9
NSE Eq. (2.10)	0.51	0.48	0.47	0.60	0.76	0.74	0.40	0.29	0.03	0.24
NSE ranking	4	5	6	3	1	2	7	8	10	9
RMSE Eq. (2.11)	205.85	212.08	213.24	184.18	142.58	148.03	289.90	322.03	370.35	331.96
RMSE ranking	4	5	6	3	1	2	7	8	10	9
SE Eq. (2.12) m^3/s	151.48	168.73	146.29	172.02	117.75	130.49	267.50	310.06	237.63	277.38
SE ranking	4	5	3	6	1	2	8	10	7	9
Sum of rankings	28	31	31	19	7	10	31	35	40	43
Overall Ranking	**4**	**5**	**5**	**3**	**1**	**2**	**5**	**8**	**9**	**10**

Table A.39: GOF ranking of event-based deterministic DFE methods in PDR J

GOF statistics	**RM3-ARF (A)**	**RM3-ARF (P)**	**SCS**	**SCS-SA**	**SUH-ARF (A)**	**SUH-ARF (P)**	**LRH-Veld-ARF (A)**	**LRH-Veld-ARF (P)**	**LRH-T_C-ARF (A)**	**LRH-T_C-ARF (P)**
r^2 Eq. (2.8)	0.73	0.69	0.65	0.80	0.70	0.68	0.82	0.81	0.80	0.80
r^2 ranking	6	8	10	4	7	9	1	2	5	3
MARE Eq. (2.9) %	361.07	310.44	210.92	194.27	267.52	259.54	214.59	181.29	368.57	286.40
MARE ranking	9	8	3	2	6	5	4	1	10	7
NSE Eq. (2.10)	-0.11	-1.53	0.52	-0.24	-2.12	-4.61	-0.49	-1.97	-0.42	-1.59
NSE ranking	2	6	1	3	9	10	5	8	4	7
RMSE Eq. (2.11)	764.44	1154.38	501.21	806.33	1281.57	1717.08	908.86	1295.93	885.63	1211.73
RMSE ranking	2	6	1	3	8	10	5	9	4	7
SE Eq. (2.12) m^3/s	643.81	918.58	501.72	583.64	951.56	1229.92	598.98	795.72	593.43	759.60
SE ranking	5	8	1	2	9	10	4	7	3	6
Sum of rankings	24	36	16	14	39	44	19	27	26	30
Overall Ranking	**4**	**8**	**2**	**1**	**9**	**10**	**3**	**6**	**5**	**7**

Table A.40: GOF ranking of event-based deterministic DFE methods in PDR K

GOF statistics	**RM3-ARF (A)**	**RM3-ARF (P)**	**SCS**	**SCS-SA**	**SUH-ARF (A)**	**SUH-ARF (P)**	**LRH-Veld-ARF (A)**	**LRH-Veld-ARF (P)**	**LRH-T_C-ARF (A)**	**LRH-T_C-ARF (P)**
r^2 Eq. (2.8)	0.88	0.84	0.79	0.78	0.35	0.34	0.18	0.17	0.29	0.27
r^2 ranking	1	2	3	4	5	6	9	10	7	8
MARE Eq. (2.9) %	96.95	77.37	176.80	68.65	74.19	75.46	119.84	124.07	110.16	110.22
MARE ranking	5	4	10	1	2	3	8	9	6	7
NSE Eq. (2.10)	0.49	0.82	0.55	0.65	-0.09	-0.19	-0.15	-0.37	0.18	0.16
NSE ranking	4	1	3	2	7	9	8	10	5	6
RMSE Eq. (2.11)	102.61	60.46	95.78	83.93	148.47	155.50	182.09	201.32	154.27	157.28
RMSE ranking	4	1	3	2	5	7	9	10	6	8
SE Eq. (2.12) m^3/s	69.35	60.70	82.40	83.60	60.93	52.55	91.70	62.39	147.05	99.60
SE ranking	5	2	6	7	3	1	8	4	10	9
Sum of rankings	19	10	25	16	22	26	42	43	34	38
Overall Ranking	**3**	**1**	**5**	**2**	**4**	**6**	**9**	**10**	**7**	**8**

