COOPERATIVE RESEARCH CENTRE FOR **CATCHMENT HYDROLOGY**

STOCHASTIC MODELS FOR GENERATING ANNUAL, MONTHLY AND DAILY RAINFALL AND CLIMATE DATA AT A SITE

TECHNICAL REPORT
Report 03/16
December 2003

Ratnasingham Srikanthan / Francis Chiew

COOPERATIVE RESEARCH CENTRE FOR
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Stochastic Models for Generating Annual, Monthly and Daily Rainfall and Climate Data at a Site

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Preface

One of the goals of the Climate Variability Program in the Cooperative Research Centre (CRC) for Catchment Hydrology is to develop computer programs for generating stochastic data at time scales from less than one hour to one year and for point sites to large catchments.

The first phase of the program (2000-2002) has developed models to stochastically generate rainfall and climate data for a site at annual, monthly and daily time scales. Different models have been tested using data from across Australia, and the results have been reported in a series of CRC for Catchment Hydrology reports and research papers (see Reference section).

The purpose of this report is to provide guidance on the use of the stochastic modelling software.

Francis Chiew
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CRC for Catchment Hydrology

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INTRODUCTION

One of the goals of the Climate Variability Program in the CRC for Catchment Hydrology is to provide catchment and river managers and modellers, consultants and other researchers, with computer programs to generate stochastic climate data. The stochastic data are needed at time scales from less than one hour to a year and for point sites to large catchments.

The first phase of the program (2000-2002) has developed models to stochastically generate rainfall and climate data for a site at annual, monthly and daily time scales. The developed models were tested using data from a number of sites located in various parts of Australia. The description of the models and the detail results of the model testing have been published in a series of technical reports and working documents (see references).

The purpose of this document is to provide the background and guidance on the use of the six stochastic models and the stochastic modelling software.

- annual rainfall[#] [annrain_ar1 and annrain_ar1pu]
- monthly rainfall [monrain_mfm]
- daily rainfall [dayrain_tpmb]
- annual climate* [annclim_mvm]
- monthly climate [monclim_mfm]
- daily climate [dayclim_dma]

To use each model, the user needs to provide a specification file and a historical data file (the historical data file must have complete data). The model will produce a file containing the generated stochastic data and a diagnostic file comparing the statistics of the generated data and the recorded data. Some of the models also produce several other files containing information on the calibrated stochastic model parameters.

Part A of this document provides a very brief description of the stochastic models.

Part B of this document provides a list of the variables/statistics used to assess the quality of the stochastically generated data. The diagnostic file outputs the mean and the percentiles of these statistics estimated from the generated data and the corresponding values from the historical data.

Part C gives the criteria used by the programs to make a general overall assessment of the quality of the stochastically generated data. An informed user can also use the diagnostic file to make a judgement of the quality of the stochastically generated data.

Part D specifies the input file requirements and provides examples of input and output files.

[#] Two programs are given to generate annual rainfall data. The user can make a choice between the simpler annrain_ar1 model or the more complex annrain_ar1pu model by evaluating the diagnostic files or simply use the annrain_ar1pu model.

* The "rainfall" models generate rainfall data only. The "climate" models generate rainfall and other climate variables. The climate models have been tested using rainfall, potential evapotranspiration and maximum temperature data. The "rainfall" models should be used when only stochastic rainfall data are required. The climate models developed here require concurrent rainfall and climate which are of considerably shorter length than the rainfall data itself.

PART A: DESCRIPTION OF THE STOCHASTIC MODELS

A1 Annual Rainfall Data Generation Model

A1.1 AR(1) Model Without Parameter Uncertainty

Rainfall data are less variable than streamflow data, with little correlation between the values in successive years. Hence a first order autoregressive [AR(1)] or a random model is adequate for most cases. The AR(1) model is of the form:

$$X_t = rX_{t-1} + (1 - r^2) - \eta_t \quad (1)$$

where,

X_t is standardised rainfall in year t

η_t is normally distributed random component with zero mean and unit variance

r is lag one autocorrelation coefficient.

The annual rainfall amount is obtained from:

$$x_t = \overline{x} + s\,X_t \quad (2)$$

where,

x_t is rainfall in year t

$\overline{x}$ is mean annual rainfall

s is standard deviation of annual rainfall.

If the annual data are skewed, the skewness in the data is modelled through the Wilson-Hilferty transformation:

$$\varepsilon_t = \frac{2}{g_\varepsilon}\left\{\left(1 + \frac{g_\varepsilon \eta_t}{6} - \frac{g_\varepsilon^2}{36}\right)^3 - 1\right\} \quad (3)$$

where g_ε is the skewness of ε_t, which is related to the skewness (g) of annual rainfall through:

$$g_\varepsilon = \frac{(1 - r^3)}{(1 - r^2)^{3/2}} g \quad (4)$$

The skewness in the data is modelled using the Wilson-Hilferty transformation when the coefficient of skewness is greater than 0.5. The AR(1) model is used when the lag one autocorrelation coefficient is greater than 0.05, otherwise a random model is used.

The computer program *annrain_ar1* is used to generate annual rainfall data without parameter uncertainty.

A1.2 AR(1) Model With Parameter Uncertainty

The AR(1) model can be rewritten in the form:

$$z_t = \mu + \phi_1 (z_{t-1} - \mu) + \varepsilon_t \quad (5)$$

where,

z_t is a normally distributed time series

μ is the mean

ϕ_1 is the autoregressive parameter

ε_t is a Gaussian random variable with zero mean and variance .

In the case of non-normal data, the data is normalised using the Box-Cox transformation:

$$z_t = \begin{cases} \dfrac{x_t^\lambda - 1}{\lambda} & \lambda \neq 0 \\ \log x_t & \lambda = 0 \end{cases} \quad (6)$$

where λ is the transformation parameter which transforms the skewed data to approximately Gaussian. With the transformation parameter included, the vector of unknown AR(1) model parameters is given by:

$$\theta^T = (\mu, \sigma_\varepsilon, \phi_1, \lambda) \quad (7)$$

The Metropolis algorithm is used to simulate the

posterior distribution of the model parameters. To improve the acceptance rate of the Metropolis algorithm, the parameter space is transformed to remove the dependencies of μ and σ_ε on λ.

$$\mu = \frac{\mu_x^\lambda - 1}{\lambda}$$
$$\sigma_\varepsilon = \mu_x^{\lambda-1}\sigma_x\sqrt{1-\phi_1^2} \quad (8)$$

where μ_x and σ_x represent a first order approximation to the expected value and the standard deviation of the untransformed rainfall data.

The computer program *annrain_ar1pu* is used to generate annual rainfall data with parameter uncertainty.

A2 Monthly Rainfall Data Generation Model

Monthly rainfall data are generated by disaggregating generated annual rainfall data using the modified method of fragments.

In the modified method of fragments, the observed monthly rainfalls are standardised year by year so that the sum of the monthly rainfall in any year equals to unity. This is done by dividing the monthly rainfall in a year by the corresponding annual rainfall. By doing so, from a record of n years, one will have n sets of fragments of monthly rainfalls. The appropriate monthly fragments for a given year, k, is selected by considering the closeness of the generated annual rainfall data and the monthly rainfall for the last month of the previous year of the already disaggregated data to the corresponding historical values. This is achieved by selecting the monthly fragments of a year, i, in the generated monthly series that produces a minimum value for α_i, which is defined below:

$$\alpha_i = \left(\frac{x'_k - x_i}{s_x}\right)^2 + \left(\frac{y'_{k-1} - y_{i-1}}{s_y}\right)^2 \quad (9)$$

where,

x_k is generated annual rainfall for year k

x_i is historical annual rainfall for year i

s_x is standard deviation of the annual rainfall

y_{k-1} is disaggregated monthly rainfall for the last month of year k-1

y_{i-1} is historical monthly rainfall for the last month of year i-1

s_y is standard deviation of the monthly rainfall for the last month of a year

The generated annual rainfalls are disaggregated by multiplying the generated rainfall by each of the 12 fragments to give 12 generated monthly rainfalls.

The computer program *monrain_mfm* is used to generate monthly rainfall data.