Table A.41: GOF ranking of event-based deterministic DFE methods in PDR L

GOF statistics	RM3-ARF (A)	RM3-ARF (P)	SCS	SCS-SA	SUH-ARF (A)	SUH-ARF (P)	LRH-Veld-ARF (A)	LRH-Veld-ARF (P)	LRH-T_c-ARF (A)	LRH-T_c-ARF (P)
r^2 Eq. (2.8)	0.78	0.81	0.80	0.80	0.62	0.72	0.82	0.87	0.82	0.86
r^2 ranking	8	5	6	7	10	9	3	1	4	2
MARE Eq. (2.9) %	77.54	69.47	65.90	181.33	65.22	55.28	96.26	87.94	86.78	85.57
MARE ranking	5	4	3	10	2	1	9	8	7	6
NSE Eq. (2.10)	-2.42	-2.56	-1.57	-37.14	0.55	0.65	0.26	0.34	-0.03	0.00
NSE ranking	8	9	7	10	2	1	4	3	6	5
RMSE Eq. (2.11)	597.19	610.03	518.45	1995.52	215.86	191.36	304.32	296.84	358.94	364.21
RMSE ranking	8	9	7	10	2	1	4	3	5	6
SE Eq. (2.12) m^3/s	387.79	379.80	335.39	940.77	208.70	179.99	218.93	190.52	252.65	234.06
SE ranking	9	8	7	10	3	1	4	2	6	5
Sum of rankings	38	35	30	47	19	13	24	17	28	24
Overall Ranking	**9**	**8**	**7**	**10**	**3**	**1**	**4**	**2**	**6**	**4**

Table A.42: GOF ranking of event-based deterministic DFE methods in PDR N

GOF statistics	RM3-ARF (A)	RM3-ARF (P)	SCS	SCS-SA	SUH-ARF (A)	SUH-ARF (P)	LRH-Veld-ARF (A)	LRH-Veld-ARF (P)	LRH-T_c-ARF (A)	LRH-T_c-ARF (P)
r^2 Eq. (2.8)	0.79	0.79	0.86	0.74	0.77	0.80	0.86	0.86	0.81	0.83
r^2 ranking	8	7	3	10	9	6	2	1	5	4
MARE Eq. (2.9) %	62.93	55.61	63.22	35.48	66.17	51.27	70.96	63.26	57.65	42.88
MARE ranking	6	4	7	1	9	3	10	8	5	2
NSE Eq. (2.10)	0.78	0.73	-0.06	0.71	0.72	0.79	0.86	0.68	0.61	0.79
NSE ranking	4	5	10	7	6	2	1	8	9	3
RMSE Eq. (2.11)	489.67	543.19	1068.36	563.60	548.03	474.71	392.78	585.82	652.90	479.15
RMSE ranking	4	5	10	7	6	2	1	8	9	3
SE Eq. (2.12) m^3/s	462.43	553.52	138.83	562.78	382.59	474.38	356.14	493.68	271.72	360.56
SE ranking	6	9	1	10	5	7	3	8	2	4
Sum of rankings	28	30	31	35	35	20	17	33	30	16
Overall Ranking	**4**	**5**	**7**	**9**	**9**	**3**	**2**	**8**	**5**	**1**

Table A.43: GOF ranking of event-based deterministic DFE methods in PDR P

GOF statistics	RM3-ARF (A)	RM3-ARF (P)	SCS	SCS-SA	SUH-ARF (A)	SUH-ARF (P)	LRH-Veld-ARF (A)	LRH-Veld-ARF (P)	LRH-T_c-ARF (A)	LRH-T_c-ARF (P)
r^2 Eq. (2.8)	0.92	0.91	0.97	0.98	0.87	0.85	0.82	0.78	0.86	0.83
r^2 ranking	3	4	2	1	5	7	9	10	6	8
MARE Eq. (2.9) %	39.45	34.54	61.00	39.89	37.91	32.75	74.52	54.98	38.22	32.76
MARE ranking	6	3	9	7	4	1	10	8	5	2
NSE Eq. (2.10)	0.92	0.90	0.17	0.12	0.69	0.60	0.71	0.75	0.67	0.58
NSE ranking	1	2	9	10	5	7	4	3	6	8
RMSE Eq. (2.11)	93.20	107.00	303.28	312.78	186.16	211.14	178.52	167.74	190.84	215.25
RMSE ranking	1	2	9	10	5	7	4	3	6	8
SE Eq. (2.12) m^3/s	91.93	97.36	30.01	89.98	81.76	87.63	153.59	166.28	83.89	92.61
SE ranking	6	8	1	5	2	4	9	10	3	7
Sum of rankings	17	19	30	33	21	26	36	34	26	33
Overall Ranking	**1**	**2**	**6**	**7**	**3**	**4**	**10**	**9**	**4**	**7**