A3 Daily Rainfall Data Generation Model

Daily rainfall data are generated using the transition probability matrix method with Boughton's correction (TPMb).

In the Transition Probability Matrix (TPM) model, the seasonality in occurrence and magnitude of daily rainfall are taken into account by considering each month separately. The daily rainfalls are divided into a number of states, up to a maximum of seven. State 1 is dry (no rainfall) and the other states are wet. The number of states for each month can be determined from Table 1 and Figure 1.

Table 1 Number of States used for Different Rainfall Stations

Station	Latitude ° ' S	Longitude ° ' E	J	F	M	A	M	J	J	A	S	O	N	D
Melbourne	37 49	144 58	6	6	6	6	6	6	6	6	6	6	6	6
Lerderderg	37 30	144 22	6	6	6	6	6	6	6	6	6	6	6	6
Monto	24 51	151 01	6	6	6	6	6	6	6	6	6	6	6	6
Cowra	33 49	148 42	6	6	6	6	6	6	6	6	6	6	6	6
Adelaide	34 56	138 35	6	6	6	6	6	6	6	6	6	6	6	6
Perth	31 57	115 51	6	6	6	6	6	6	6	6	6	6	6	6
Sydney	33 52	151 12	7	7	7	7	7	7	7	7	7	7	7	7
Brisbane	27 28	21 06	7	7	7	7	7	7	7	7	7	7	7	7
Mackay	21 06	149 06	7	7	7	7	7	7	7	7	7	7	7	7
Kalgoorlie	30 47	121 27	5	5	5	5	5	5	5	5	5	5	5	5
Alice Springs	23 49	133 53	4	4	4	4	4	4	4	4	4	4	4	4
Onslow	21 40	115 07	4	4	4	3	4	3	4	3	3	3	3	3
Bamboo Springs	22 03	119 38	6	6	6	5	5	5	2	2	2	2	2	5
Broome	17 57	122 15	7	7	7	3	3	3	3	3	3	3	3	4
Darwin	12 27	130 48	7	7	7	7	3	2	2	2	3	7	7	7

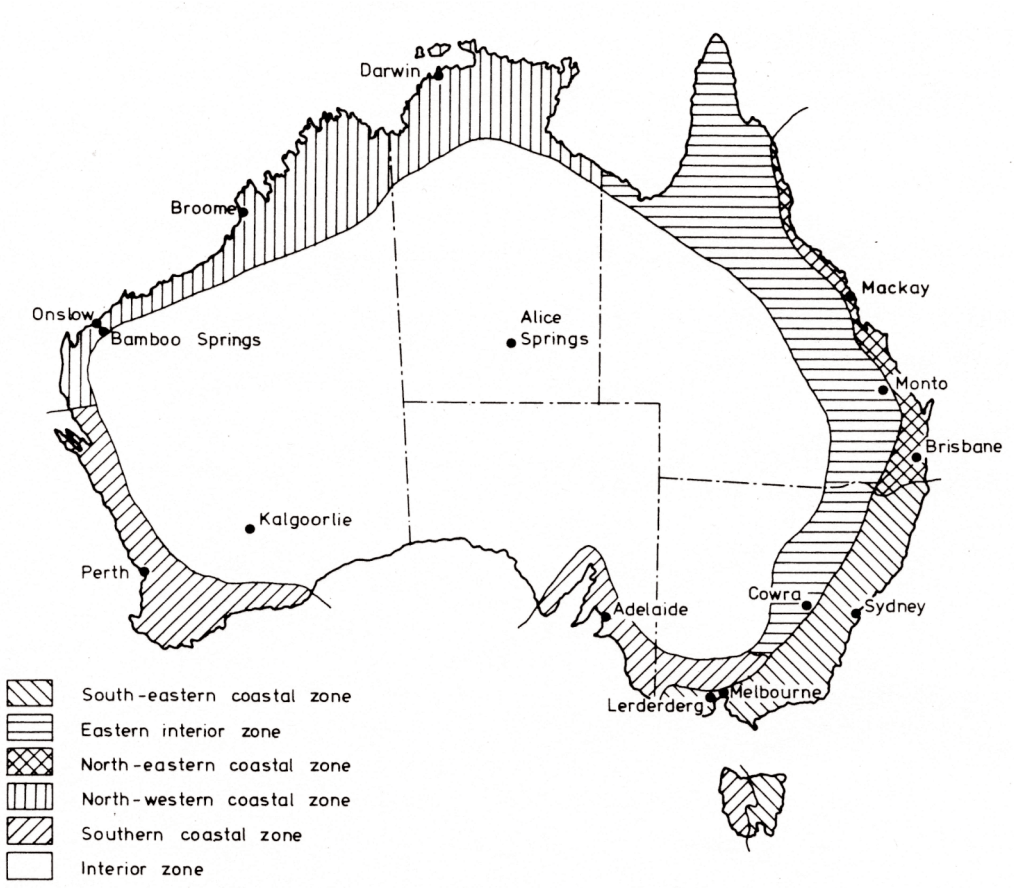

Figure 1 Location of the Rainfall Stations in Table 1

The state boundaries for rainfall amounts are given in Table 2. If the number of states is less than seven, the upper limit of the last state is infinite.

Table 2 State Boundaries for Rainfall Amounts in the TPM Model

State Number	Upper State Boundary Limit (mm)
1	0.0
2	0.9
3	2.9
4	6.9
5	14.9
6	30.9
7	∝

The shifted Gamma distribution is used to model rainfall amounts for the last state, while a linear distribution is used for the intermediate states. The latter is chosen because daily rainfall usually exhibits a J shape distribution.

The transition probabilities are estimated from:

$$p_{ij}(k) = \frac{f_{ij}(k)}{\sum_{j=1}^{C} f_{ij}(k)} \quad i, j = 1, 2, \ldots, C; \; k = 1, 2, \ldots, 12 \tag{10}$$

where,

$f_{ij}(k)$ is historical frequency of transition from state i to state j within month k

C is the maximum number of states.

The Gamma distribution parameters are obtained by the method of moments.

The daily rainfall data are generated by following the steps set out below, assuming that the initial state is dry (that is, state one).

Step 1: Generate a uniformly distributed random number between 0 and 1. Using the appropriate TPM for the month, determine the state of the next day.

Step 2: If the state is wet, go to step 3. Otherwise, set the rainfall depth to zero and go to step 1.

Step 3: Calculate the rainfall depth by using the linear distribution for the intermediate states and shifted Gamma distribution for the largest state.

Step 4: Repeat steps 1 to 3 until the required length of daily rainfall data is generated.

The generated daily rainfall is adjusted using Boughton's correction so that the model reproduces the interannual variability (standard deviation) in the historical data. The adjustment factor (F) is obtained as a ratio of the standard deviation of the generated and observed annual rainfall:

$$F = \frac{stdev_o}{stdev_g} \tag{11}$$

The generated daily rainfall is multiplied by the ratio:

$$Ratio = \frac{\{G + (T_i - G)F\}}{T_i} \tag{12}$$

where G is generated mean annual rainfall and T_i is the generated rainfall for year i.

The computer program dayrain_tpmb is used to generate daily rainfall data.

A4 Annual Climate Data Generation Model

Because the variability (C_v), skewness (C_s), and lag one autocorrelation (r_1) of annual climate data are low ($C_v < 0.5$, $C_s < 1$ and $r_1 < 0.5$) a first order autoregressive model with Wilson-Hilferty transformation is adequate for the generation of annual climate data. Since the climate data are cross correlated, a first order autoregressive multivariate model is required to generate annual climate data to preserve the cross and autocorrelations.

A multivariate model of annual climate data is of the form:

$$\boldsymbol{X_t = AX_{t-1} + B\varepsilon_t} \quad (13)$$

where,

$\boldsymbol{X_t}$ is (3x1) matrix of standardised climate data for year t (for the generation of three climate variables)

$\boldsymbol{A}$, $\boldsymbol{B}$ are (3x3) coefficient matrices to preserve the correlations

$\boldsymbol{\varepsilon_t}$ is a random component with zero mean and unit variance.

The matrices $\boldsymbol{A}$ and $\boldsymbol{B}$ are determined from the following:

$$\boldsymbol{A = M_1 M_0^{-1}} \quad (14)$$

$$\boldsymbol{BB^T = M_0 - M_1 M_0^{-1} M_1^T} \quad (15)$$

where $\boldsymbol{M_0}$ and $\boldsymbol{M_1}$ are the lag zero and lag one cross correlation matrices respectively. The elements of $\boldsymbol{M_0}$ and $\boldsymbol{M_1}$ corresponding to variables i and j are given by

$$m_0^{ij} = \frac{1}{n}\sum_{t=1}^{n} X_i X_j \quad (16)$$

$$m_1^{ij} = \frac{1}{n-1}\sum_{t=1}^{n-1} X_i X_{j-1} \quad (17)$$

The matrix $\boldsymbol{A}$ can be obtained from Equation 14. The matrix $\mathbf{BB^T}$ is symmetric and should be positive semi-definite for solving for $\boldsymbol{B}$. The matrix $\boldsymbol{B}$ can be obtained by the Cholesky decomposition where the matrix $\boldsymbol{B}$ is assumed to be lower triangular. The elements b_{ij} of $\boldsymbol{B}$ are obtained from the recursive relationships:

$$bij = 0, \qquad j > i \quad (18)$$

$$b_{11} = \sqrt{c_{11}} \quad (19)$$

where c_{ij} is the element of matrix $\boldsymbol{B} = \boldsymbol{BB^T}$. The remaining elements in the first column of $\boldsymbol{B}$ are given by:

$$b_{1j} = c_{1j} / b_{11} \quad (20)$$

For $j > 1$, the j^{th} diagonal element is obtained from:

$$b_{jj} = \left[c_{jj} - \sum_{k=1}^{j-1} b_{jk}^2 \right]^{1/2} \qquad j = 2, 3 \quad (21)$$

The solution is complete when $j = 3$. Otherwise, the other elements of column j of $\boldsymbol{B}$ are computed from:

$$b_{ij} = \frac{c_{ij} - \sum_{k=1}^{j-1} b_{ik} b_{jk}}{b_{jj}} \qquad j = 2 \quad (22)$$

Once matrices A and B are determined, standardised normally distributed values are generated using Equation 13. The skewness is then input to the generated values by the Wilson-Hilferty transformation, rescaled by the standard deviation and the mean added to obtain the generated annual climate data.

The computer program *annclim_mvm* is used to generate annual climate data.

A5 Monthly Climate Data Generation Model

Monthly climate data are generated by disaggregating generated annual climate data using the modified method of fragments.

The observed monthly climate data are standardised year by year so that the sum of the monthly climate data in any year equals to unity. This is done by dividing the monthly climate data in a year by the corresponding annual climate data. In the case of maximum temperature, the mean annual maximum temperature is first multiplied by 12. By doing so, from a record of n years, one will have n sets of fragments of monthly climate data. The generated annual climate data are disaggregated by selecting a fragment whose annual climate data are closest to the generated annual climate data by using the following indices:

$$\alpha_i = \sum_{j=1}^{3} \left(\frac{x_k^j - x_i^j}{s_x^j} \right)^2 \quad (23)$$

$$\beta_i = \sum_{j=1}^{3} \left(\frac{y_{k-1}^j - y_{i-1}^j}{s_y^j} \right)^2 \quad (24)$$

where,

x_k^j is generated annual climate data for variable *j* and year *k*

x_i^j is observed annual climate data for variable *j* and year *i*

s_x^j is standard deviation of the observed annual climate data for variable *j*

y_{k-1}^j is disaggregated monthly climate data for variable *j* for the last month of year *k-1*

y_{i-1}^j is disaggregated monthly climate data for variable *j* for the last month of year *i-1*

s_y^j is standard deviation of the observed monthly climate data for variable *j* for the last month of the year.

A set of fragments is selected for which the sum (α_i + β_i) is minimum, using the same set of fragments for all the climate data. The monthly climate data are then obtained by multiplying the generated annual climate data by the 12 fragments.

The computer program *monclim_MFM* is used to generate monthly climate data.

A6 Daily Climate Data Generation Model

Daily climate data are generated by using a first order autoregressive multivariate model with Wilson-Hilferty transformation conditioned on the rainfall state of the day and nested in monthly and annual models.

The model developed is a nested model in which the daily model is nested in a monthly model which in turn is nested in an annual model. This is an aggregation model in contrast to the disaggregation model used to generate monthly climate data. According to the rainfall states of the present day, the daily evaporation and maximum temperature are divided into two groups. A multivariate model is used for each group, with the seasonality taken into account by considering each month separately. Once the daily climate data (Y_j^i) is generated for a month, the monthly climate data $(\tilde{X}_j^i)$ is obtained by summing the daily climate data. The generated monthly climate data is then modified using the Thomas-Fiering monthly model:

$$\frac{X_j^i - \mu(X_j^i)}{\sigma(X_j^i)} = \rho_{j,j-1}^i \frac{X_{j-1}^i - \mu(X_{j-1}^i)}{\sigma(X_{j-1}^i)} + (1 - \rho_{j,j-1}^{i\,2})^{1/2} \frac{\tilde{X}_j^i - \mu'(X_j^i)}{\sigma'(X_j^i)} \quad (25)$$

where,

$\mu(X_j^i)$ is historical mean monthly value for climate variable *i* and month *j*

$\mu'(X_j^i)$ is theoretical mean monthly value for climate variable *i* and month *j*

$\sigma(X_j^i)$ is historical standard deviation of monthly climate data for climate variable *i* and month *j*

$\sigma'(X_j^i)$ is theoretical standard deviation of monthly climate data for climate variable *i* and month *j*

$\rho_{j,j-1}^i$ is historical correlation coefficient of monthly climate data for climate variable *i* between months *j* and *j-1*

X_j^i is modified monthly climate data for climate variable *i* and month *j*.

The theoretical values of the mean and standard deviation are given by:

$$\mu'(X_j^i) = N_d(j)\mu_d(Y_j^i) + N_w(j)\mu_w(Y_j^i) \quad (26)$$

$$\sigma'^2(X_j^i) \approx \sigma_d^2(Y_j^i)\{N_d(j) + 2\rho(Y_j^i)[N_d(j)-1] + 2\rho^2(Y_j^i)[N_d(j)-2] + 2\rho^3(Y_j^i)[N_d(j)-3]\} + \sigma_w^2(Y_j^i)\{N_w(j) + 2\rho(Y_j^i)[N_w(j)-1] + 2\rho^2(Y_j^i)[N_w(j)-2] + 2\rho^3(Y_j^i)[N_w(j)-3]\} + 2\rho(Y_j^i)\sigma_d(Y_j^i)\sigma_w(Y_j^i) \quad (27)$$

where,

$N_d(j)$ is number of dry days in month j

$N_w(j)$ is number of dry days in month j

$\mu_d(Y_j^i)$ is mean of daily climate data for climate variable *i* and month *j* for dry days

$\mu_w(Y_j^i)$ is mean of daily climate data for climate variable *i* and month *j* for wet days

$\sigma_d(Y_j^i)$ is standard deviation of daily climate data for climate variable *i* and month *j* for dry days

$\sigma_w(Y_j^i)$ is standard deviation of daily climate data for climate variable *i* and month *j* for wet days

$\rho(Y_j^i)$ is lag one autocorrelation coefficient of daily climate data for climate variable *i* and month *j*

The generated daily climate data is multiplied by the ratio $X_j^i / \tilde{X}_j^i$. Once the data for the twelve months of a year have been generated, the monthly climate data can be aggregated to obtain the annual value $(\tilde{Z}_k^i)$. The aggregated annual value is modified by using a lag one autoregressive model:

$$\frac{Z_k^i - \mu(Z^i)}{\sigma(Z^i)} = \rho(Z^i)\frac{Z_{k-1}^i - \mu(Z^i)}{\sigma(Z^i)} + [1-\rho^2(Z^i)]^{1/2}\frac{\tilde{Z}_k^i - \mu'(Z^i)}{\sigma'(Z^i)} \quad (28)$$

where,

$\mu(Z^i)$ is historical mean annual value for climate variable *i*

$\mu'(Z^i)$ is theoretical mean annual value for climate variable *i* and month *j*