Table A.44: GOF ranking of event-based deterministic DFE methods in PDR Q

GOF statistics	RM3-ARF (A)	RM3-ARF (P)	SCS	SCS-SA	SUH-ARF (A)	SUH-ARF (P)	LRH-Veld-ARF (A)	LRH-Veld-ARF (P)	LRH-T_C-ARF (A)	LRH-T_C-ARF (P)
r^2 Eq. (2.8)	0.25	0.26	0.33	0.52	0.25	0.23	0.37	0.33	0.39	0.38
r^2 ranking	8	7	6	1	9	10	4	5	2	3
MARE Eq. (2.9) %	157.22	133.50	78.60	117.85	224.64	176.01	153.72	127.02	125.93	77.02
MARE ranking	8	6	2	3	10	9	7	5	4	1
NSE Eq. (2.10)	-2.22	-2.37	0.29	-0.81	-1.88	-1.94	-1.44	-2.01	-0.16	-0.18
NSE ranking	9	10	1	4	6	7	5	8	2	3
RMSE Eq. (2.11)	546.18	558.64	256.05	409.96	516.55	521.61	475.12	533.25	327.81	334.00
RMSE ranking	9	10	1	4	6	7	5	8	2	3
SE Eq. (2.12) m^3/s	454.12	496.34	189.66	319.47	377.39	428.96	367.28	466.90	243.40	302.29
SE ranking	8	10	1	4	6	7	5	9	2	3
Sum of rankings	42	43	11	16	37	40	26	35	12	13
Overall Ranking	**9**	**10**	**1**	**4**	**7**	**8**	**5**	**6**	**2**	**3**

Table A.45: GOF ranking of event-based deterministic DFE methods in PDR R

GOF statistics	RM3-ARF (A)	RM3-ARF (P)	SCS	SCS-SA	SUH-ARF (A)	SUH-ARF (P)	LRH-Veld-ARF (A)	LRH-Veld-ARF (P)	LRH-T_C-ARF (A)	LRH-T_C-ARF (P)
r^2 Eq. (2.8)	0.90	0.93	0.91	0.94	0.94	0.97	0.94	0.94	0.80	0.94
r^2 ranking	9	7	8	2	6	1	4	3	10	5
MARE Eq. (2.9) %	42.22	44.01	37.11	35.42	54.42	47.33	72.40	61.24	62.60	64.30
MARE ranking	3	4	2	1	6	5	10	7	8	9
NSE Eq. (2.10)	0.79	0.77	0.53	0.91	0.90	0.90	0.90	0.88	0.72	0.70
NSE ranking	6	7	10	1	2	3	4	5	8	9
RMSE Eq. (2.11)	267.43	275.76	398.18	178.97	183.15	184.16	215.94	227.50	355.74	365.14
RMSE ranking	6	7	10	1	2	3	4	5	8	9
SE Eq. (2.12) m^3/s	129.35	103.35	85.03	157.65	118.70	75.64	112.68	118.29	168.04	90.97
SE ranking	8	4	2	9	7	1	5	6	10	3
Sum of rankings	32	29	32	14	23	13	27	26	44	35
Overall Ranking	**7**	**6**	**7**	**2**	**3**	**1**	**5**	**4**	**10**	**9**