$\sigma(Z^i)$ is historical standard deviation of annual climate data for climate variable *i*

$\sigma'(Z^i)$ is theoretical standard deviation of annual climate data for climate variable *i j*

$\rho(Z^i)$ is historical lag one autocorrelation coefficient of annual climate data for climate variable *i*

Z_k^i is modified annual climate data for climate variable *i* and year *k.*

The theoretical values of the mean and standard deviation are given by:

$$\mu(Z^i) = \sum_{j=1}^{12}\mu(X_j^i) \quad (29)$$

$$\sigma^2(Z^i) \approx \sum_{j=1}^{12}\sigma^2(X_j^i) + 2\sum_{j=2}^{12}\sigma(X_j^i)\sigma(X_{j-1}^i)\rho_{j,j-1}^i + 2\sum_{j=3}^{12}\sigma(X_j^i)\sigma(X_{j-2}^i)\rho_{j,j-1}^i\rho_{j-1,j-2}^i + 2\sum_{j=4}^{12}\sigma(X_j^i)\sigma(X_{j-3}^i)\rho_{j,j-1}^i\rho_{j-1,j-2}^i\rho_{j-2,j-3}^i \quad (30)$$

The generated monthly climate data is multiplied by the ratio $Z_k^i / \tilde{Z}_k^i$. This will preserve the annual characteristics. Rather than adjusting twice, the adjustment is done in one step by multiplying the generated climate data for each month (*j*) by the ratio $X_j^i Z_k^i / \tilde{X}_j^i \tilde{Z}_k^i$.

The daily rainfall is generated using a two-part model. The occurrence of the rainfall is modelled using a first order Markov chain. On rain days, the rainfall amount is generated using a gamma distribution. The generated daily rainfall is adjusted to match the monthly rainfall. The monthly rainfall data are aggregated to obtain the annual rainfall and this is modified using Equations 25 to 27.

The computer program *dayclim_dma* is used to generate daily climate data.

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PART B: PARAMETERS USED TO ASSESS QUALITY OF STOCHASTICALLY GENERATED DATA

B1 Annual Parameters

Parameter	Tolerance
Mean (%)	5
Standard deviation (%)	5
Coefficient of skewness	0.5
Lag one autocorrelation coefficient	0.15
Maximum (%)	10
Minimum (%)	10
Range (%)	10
2-year low rainfall sums (%)	10
3-year low rainfall sums (%)	10
5-year low rainfall sums (%)	10
7-year low rainfall sums (%)	10
10-year low rainfall sums (%)	10

For the daily rainfall model, the following parameter is also evaluated.

Parameter	Tolerance
Mean annual number of wet days (%)	5

For the climate models, the range and low rainfall sums are not evaluated but the cross correlation is evaluated.

Parameter	Tolerance
Cross correlation between the climate variable	0.2

B2 Monthly Parameters

Parameter	Tolerance
Mean (%)	7.5
Standard deviation (%)	7.5
Coefficient of skewness	0.75
Lag one autocorrelation coefficient	0.2
Maximum (%)	10
Minimum (%)	10
Proportion of months with no rainfall (%)	5

For the climate models, the proportion of months with no rainfall is not evaluated, but the cross correlation is evaluated.

Parameter	Tolerance
Cross correlation between the climate variables	0.2

B3 Daily Parameters for each Month

(a) For Daily Rainfall Model

Parameter	Tolerance
Mean number of wet days (day)	1
Maximum daily rainfall (%)	10
Mean daily rainfall (of wet days) (%)	7.5
Standard deviation (of wet days) (%)	7.5
Coefficient of skewness (of wet days)	0.75
Mean daily rainfall on solitary wet days (mm)	0.75
Mean daily rainfall on wet days bounded by wet day on one side (mm)	0.75
Mean daily rainfall on wet days bounded by wet day on both sides (mm)	0.75
Correlation between rainfall depth and wet spell duration	0.2
Mean dry spell length (day)	1
Standard deviation of dry spell length (day)	1
Skewness of dry spell length	0.75
Mean wet spell length (day)	0.5
Standard deviation of wet spell length (day)	0.5
Skewness of wet spell length	0.75
Longest dry spell length (day)	5
Longest wet spell length (day)	1

(b) For Daily Climate Model

Rainfall

Mean daily rainfall (of wet days) (%)	7.5
Standard deviation (of wet days) (%)	7.5
Coefficient of skewness (of wet days)	0.75
Mean number of wet days (%)	5
Maximum (%)	10

Other Climate Variable

Mean (%)	7.5
Standard deviation (%)	7.5
Coefficient of skewness	0.75
Lag one autocorrelation coefficient	0.2
Maximum (%)	10
Minimum (%)	10
Cross correlation	0.2

PART C: CRITERIA USED BY PROGRAM TO MAKE OVERALL ASSESSMENT OF THE QUALITY OF STOCHASTICALLY GENERATED DATA

The diagnostic files output the values (and distributions) of the parameters listed in Part B in the generated data and the values in the historical data. These can be used to make a judgement of the quality of the stochastically generated data.

This section provides the criteria used by the programs to make a general overall assessment of the stochastically generated data (categorised as good, fair or poor). **These criteria are subjective and the categorisation of the model performance should only be used as a guide.**

C1 Annual Rainfall Model

The number of parameters assessed in the annual rainfall model (na) is 12.

The model is considered good if $na \geq 10$

The model is considered fair if $na \geq 7$

Otherwise the stochastically generated data is considered to be poor.

C2 Monthly Rainfall Model

The number of annual parameters assessed in the monthly rainfall model (na) is 12. The number of monthly parameters assessed in the monthly rainfall model (nm) is 84 (7 x 12).

The model is considered good if $na \geq 10$ and $nm \geq 70$

The model is considered fair if $na \geq 7$ and $nm \geq 50$

Otherwise the stochastically generated data is considered to be poor.

C3 Daily Rainfall Model

The number of annual parameters assessed in the daily rainfall model (na) is 13. The number of monthly parameters assessed in the daily rainfall model (nm) is 84 (7 x 12). The number of daily parameters assessed in the daily rainfall model (nd) is 204 (17 x 12).

The model is considered good if

$$na \geq 9, nm \geq 60 \text{ and } nd \geq 150$$

The model is considered fair if

$$na \geq 6, nm \geq 40 \text{ and } nd \geq 100$$

Otherwise the stochastically generated data is considered to be poor.

C4 Annual Climate Model

To make a general overall assessment in all the climate models, the programs currently assume the generation of three climate variables (rainfall and two other variables like potential evapotranspiration and maximum temperature).

The number of parameters assessed in the annual climate model (na) is 21 (6 x 3 + 3).

The model is considered good if $na \geq 18$

The model is considered fair if $na \geq 12$

Otherwise the stochastically generated data is considered to be poor.

C5 Monthly Climate Model

The number of annual parameters assessed in the monthly climate model (na) is 21 (6 x 3 + 3). The number of monthly parameters assessed in the monthly climate model (nm) is 252 (6 x 3 x 12 + 3 x 12).

The model is considered good if

$$na \geq 18 \text{ and } nm \geq 200$$

The model is considered fair if

$$na \geq 12 \text{ and } nm \geq 150$$

Otherwise the stochastically generated data is considered to be poor.

C6 Daily Climate Model

The number of annual parameters assessed in the daily climate model (na) is 21 (6 x 3 + 3). The number of monthly parameters assessed in the daily climate model (nm) is 252 (6 x 3 x 12 + 3 x 12). The number of daily parameters assessed in the daily climate model (nm) is 216 (5 x 12 + 6 x 2 x 12 + 12).

The model is considered good if

$$na \geq 16,\ nm \geq 200 \text{ and } nd \geq 175$$

The model is considered fair if

$$na \geq 10,\ nm \geq 150 \text{ and } nd \geq 100$$

Otherwise the stochastically generated data is considered to be poor.

PART D: SPECIFICATIONS AND EXAMPLES OF INPUT AND OUTPUT FILES

D1 Annual Rainfall Model

D1.1 Program annrain_ar1

Purpose: Generation of annual rainfall data using a first order autoregressive model without parameter uncertainty

Input: Model specification file

Historical annual rainfall data

Output: Generated annual rainfall data

Parameter diagnostic file containing statistics from generated and historical data

D1.2 Specification File for Program annrain_ar1

Record 1 Name of historical annual rainfall data file (input file)

Record 2 Name of generated annual rainfall data file (output file)

Record 3 Name of diagnostic file (output file)

Record 4 Header for the generated rainfall data file

Record 5 Length of each replicate and number of replicates

A sample input specification file is given below (annrain_ar1.par):

```
086071annrain.dat
086071annrain.gen
086071annrain.out
Melbourne: Generated annual data
143  1000
```

D1.3 Program annrain_ar1pu

Purpose: Generation of annual rainfall data using a first order autoregressive model with parameter uncertainty

Input: Model specification file
Historical annual rainfall data

Output: Generated annual rainfall data

Parameter diagnostic file containing statistics from generated and historical data

Markov chain Monte Carlo simulation results (called fitAR1.par)

D1.4 Specification File for Program annrain_ar1pu

Record 1 Name of historical annual rainfall data file (input file)

Record 2 Name of generated annual rainfall data file (output file)

Record 3 Header for the generated rainfall data file

Record 4 Length of each replicate and number of replicates

Record 5 Name of diagnostic file (output file)

A sample input specification file is given below (annrain_ar1pu.par):

```
086071annrain.dat
086071annrain.gen
Melbourne: Generated annual rainfall data
using program annrain_ar1pu
143  1000
086071annrain.out
```

D1.5 Sample Files

Sample historical annual rainfall data file for both AR1 and AR1PU programs (086071annrain.dat):

Record 1 Header

Record 2 Number of years of data

Record 3 Annual rainfall

```
Melbourne RO
 143
707.8
655.7
627.4
…
…
…
495.6
471.2
571.0
```

Sample generated annual rainfall data file (086071annrain.gen):

Record 1 Header

Record 2 Length of replicate, number of replicates and historical annual mean rainfall

Record 3 Replicate number

Record 4 …Generated annual rainfall data

```
Melbourne: Generated annual rainfall data

          143          1000    656.4673
              1
    585.7    864.6    910.4    731.9    590.5    827.7    750.3    574.5    749.1
    838.6    872.5    631.1    548.5    645.8    547.5    696.0    451.8    447.4
    636.9    559.1    622.4    657.8    774.2    678.2    697.2    672.9    727.6

    755.3    755.0    865.1    730.1    674.8    712.9    680.8    611.0    835.0
    673.9    709.9    578.7    489.2    720.5    612.0    582.5    753.6    637.1
    701.4    784.8    609.8
              2
    747.5    491.8    610.4    629.6    708.6    771.9    728.7    584.8    512.6
    589.7    874.6    700.1    788.0    630.4    785.4    774.3    815.0    598.7
    634.6    601.2    592.4    537.4    354.3    823.8    716.0    514.0    406.5
      …        …        …        …        …        …        …        …        … …
      …        …        …        …        …        …        …        …        … …
      …        …        …        …        …        …        …        …        … …
    492.3    697.2    647.5    591.4    661.9    599.8    563.3    925.1    669.3
    498.6    565.9    656.1    629.6    454.6    551.9    725.1    674.7    904.0
    744.6    756.1    608.7    648.4    679.5    454.3    500.0    470.0    706.7
    836.1    914.2    519.1
             1000
    667.6    537.1    634.5    601.5    784.8    915.5    602.2    790.9    568.3
    872.0    602.0    626.2    631.3    581.0    429.0    688.2    694.0    709.0
    476.3    680.7    689.5    887.7    636.6    692.2    560.1    530.1    705.2
      …        …        …        …        …        …        …        …        … …
      …        …        …        …        …        …        …        …        … …
      …        …        …        …        …        …        …        …        … …
    608.8    526.5    699.2    764.3    515.1    703.3    882.1    550.5    689.6
    760.9    609.8    728.4    651.8    422.1    391.6    488.1    584.5    870.3
    632.8    506.7    422.5    633.6    513.0    845.5    787.6    678.9    853.1
    888.6    534.0    620.8
```

Sample diagnostic file (086071annrain.out):

```
Melbourne: Generated annual rainfall data
Length =  143  Number of replicates = 1000

Parameter      Hist    Mean     Tol      Y/N   2.5 %    25 %   50 %     75 %     97.5%
Mean          656.5   656.5    5.00      Y    633.5    648.8  656.3    664.3    679.4
Std Dev       121.6   121.4    5.00      Y    107.8    116.3  121.2    126.2    136.4
Skew          0.453   0.434    0.50      Y    0.007    0.282  0.435    0.572    0.882
Corr          0.096   0.087    0.15      Y   -0.069    0.029  0.088    0.141    0.246
Maximum       1.511   1.573   10.00      Y    1.401    1.496  1.559    1.635    1.811
Minimum       0.601   0.597   10.00      Y    0.494    0.568  0.601    0.630    0.680
Range         2.172   2.812   10.00      N    1.703    2.279  2.744    3.267    4.290
2-year        1.372   1.374   10.00      Y    1.197    1.319  1.379    1.434    1.523
3-year        2.330   2.217   10.00      Y    1.952    2.146  2.224    2.297    2.430
5-year        4.067   3.988   10.00      Y    3.603    3.872  4.004    4.114    4.309
7-year        6.076   5.829   10.00      Y    5.356    5.693  5.852    5.981    6.221
10-year       9.044   8.646   10.00      Y    7.981    8.463  8.662    8.845    9.189

Annual parameters within tolerance   na =   11  (out of  12)

Overall assessment of the generated data: GOOD
```

D2 Monthly Rainfall Model

D2.1 Program monrain_mfm

Purpose: Generation of monthly rainfall data using the modified method of fragments

Input: Model specification file

Historical monthly rainfall data

Generated annual rainfall data (if it is to be provided)

Output: Generated monthly rainfall data

Parameter diagnostic file containing statistics from generated and historical data

Generated annual rainfall data if it is not suppled as an input

D2.2 Specification File

Record 1 Name of parameter diagnostic file (output file)

Record 2 Name of historical monthly rainfall data file (input file)

Record 3 Name of generated monthly rainfall data file (output file)

Record 4 Name of generated annual rainfall data file (can be input or output file) (same format as generated annual rainfall data file in Section D1)

Record 5 Y if generated rainfall data is provided as an input, N otherwise

No further records needed if Record 5 is Y

If Record 5 is N,

Record 6 Header for the generated annual rainfall data

Record 7 Number of replicates and length of each replicate

D2.3 Sample Files

Sample input specification file for the case where generated annual rainfall data is not provided as an input (monrain_mfm_no.par):

```
086071monrain.out
086071monrain.dat
086071monrain.gen
086071annrain.gen
N
Generated annual rainfall data for 086071
100 125
```

Sample input specification file for the case where generated annual rainfall data is provided as an input (monrain_mfm_yes.par):

```
086071monrain.out
086071monrain.dat
086071monrain.gen
086071annrain.gen
Y
```

Sample historical monthly rainfall data file (086071monrain.dat):

Record 1 Header

Record 2 Length of record in years

Record 3 …Year and monthly rainfall values for the year

```
086071 Melbourne
 140
 1856   60.4   24.9   71.4  121.1   75.1   71.0   59.8   31.1   88.6   70.6   35.4   46.7
 1857   31.2  101.0   96.5   25.1   50.8   50.7   29.6   43.1   97.6  134.2   53.8   21.0
 1858   22.4  124.8   27.7   15.5   35.3    8.0   63.2   36.6   61.4   22.3   75.4  169.9
   …   …   …  …   …   …       …      …      …      …      …
   …   …   …  …   …   …       …      …      …      …      …
   …   …   …  …   …   …       …      …      …      …      …
 1997   29.2    4.6   20.0   13.8   59.6   35.0   18.2   27.8   56.8   30.8   56.8    7.2
 1998   59.4   71.6    7.4   50.2   50.0   50.6   39.6   22.8   35.4   78.6   57.0   62.4
 1999   25.4   47.6   48.0   40.2   63.4   54.2   17.8   86.6   30.8   62.0   40.2   94.2
```