Table A.46: GOF ranking of event-based deterministic DFE methods in PDR S

GOF statistics	RM3-ARF (A)	RM3-ARF (P)	SCS	SCS-SA	SUH-ARF (A)	SUH-ARF (P)	LRH-Veld-ARF (A)	LRH-Veld-ARF (P)	LRH-T_C-ARF (A)	LRH-T_C-ARF (P)
r^2 Eq. (2.8)	0.67	0.68	0.58	0.89	0.85	0.85	0.81	0.79	0.71	0.72
r^2 ranking	9	8	10	1	2	3	4	5	7	6
MARE Eq. (2.9) %	263.96	185.78	161.82	202.11	246.82	142.57	214.51	146.96	220.28	133.31
MARE ranking	10	5	4	6	9	2	7	3	8	1
NSE Eq. (2.10)	-5.74	-5.99	-0.63	-2.46	-1.37	-1.04	-2.83	-3.15	-1.96	-2.06
NSE ranking	9	10	1	6	3	2	7	8	4	5
RMSE Eq. (2.11)	381.05	388.28	187.43	273.15	225.84	209.65	287.44	299.22	252.42	256.72
RMSE ranking	9	10	1	6	3	2	7	8	4	5
SE Eq. (2.12) m^3/s	229.00	248.47	143.58	104.72	93.79	108.90	142.36	169.67	150.18	175.04
SE ranking	9	10	5	2	1	3	4	7	6	8
Sum of rankings	46	43	21	21	18	12	29	31	29	25
Overall Ranking	**10**	**9**	**3**	**3**	**2**	**1**	**6**	**8**	**6**	**5**

Table A.47: GOF ranking of event-based deterministic DFE methods in PDR T

GOF statistics	**RM3-ARF (A)**	**RM3-ARF (P)**	**SCS**	**SCS-SA**	**SUH-ARF (A)**	**SUH-ARF (P)**	**LRH-Veld-ARF (A)**	**LRH-Veld-ARF (P)**	**LRH-T_C-ARF (A)**	**LRH-T_C-ARF (P)**
r^2 Eq. (2.8)	0.60	0.61	0.63	0.56	0.61	0.64	0.65	0.62	0.62	0.63
r^2 ranking	9	8	3	10	7	2	1	6	5	4
MARE Eq. (2.9) %	65.48	51.42	37.22	33.18	45.95	32.74	41.69	39.42	43.40	34.09
MARE ranking	10	9	4	2	8	1	6	5	7	3
NSE Eq. (2.10)	0.34	0.19	0.55	0.55	0.56	0.57	0.60	0.39	0.62	0.60
NSE ranking	9	10	6	7	5	4	2	8	1	3
RMSE Eq. (2.11)	604.43	670.46	500.99	501.47	491.96	489.49	468.29	582.80	457.92	473.75
RMSE ranking	9	10	6	7	5	4	2	8	1	3
SE Eq. (2.12) m^3/s	568.42	640.56	312.69	390.10	445.87	479.51	432.97	574.00	359.35	447.20
SE ranking	8	10	1	3	5	7	4	9	2	6
Sum of rankings	45	47	20	29	30	18	15	36	16	19
Overall Ranking	**9**	**10**	**5**	**6**	**7**	**3**	**1**	**8**	**2**	**4**

Table A.48: GOF ranking of event-based deterministic DFE methods in PDR U

GOF statistics	**RM3-ARF (A)**	**RM3-ARF (P)**	**SCS**	**SCS-SA**	**SUH-ARF (A)**	**SUH-ARF (P)**	**LRH-Veld-ARF (A)**	**LRH-Veld-ARF (P)**	**LRH-T_C-ARF (A)**	**LRH-T_C-ARF (P)**
r^2 Eq. (2.8)	0.37	0.33	0.46	0.46	0.31	0.26	0.34	0.27	0.38	0.33
r^2 ranking	4	7	1	2	8	10	5	9	3	6
MARE Eq. (2.9) %	239.68	210.99	160.64	146.57	202.29	155.68	133.80	99.42	121.14	86.10
MARE ranking	10	9	7	5	8	6	4	2	3	1
NSE Eq. (2.10)	-1.91	-2.33	-0.45	-0.85	-1.33	-1.29	-0.90	-1.48	-0.05	-0.30
NSE ranking	9	10	3	4	7	6	5	8	1	2
RMSE Eq. (2.11)	724.24	773.96	511.25	577.79	647.15	649.28	608.63	696.18	452.73	503.67
RMSE ranking	9	10	3	4	6	7	5	8	1	2
SE Eq. (2.12) m^3/s	646.91	727.42	462.32	502.32	596.95	638.39	552.93	677.64	417.04	496.43
SE ranking	8	10	2	4	6	7	5	9	1	3
Sum of rankings	40	46	16	19	35	36	24	36	9	14
Overall Ranking	**9**	**10**	**3**	**4**	**6**	**7**	**5**	**7**	**1**	**2**