Sample generated monthly rainfall data file (086071monrain.gen):

Record 1 Header

Record 2 Number of replicates and length of each replicate

Record 3 Replicate number

Record 4 … Year and generated monthly rainfall values for the year

```
Generated: 086071 Melbourne
          100          125
            1
   1   13.7  31.4   102.9   15.4   37.1   60.6   64.5   46.6   102.7  81.7   23.2   68.7
   2   39.6  32.1   43.7    20.5   105.5  55.1   65.2   80.1   16.3   53.7   53.6   27.4
   3   52.6  41.2   80.1    58.0   111.0  25.9   53.0   93.8   46.6   68.9   128.5  110.8
       …     …      …       …      …      …      …      …      …      …
       …     …      …       …      …      …      …      …      …      …
       …     …      …       …      …      …      …      …      …      …
 123 75.5  81.2   59.5    32.4   35.0   31.5   52.3   84.2   52.3   72.3   105.1  76.5
 124 46.1  61.6   10.9    196.1  95.8   20.1   52.3   71.3   93.0   39.2   138.7  31.8
 125 85.0  11.8   101.6   127.9  98.7   45.2   27.5   60.2   74.9   33.2   26.8   30.5
            2
   1   13.0  102.4  21.3    27.1   88.7   15.5   52.4   80.8   76.2   101.7  69.9   31.5
   2   85.1  11.9   101.8   128.1  98.8   45.3   27.6   60.3   75.0   33.2   26.9   30.5
   3   75.4  16.1   78.6    168.2  11.3   50.0   31.6   47.3   37.0   108.0  47.8   17.1
       …     …      …       …      …      …      …      …      …      …
       …     …      …       …      …      …      …      …      …      …
       …     …      …       …      …      …      …      …      …      …
 123 7.5   7.5    24.0    58.1   65.0   36.7   57.1   50.3   38.0   47.1   102.8  79.8
 124 51.9  115.0  48.3    50.9   34.2   66.7   35.9   52.0   64.6   66.2   42.8   15.4
 125 60.7  19.5   15.3    73.6   60.7   84.0   32.6   45.2   26.5   92.7   43.3   68.2
          100
   1   40.1  32.5   44.3    20.8   107.0  55.9   66.1   81.2   16.6   54.5   54.3   27.7
   2   33.9  38.0   60.6    76.6   78.9   52.2   54.6   56.5   26.0   36.2   26.6   27.4
   3   33.2  37.2   59.3    75.0   77.2   51.1   53.5   55.3   25.5   35.5   26.0   26.8
       …     …      …       …      …      …      …      …      …      …
       …     …      …       …      …      …      …      …      …      …
       …     …      …       …      …      …      …      …      …      …
 123 48.6  8.3    52.4    33.8   46.5   28.8   12.0   27.3   42.1   39.1   16.7   45.0
 124 16.4  6.1    48.8    61.4   53.1   62.0   37.3   79.8   41.5   52.1   76.0   135.1
 125 61.1  120.0  69.8    34.1   22.4   41.7   57.8   42.4   74.4   133.2  43.1   68.6
```

Sample diagnostic file (086071monrain.out):

```
Generated monthly rainfall data for 086071
 nr, ny:  100  125
086071 Melbourne
           140
Percentage of zero values =    0.00

 Annual Parameters
```

Parameter	Hist	Mean	Tol	Y/N	2.5%	25%	50%	75%	97.5%
Mean	659.2	659.9	5.00	Y	637.3	651.5	657.9	666.4	682.0
Stdev	127.5	126.9	5.00	Y	107.8	121.1	127.2	131.9	142.2
Skew	0.001	0.003	0.50	Y	-0.354	-0.159	-0.027	0.162	0.484
Corr	0.012	-0.001	0.15	Y	-0.194	-0.065	0.013	0.056	0.162
Max	1.468	1.491	10.00	Y	1.360	1.441	1.481	1.543	1.648
Min	0.504	0.512	10.00	Y	0.268	0.465	0.521	0.565	0.639
Range	2.239	2.482	10.00	N	1.510	2.003	2.426	2.815	3.880
2-year	1.313	1.317	10.00	Y	1095	1.248	1.324	1.394	1.499
3-year	2.166	2.186	10.00	Y	1.841	2.097	2.192	2.271	2.434
5-year	4.107	3.995	10.00	Y	3.545	3.854	4.014	4.157	4.329
7-year	6.107	5.843	10.00	Y	5.288	5.697	5.872	6.020	6.260
10-year	8.899	8.692	10.00	Y	7.828	8.463	8.713	8.925	9.260

Monthly Parameters

Jan

Parameter	Hist	Mean	Tol	Y/N	2.5%	25%	50%	75%	97.5%
Mean	48.5	49.1	7.50	Y	42.7	46.4	48.6	50.6	56.8
StdDev	36.1	36.1	7.50	Y	30.6	33.5	36.2	38.3	41.4
Skew	1.177	1.426	0.75	Y	0.908	1.231	1.431	1.590	1.952
Corr	-0.092	-0.122	0.20	Y	-0.243	-0.169	-0.122	-0.091	0.008
Max	3.204	3.203	10.00	Y	2.516	3.197	3.257	3.301	3.339
Min	0.005	0.023	10.00	N	0.005	0.005	0.018	0.038	0.081
Zero	0.000	0.000	5.00	Y	0.000	0.000	0.000	0.000	0.000

Feb

Parameter	Hist	Mean	Tol	Y/N	2.5%	25%	50%	75%	97.5%
Mean	47.4	44.2	7.50	Y	36.5	41.0	44.2	46.9	52.5
StdDev	44.8	42.3	7.50	Y	31.9	39.1	42.1	45.1	50.6
Skew	1.662	1.665	0.75	Y	1.087	1.460	1.614	1.871	2.163
Corr	-0.023	-0.028	0.20	Y	-0.221	-0.078	-0.035	0.022	0.154
Max	4.336	3.792	10.00	N	2.537	3.512	3.656	4.336	4.443
Min	0.009	0.012	10.00	N	0.009	0.009	0.009	0.011	0.027
Zero	0.000	0.000	5.00	Y	0.000	0.000	0.000	0.000	0.000

Mar

Parameter	Hist	Mean	Tol	Y/N	2.5%	25%	50%	75%	97.5%
Mean	51.8	53.4	7.50	Y	46.0	51.2	53.4	55.8	60.3
StdDev	39.0	40.3	7.50	Y	34.0	37.6	40.5	42.2	46.2
Skew	1.229	1.160	0.75	Y	0.775	1.018	1.170	1.299	1.513
Corr	0.107	0.036	0.20	Y	-0.148	-0.032	0.028	0.114	0.207
Max	3.472	3.225	10.00	Y	2.650	2.796	3.322	3.521	3.892
Min	0.067	0.076	10.00	N	0.064	0.066	0.071	0.086	0.113
Zero	0.000	0.000	5.00	Y	0.000	0.000	0.000	0.000	0.000

Continued next page

Apr

Parameter	Hist	Mean	Tol	Y/N	2.5%	25%	50%	75%	97.5%
Mean	57.8	56.0	7.50	Y	49.4	53.8	56.0	58.1	62.1
StdDev	37.1	36.3	7.50	Y	30.9	34.0	35.7	38.1	42.2
Skew	1.030	0.973	0.75	Y	0.480	0.815	0.968	1.121	1.466
Corr	-0.026	0.014	0.20	Y	-0.193	-0.045	0.003	0.083	0.167
Max	3.550	3.300	10.00	Y	2.501	3.082	3.452	3.634	3.708
Min	0.000	0.018	10.00	Y	0.000	0.000	0.000	0.000	0.171
Zero	0.714	1.520	5.00	Y	0.000	0.800	1.600	2.400	4.000

May

Parameter	Hist	Mean	Tol	Y/N	2.5%	25%	50%	75%	97.5%
Mean	57.5	57.6	7.50	Y	53.5	56.1	57.5	59.0	62.5
StdDev	27.7	26.9	7.50	Y	23.5	26.0	27.0	28.1	29.5
Skew	0.500	0.438	0.75	Y	0.123	0.324	0.443	0.525	0.785
Corr	-0.029	-0.063	0.20	Y	-0.262	-0.134	-0.074	0.004	0.121
Max	2.594	2.499	10.00	Y	2.114	2.396	2.571	2.611	2.641
Min	0.069	0.120	10.00	N	0.066	0.067	0.073	0.188	0.219
Zero	0.000	0.000	5.00	Y	0.000	0.000	0.000	0.000	0.000

Jun

Parameter	Hist	Mean	Tol	Y/N	2.5%	25%	50%	75%	97.5%
Mean	50.0	50.8	7.50	Y	47.3	49.5	50.8	52.2	53.9
StdDev	23.8	23.3	7.50	Y	20.7	22.6	23.3	24.1	25.5
Skew	0.745	0.714	0.75	Y	0.357	0.582	0.710	0.828	1.018
Corr	-0.081	-0.045	0.20	Y	-0.236	-0.107	-0.042	0.012	0.126
Max	2.126	2.148	10.00	Y	1.830	2.106	2.139	2.259	2.360
Min	0.146	0.178	10.00	N	0.142	0.146	0.149	0.204	0.285
Zero	0.000	0.000	5.00	Y	0.000	0.000	0.000	0.000	0.000

Jul

Parameter	Hist	Mean	Tol	Y/N	2.5%	25%	50%	75%	97.5%
Mean	48.6	48.2	7.50	Y	44.1	46.3	48.2	49.8	52.7
StdDev	22.7	23.5	7.50	Y	18.7	21.1	23.0	25.7	29.9
Skew	1.790	1.469	0.75	Y	0.304	0.855	1.527	2.042	2.591
Corr	0.055	0.006	0.20	Y	-0.173	-0.063	0.012	0.066	0.146
Max	3.248	2.802	10.00	N	1.658	2.307	3.221	3.281	3.345
Min	0.171	0.178	10.00	Y	0.147	0.160	0.167	0.188	0.265
Zero	0.000	0.000	5.00	Y	0.000	0.000	0.000	0.000	0.000

Aug

Parameter	Hist	Mean	Tol	Y/N	2.5%	25%	50%	75%	97.5%
Mean	50.8	51.3	7.50	Y	46.9	50.1	50.9	52.6	55.4
StdDev	20.5	21.7	7.50	Y	19.2	20.8	21.7	22.4	25.0
Skew	0.526	0.499	0.75	Y	0.133	0.411	0.508	0.604	0.760
Corr	-0.017	-0.005	0.20	Y	-0.186	-0.055	-0.006	0.054	0.154
Max	2.017	2.024	10.00	Y	1.790	1.993	2.024	2.061	2.137
Min	0.226	0.225	10.00	Y	0.206	0.209	0.213	0.226	0.306
Zero	0.000	0.000	5.00	Y	0.000	0.000	0.000	0.000	0.000

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Sep

Parameter	Hist	Mean	Tol	Y/N	2.5%	25%	50%	75%	97.5%
Mean	59.1	58.5	7.50	Y	53.7	56.9	58.7	60.1	63.2
StdDev	29.4	27.0	7.50	N	22.3	25.0	26.6	28.3	33.3
Skew	1.392	0.985	0.75	Y	0.202	0.531	0.825	1.434	1.976
Corr	0.072	0.078	0.20	Y	-0.099	0.027	0.079	0.138	0.245
Max	3.670	2.951	10.00	N	2.065	2.352	2.698	3.637	4.025
Min	0.244	0.268	10.00	N	0.240	0.244	0.249	0.289	0.301
Zero	0.000	0.000	5.00	Y	0.000	0.000	0.000	0.000	0.000

Oct

Parameter	Hist	Mean	Tol	Y/N	2.5%	25%	50%	75%	97.5%
Mean	67.7	67.8	7.50	Y	61.8	66.0	67.1	69.6	73.7
StdDev	33.2	34.2	7.50	Y	30.2	32.5	33.9	35.8	38.7
Skew	0.738	0.694	0.75	Y	0.194	0.501	0.681	0.850	1.141
Corr	0.181	0.201	0.20	Y	0.033	0.131	0.206	0.248	0.368
Max	3.519	3.249	10.00	Y	2.674	2.878	3.499	3.554	3.599
Min	0.137	0.178	10.00	N	0.133	0.137	0.142	0.231	0.317
Zero	0.000	0.000	5.00	Y	0.000	0.000	0.000	0.000	0.000

Nov

Parameter	Hist	Mean	Tol	Y/N	2.5%	25%	50%	75%	97.5%
Mean	60.3	61.6	7.50	Y	55.4	59.5	61.3	64.3	67.5
StdDev	37.3	37.5	7.50	Y	31.7	35.0	37.6	39.7	44.4
Skew	1.144	1.129	0.75	Y	0.571	0.966	1.117	1.278	1.650
Corr	0.185	0.141	0.20	Y	-0.018	0.085	0.135	0.202	0.264
Max	3.752	3.612	10.00	Y	2.978	3.621	3.758	3.818	3.883
Min	0.118	0.155	10.00	N	0.102	0.117	0.158	0.182	0.241
Zero	0.000	0.000	5.00	Y	0.000	0.000	0.000	0.000	0.000

Dec

Parameter	Hist	Mean	Tol	Y/N	2.5%	25%	50%	75%	97.5%
Mean	59.6	61.4	7.50	Y	54.2	59.6	61.4	63.2	67.9
StdDev	38.9	39.6	7.50	Y	33.8	37.6	39.8	41.3	44.5
Skew	1.042	0.930	0.75	Y	0.489	0.793	0.938	1.038	1.300
Corr	0.293	0.286	0.20	Y	0.089	0.232	0.287	0.334	0.455
Max	3.594	3.435	10.00	Y	3.018	3.250	3.428	3.654	3.795
Min	0.031	0.058	10.00	N	0.031	0.031	0.049	0.053	0.185
Zero	0.000	0.000	5.00	Y	0.000	0.000	0.000	0.000	0.000

Annual parameters na = 11 (out of 12)
Monthly parameters nm = 71 (out of 84)
Generated data is considered GOOD

D3 Daily Rainfall Model

D3.1 Program dayrain_tpmb

Purpose: Generation of daily rainfall data using the transition probability matrix method with Boughton's corrections

Input: Model specification file

Historical daily rainfall data

Output: Generated daily rainfall data

Parameter diagnostic file containing statistics from generated and historical data

D3.2 Specification File

Record 1 Name of parameter diagnostic file (output file)

Record 2 Name of historical daily rainfall data file (input file)

Record 3 Name of generated daily rainfall data file (output file)

Record 4 Number of replicates and length of each replicate in years

Record 5 Number of states for each month

D3.3 Sample Files

Sample input specification file (dayrain_tpmb.par):

```
086071dayrain.out
086071dayrain.dat
086071dayrain.gen
100 125
6 6 6 6 6 6 6 6 6 6 6 6
```

Sample historical daily rainfall data file (086071dayrain.dat) (the lines are truncated):

Record 1 Header

Record 2 Number of years of data

Record 3 …Year, month and daily rainfall values for the month

```
dr 000 086071 86    MELBOURNE REGIONAL
 125
1856    1    0.0   0.0   0.0   4.6   0.0   0.0   20.1  2.5   0.0   5.3   8.6   0.0   0.0   0.0
1856    2    0.0   0.0   0.0   0.0   0.0   0.0   0.5   13.7  1.0   0.0   0.3   0.0   0.0   0.0
1856    3    0.0   0.0   0.0   1.0   0.0   0.0   0.0   0.0   0.0   0.0   15.2  0.0   0.0   10.7
1856    4    0.0   9.9   0.0   0.0   0.3   0.0   1.3   0.0   0.0   0.0   0.3   14.5  2.8   0.0
1856    5    0.0   0.0   0.0   0.0   0.0   1.5   25.4  1.3   2.8   0.0   0.0   1.8   0.0   6.9
1856    6    0.0   0.8   1.0   8.1   0.0   2.8   0.0   0.0   0.5   0.0   9.1   6.6   0.0   5.1
1856    7    0.0   3.3   2.3   4.3   0.0   1.8   2.3   0.0   0.0   0.0   14.0  13.0  0.0   2.5
1856    8    0.0   0.0   0.0   0.0   7.6   3.3   4.1   0.0   1.3   0.0   0.3   0.0   0.0   0.0
1856    9    5.6   0.0   7.6   1.5   8.6   4.6   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0
1856   10    0.0   0.0   0.0   2.5   22.4  0.0   2.8   0.0   0.0   2.5   0.0   0.0   0.0   7.6
1856   11    0.0   0.0   0.0   1.8   1.8   0.0   0.0   0.0   3.6   0.0   0.0   3.3   0.0   0.0
1856   12    0.0   0.0   0.0   0.0   0.0   0.0   5.6   8.4   0.0   7.1   6.6   1.5   2.5   3.8
1857    1    0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   4.1   0.0
        …    …     …     …     …     …     …     …     …     …     …
        …    …     …     …     …     …     …     …     …     …     …
1980   10    0.0   0.0   0.0   0.0   0.0   3.8   15.2  2.0   0.4   4.6   0.0   10.0  14.6  0.2
1980   11    1.6   7.8   8.0   0.0   2.2   5.2   1.4   2.8   0.2   0.0   0.0   0.0   0.0   0.4
1980   12    0.0   1.6   10.2  0.8   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.4   0.4   20.8
```