Table A.49: GOF ranking of event-based deterministic DFE methods in PDR V

GOF statistics	**RM3-ARF (A)**	**RM3-ARF (P)**	**SCS**	**SCS-SA**	**SUH-ARF (A)**	**SUH-ARF (P)**	**LRH-Veld-ARF (A)**	**LRH-Veld-ARF (P)**	**LRH-T_C-ARF (A)**	**LRH-T_C-ARF (P)**
r^2 Eq. (2.8)	0.67	0.69	0.75	0.80	0.60	0.52	0.64	0.59	0.61	0.61
r^2 ranking	4	3	2	1	8	10	5	9	7	6
MARE Eq. (2.9) %	126.45	85.88	56.36	59.59	83.90	72.55	59.61	54.39	66.36	54.75
MARE ranking	10	9	3	4	8	7	5	1	6	2
NSE Eq. (2.10)	-0.04	0.11	0.70	0.80	0.60	0.49	0.65	0.54	0.57	0.53
NSE ranking	10	9	2	1	4	8	3	6	5	7
RMSE Eq. (2.11)	555.56	514.54	296.58	244.52	343.10	387.38	329.02	376.29	363.79	381.19
RMSE ranking	10	9	2	1	4	8	3	6	5	7
SE Eq. (2.12) m^3/s	457.42	450.87	292.16	216.33	276.08	297.75	275.59	338.18	214.90	233.37
SE ranking	10	9	6	2	5	7	4	8	1	3
Sum of rankings	44	39	15	9	29	40	20	30	24	25
Overall Ranking	**10**	**8**	**2**	**1**	**6**	**9**	**3**	**7**	**4**	**5**

Table A.50: GOF ranking of event-based deterministic DFE methods in PDR W

GOF statistics	**RM3-ARF (A)**	**RM3-ARF (P)**	**SCS**	**SCS-SA**	**SUH-ARF (A)**	**SUH-ARF (P)**	**LRH-Veld-ARF (A)**	**LRH-Veld-ARF (P)**	**LRH-T_C-ARF (A)**	**LRH-T_C-ARF (P)**
r^2 Eq. (2.8)	0.50	0.52	0.57	0.64	0.43	0.43	0.43	0.42	0.38	0.39
r^2 ranking	4	3	2	1	5	6	7	8	10	9
MARE Eq. (2.9) %	117.48	84.39	132.85	137.18	129.72	114.30	166.59	145.29	129.65	116.75
MARE ranking	4	1	7	8	6	2	10	9	5	3
NSE Eq. (2.10)	0.48	0.48	0.51	0.61	0.38	0.32	0.46	0.44	0.33	0.31
NSE ranking	3	4	2	1	7	9	5	6	8	10
RMSE Eq. (2.11)	608.54	610.93	591.26	528.69	667.58	698.06	682.87	704.90	755.90	779.26
RMSE ranking	3	4	2	1	5	7	6	8	9	10
SE Eq. (2.12) m^3/s	360.49	353.36	307.51	487.97	307.01	272.96	417.10	441.13	293.27	306.49
SE ranking	7	6	5	10	4	1	8	9	2	3
Sum of rankings	21	18	18	21	27	25	36	40	34	35
Overall Ranking	**3**	**1**	**1**	**3**	**6**	**5**	**9**	**10**	**7**	**8**

Table A.51: GOF ranking of event-based deterministic DFE methods in PDR X

GOF statistics	**RM3-ARF (A)**	**RM3-ARF (P)**	**SCS**	**SCS-SA**	**SUH-ARF (A)**	**SUH-ARF (P)**	**LRH-Veld-ARF (A)**	**LRH-Veld-ARF (P)**	**LRH-T_C-ARF (A)**	**LRH-T_C-ARF (P)**
r^2 Eq. (2.8)	0.70	0.71	0.85	0.84	0.68	0.70	0.74	0.74	0.71	0.72
r^2 ranking	8	6	1	2	10	9	3	4	7	5
MARE Eq. (2.9) %	741.72	647.03	180.00	186.09	555.14	521.18	190.57	120.56	203.22	128.54
MARE ranking	10	9	3	4	8	7	5	1	6	2
NSE Eq. (2.10)	-0.47	-0.71	0.83	0.68	0.43	0.42	0.05	-0.32	0.56	0.52
NSE ranking	9	10	1	2	5	6	7	8	3	4
RMSE Eq. (2.11)	723.28	781.37	242.80	340.23	452.73	454.52	612.31	725.95	415.62	437.44
RMSE ranking	8	10	1	2	5	6	7	9	3	4
SE Eq. (2.12) m^3/s	545.70	605.60	188.03	289.88	407.45	429.99	483.93	581.76	355.55	416.03
SE ranking	8	10	1	2	4	6	7	9	3	5
Sum of rankings	43	45	7	12	32	34	29	31	22	20
Overall Ranking	**9**	**10**	**1**	**2**	**7**	**8**	**5**	**6**	**4**	**3**

Table A.52: GOF ranking of event-based deterministic DFE methods (T = 2-yr)

GOF statistics	**RM3-ARF (A)**	**RM3-ARF (P)**	**SCS**	**SCS-SA**	**SUH-ARF (A)**	**SUH-ARF (P)**	**LRH-Veld-ARF (A)**	**LRH-Veld-ARF (P)**	**LRH-T_C-ARF (A)**	**LRH-T_C-ARF (P)**
r^2 Eq. (2.8)	81.00	92.00	126.00	101.00	120.00	123.00	99.00	137.00	105.00	116.00
r^2 ranking	1	2	9	4	7	8	3	10	5	6
MARE Eq. (2.9) %	155.00	104.00	56.00	61.00	149.00	86.00	150.00	99.00	146.00	94.00
MARE ranking	10	6	1	2	8	3	9	5	7	4
NSE Eq. (2.10)	138.00	112.00	66.00	76.00	134.00	87.00	154.00	133.00	112.00	88.00
NSE ranking	9	5	1	2	8	3	10	7	5	4
RMSE Eq. (2.11)	134.00	110.00	65.00	70.00	129.00	82.00	161.00	141.00	113.00	95.00
RMSE ranking	8	5	1	2	7	3	10	9	6	4
SE Eq. (2.12) m^3/s	135.00	124.00	46.00	89.00	130.00	94.00	140.00	152.00	103.00	87.00
SE ranking	8	6	1	3	7	4	9	10	5	2
Sum of rankings	643	542	359	397	662	472	704	662	579	480
Overall Ranking	**7**	**5**	**1**	**2**	**8**	**3**	**10**	**8**	**6**	**4**

Table A.53: GOF ranking of event-based deterministic DFE methods (*T* = 5-yr)

GOF statistics	**RM3-ARF (A)**	**RM3-ARF (P)**	**SCS**	**SCS-SA**	**SUH-ARF (A)**	**SUH-ARF (P)**	**LRH-Veld-ARF (A)**	**LRH-Veld-ARF (P)**	**LRH-T_C-ARF (A)**	**LRH-T_C-ARF (P)**
r^2 Eq. (2.8)	90.00	92.00	111.00	90.00	128.00	125.00	103.00	139.00	105.00	117.00
r^2 ranking	1	3	6	1	9	8	4	10	5	7
MARE Eq. (2.9) %	127.00	90.00	83.00	60.00	144.00	91.00	152.00	105.00	153.00	95.00
MARE ranking	7	3	2	1	8	4	9	6	10	5
NSE Eq. (2.10)	96.00	93.00	86.00	75.00	118.00	106.00	138.00	154.00	122.00	112.00
NSE ranking	4	3	2	1	7	5	9	10	8	6
RMSE Eq. (2.11)	94.00	91.00	85.00	71.00	115.00	103.00	142.00	158.00	123.00	118.00
RMSE ranking	4	3	2	1	6	5	9	10	8	7
SE Eq. (2.12) m^3/s	107.00	111.00	47.00	91.00	131.00	107.00	142.00	162.00	102.00	100.00
SE ranking	5	7	1	2	8	5	9	10	4	3
Sum of rankings	514	477	412	387	636	532	677	718	605	542
Overall Ranking	**4**	**3**	**2**	**1**	**8**	**5**	**9**	**10**	**7**	**6**

Table A.54: GOF ranking of event-based deterministic DFE methods (*T* = 10-yr)

GOF statistics	**RM3-ARF (A)**	**RM3-ARF (P)**	**SCS**	**SCS-SA**	**SUH-ARF (A)**	**SUH-ARF (P)**	**LRH-Veld-ARF (A)**	**LRH-Veld-ARF (P)**	**LRH-T_C-ARF (A)**	**LRH-T_C-ARF (P)**
r^2 Eq. (2.8)	101.00	94.00	110.00	74.00	138.00	130.00	105.00	130.00	108.00	110.00
r^2 ranking	3	2	6	1	10	8	4	8	5	6
MARE Eq. (2.9) %	123.00	95.00	97.00	67.00	137.00	93.00	144.00	106.00	147.00	91.00
MARE ranking	7	4	5	1	8	3	9	6	10	2
NSE Eq. (2.10)	94.00	90.00	98.00	74.00	116.00	113.00	122.00	155.00	122.00	116.00
NSE ranking	3	2	4	1	6	5	8	10	8	6
RMSE Eq. (2.11)	92.00	86.00	97.00	72.00	112.00	108.00	129.00	157.00	126.00	121.00
RMSE ranking	3	2	4	1	6	5	9	10	8	7
SE Eq. (2.12) m^3/s	95.00	107.00	62.00	93.00	127.00	113.00	139.00	168.00	93.00	103.00
SE ranking	4	6	1	2	8	7	9	10	2	5
Sum of rankings	505	472	464	380	630	557	639	716	596	541
Overall Ranking	**4**	**3**	**2**	**1**	**8**	**6**	**9**	**10**	**7**	**5**

Table A.55: GOF ranking of event-based deterministic DFE methods (*T* = 20-yr)

GOF statistics	**RM3-ARF (A)**	**RM3-ARF (P)**	**SCS**	**SCS-SA**	**SUH-ARF (A)**	**SUH-ARF (P)**	**LRH-Veld-ARF (A)**	**LRH-Veld-ARF (P)**	**LRH-T_C-ARF (A)**	**LRH-T_C-ARF (P)**
r^2 Eq. (2.8)	96.00	93.00	100.00	81.00	137.00	132.00	111.00	132.00	109.00	109.00
r^2 ranking	3	2	4	1	10	8	7	8	5	5
MARE Eq. (2.9) %	123.00	96.00	102.00	75.00	136.00	91.00	142.00	109.00	138.00	88.00
MARE ranking	7	4	5	1	8	3	10	6	9	2
NSE Eq. (2.10)	91.00	93.00	97.00	83.00	117.00	120.00	115.00	154.00	116.00	114.00
NSE ranking	2	3	4	1	8	9	6	10	7	5
RMSE Eq. (2.11)	88.00	87.00	91.00	80.00	114.00	113.00	124.00	159.00	123.00	121.00
RMSE ranking	3	2	4	1	6	5	9	10	8	7
SE Eq. (2.12) m^3/s	89.00	115.00	62.00	98.00	120.00	114.00	139.00	170.00	87.00	106.00
SE ranking	3	7	1	4	8	6	9	10	2	5
Sum of rankings	487	484	452	417	624	570	631	724	573	538
Overall Ranking	**4**	**3**	**2**	**1**	**8**	**6**	**9**	**10**	**7**	**5**

Table A.56: GOF ranking of event-based deterministic DFE methods (*T* = 50-yr)

GOF statistics	**RM3-ARF (A)**	**RM3-ARF (P)**	**SCS**	**SCS-SA**	**SUH-ARF (A)**	**SUH-ARF (P)**	**LRH-Veld-ARF (A)**	**LRH-Veld-ARF (P)**	**LRH-T_C-ARF (A)**	**LRH-T_C-ARF (P)**
r^2 Eq. (2.8)	94.00	91.00	101.00	87.00	137.00	133.00	104.00	130.00	111.00	112.00
r^2 ranking	3	2	4	1	10	9	5	8	6	7
MARE Eq. (2.9) %	129.00	110.00	103.00	88.00	125.00	88.00	136.00	112.00	128.00	81.00
MARE ranking	9	5	4	2	7	2	10	6	8	1
NSE Eq. (2.10)	92.00	108.00	98.00	98.00	106.00	122.00	104.00	153.00	105.00	114.00
NSE ranking	1	7	2	2	6	9	4	10	5	8
RMSE Eq. (2.11)	90.00	104.00	90.00	96.00	103.00	116.00	114.00	157.00	109.00	121.00
RMSE ranking	1	5	1	3	4	8	7	10	6	9
SE Eq. (2.12) m^3/s	100.00	123.00	68.00	109.00	105.00	117.00	121.00	167.00	83.00	107.00
SE ranking	3	9	1	6	4	7	8	10	2	5
Sum of rankings	505	536	460	478	576	576	579	719	536	535
Overall Ranking	**3**	**5**	**1**	**2**	**7**	**7**	**9**	**10**	**5**	**4**

Table A.57: GOF ranking of event-based deterministic DFE methods (*T* = 100-yr)

GOF statistics	**RM3-ARF (A)**	**RM3-ARF (P)**	**SCS**	**SCS-SA**	**SUH-ARF (A)**	**SUH-ARF (P)**	**LRH-Veld-ARF (A)**	**LRH-Veld-ARF (P)**	**LRH-T_C-ARF (A)**	**LRH-T_C-ARF (P)**
r^2 Eq. (2.8)	92.00	90.00	92.00	97.00	133.00	136.00	104.00	128.00	116.00	111.00
r^2 ranking	2	1	2	4	9	10	5	8	7	6
MARE Eq. (2.9) %	140.00	124.00	99.00	92.00	117.00	87.00	132.00	111.00	117.00	80.00
MARE ranking	10	8	4	3	6	2	9	5	6	1
NSE Eq. (2.10)	100.00	127.00	85.00	106.00	94.00	116.00	107.00	150.00	101.00	113.00
NSE ranking	3	9	1	5	2	8	6	10	4	7
RMSE Eq. (2.11)	100.00	126.00	77.00	105.00	90.00	115.00	113.00	152.00	104.00	117.00
RMSE ranking	3	9	1	5	2	7	6	10	4	8
SE Eq. (2.12) m^3/s	113.00	140.00	64.00	99.00	95.00	115.00	118.00	164.00	82.00	109.00
SE ranking	6	9	1	4	3	7	8	10	2	5
Sum of rankings	545	607	417	499	529	569	574	705	520	530
Overall Ranking	**6**	**9**	**1**	**2**	**4**	**7**	**8**	**10**	**3**	**5**

Table A.58: GOF ranking of event-based deterministic DFE methods (*T* = 200-yr)

GOF statistics	**RM3-ARF (A)**	**RM3-ARF (P)**	**SCS**	**SCS-SA**	**SUH-ARF (A)**	**SUH-ARF (P)**	**LRH-Veld-ARF (A)**	**LRH-Veld-ARF (P)**	**LRH-T_C-ARF (A)**	**LRH-T_C-ARF (P)**
r^2 Eq. (2.8)	90.00	87.00	105.00	96.00	133.00	133.00	101.00	126.00	115.00	114.00
r^2 ranking	2	1	5	3	9	9	4	8	7	6
MARE Eq. (2.9) %	162.00	141.00	93.00	112.00	108.00	80.00	122.00	102.00	105.00	75.00
MARE ranking	10	9	3	7	6	2	8	4	5	1
NSE Eq. (2.10)	125.00	137.00	80.00	103.00	90.00	117.00	99.00	147.00	97.00	105.00
NSE ranking	8	9	1	5	2	7	4	10	3	6
RMSE Eq. (2.11)	120.00	129.00	72.00	101.00	86.00	116.00	112.00	152.00	101.00	111.00
RMSE ranking	8	9	1	3	2	7	6	10	3	5
SE Eq. (2.12) m^3/s	124.00	149.00	71.00	107.00	89.00	110.00	114.00	155.00	78.00	103.00
SE ranking	8	9	1	5	3	6	7	10	2	4
Sum of rankings	621	643	421	519	506	556	548	682	496	508
Overall Ranking	**8**	**9**	**1**	**5**	**3**	**7**	**6**	**10**	**2**	**4**