Record 1 Header
Record 2 Number of replicates and length of each replicate in years
Record 3 Replicate number
Record 4 … Year, month and generated daily rainfall values for the month

```
dr 000 086071 86    MELBOURNE
          100           125

           1
1856    1    0.0   0.0   0.0   0.0   0.5   1.4   1.0  15.2  0.0   0.0   0.0   0.0  11.5  0.1
1856    2    0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0  0.0   0.0   0.0   0.0   0.0  0.0
1856    3    0.0   0.0   0.2   0.0   0.0   0.7   0.0   0.0  0.0   0.0   0.0   1.1   0.6  0.0
…       …     …     …     …     …     …     …     …     …
…       …     …     …     …     …     …     …     …     …
1980    10   0.4   0.1   0.0   9.6  20.0   3.5   1.4   0.0  0.0   0.8   0.0  38.7   3.8  0.0
1980    11   1.4   0.0   1.9   0.8   0.0   0.0   0.0   5.9  1.4   0.0   2.4   1.8   0.0 11.6
1980    12   6.3   1.1   4.9   2.7   0.0   0.0   6.4   5.1  0.4   0.0   0.0   0.3   6.0  5.5
2
1856    1    0.0   0.0   0.0   0.0   0.0   0.0   0.1   0.2  0.0   0.0   0.0   0.0   0.0  1.7
1856    2    0.0  23.0   0.0  10.9   0.0   0.0   1.9   0.0  0.0   0.0   0.0   0.0   0.0  0.5
1856    3    0.0   0.0   0.0   0.0   0.0   6.3   7.9   0.0  0.0   1.5   0.0   0.0   0.0  3.0
…       …     …     …     …     …     …     …     …     …
…       …     …     …     …     …     …     …     …     …
1980    10   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0  2.5   0.0   0.0   0.0   2.1  0.0
1980    11   0.0   0.0   0.4   0.0   0.6   0.0   0.0   3.3  1.7   0.0   0.1   0.7   0.0  0.0
1980    12   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.1  0.0   0.0   0.0   0.0   0.0  0.0
100
1856    1    0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.6  0.1   0.0   0.0  33.5   6.7  1.8
1856    2    0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0  0.0   0.0   1.9   0.3   0.0  0.0
1856    3    0.0   0.0   0.0   0.0   0.0   1.0   0.0   3.9  0.0   0.0   0.1   0.0   0.0  0.1
…       …     …     …     …     …     …     …     …     …
…       …     …     …     …     …     …     …     …     …
1980    10   2.8   0.0  10.5   2.2   2.8   1.7   0.0   0.0  0.0   0.0   1.1   0.0   0.0  3.6
1980    11   0.0   0.2   0.0   0.0   0.0   0.0   0.0   0.3  0.0   0.0   0.7   0.0   0.0  0.0
1980    12   0.0   0.0   0.0   0.0   0.0   0.0   0.2   1.9  0.5   0.0   0.0   0.0   4.0 22.0
```

Sample diagnostic file (086071dayrain.out):

```
dr 000 086071 86   MELBOURNE
Number of years of historical data          125
Number of replicates and length of each replicate:         100          125

Annual Parameters

Parameter    Hist     Mean     Tol      Y/N     2.5%     25%      50%      75%     97.5%
Mean        659.6    683.3    5.00       Y      661.5    675.0    682.6    692.9    703.7
Std Dev     127.9    127.1    5.00       Y      110.1    120.9    126.0    134.0    143.4
Skew        0.015    0.344    0.50       Y     -0.043    0.152    0.303    0.491    0.915
Corr        0.012   -0.001    0.15       Y     -0.163   -0.065   -0.003    0.051    0.143
Max         1.467    1.597   10.00       Y      1.412    1.510    1.568    1.667    1.916
Min         0.504    0.602   10.00       N      0.466    0.562    0.605    0.647    0.703
Range       2.266    2.606   10.00       N      1.439    2.190    2.547    2.952    4.066
2-year      1.312    1.429   10.00       Y      1.180    1.375    1.427    1.502    1.617
3-year      2.165    2.330   10.00       Y      2.010    2.239    2.343    2.432    2.553
5-year      4.104    4.163   10.00       Y      3.757    4.007    4.174    4.290    4.483
7-year      6.103    6.083   10.00       Y      5.595    5.913    6.098    6.261    6.527
10-year     8.892    9.038   10.00       Y      8.369    8.788    9.083    9.265    9.554
WetDay      153.4    153.2    5.00       Y      151.0    152.4    153.2    154.0    155.3

Monthly Parameters

Jan

Parameter    Hist     Mean     Tol      Y/N     2.5%     25%      50%      75%     97.5%
Mean         48.0     49.1    7.50       Y      43.1     46.8     49.2     50.9     56.8
StdDev       36.5     37.3    7.50       Y      30.7     34.8     37.0     39.7     44.4
Skew        1.225    1.212    0.75       Y     0.635    0.997    1.163    1.409    1.845
Corr       -0.055   -0.001    0.20       Y    -0.163   -0.052    0.005    0.050    0.155
Max         3.202    3.449   10.00       Y      2.621    3.062    3.342    3.784    4.711
Min         0.005    0.021   10.00       N      0.000    0.004    0.016    0.033    0.065
Zero        0.000    0.144    5.00       Y      0.000    0.000    0.000    0.000    0.800

Feb

Parameter    Hist     Mean     Tol      Y/N     2.5%     25%      50%      75%     97.5%
Mean         49.2     50.4    7.50       Y      43.8     48.3     50.1     52.7     57.1
StdDev       46.1     42.5    7.50       N      35.3     39.5     42.2     45.4     48.6
Skew        1.624    1.435    0.75       Y     0.870    1.150    1.352    1.646    2.272
Corr       -0.003    0.025    0.20       Y    -0.176   -0.038    0.029    0.078    0.173
Max         4.333    4.032   10.00       Y      2.881    3.489    3.915    4.373    5.854
Min         0.009    0.012   10.00       N      0.000    0.000    0.009    0.018    0.045
Zero        0.000    0.248    5.00       Y      0.000    0.000    0.000    0.800    0.800

Mar

Parameter    Hist     Mean     Tol      Y/N     2.5%     25%      50%      75%     97.5%
Mean         52.8     54.3    7.50       Y      47.8     51.5     53.7     56.4     62.9
StdDev       40.8     39.1    7.50       Y      32.0     36.7     38.4     41.5     45.7
Skew        1.146    1.272    0.75       Y     0.736    0.980    1.250    1.448    1.951
Corr        0.112    0.009    0.20       Y    -0.151   -0.060   -0.004    0.074    0.185
Max         3.469    3.718   10.00       Y      2.609    3.255    3.664    4.117    4.825
Min         0.067    0.038   10.00       N      0.000    0.013    0.033    0.053    0.097
Zero        0.000    0.056    5.00       Y      0.000    0.000    0.000    0.000    0.800
```

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Apr

Parameter	Hist	Mean	Tol	Y/N	2.5%	25%	50%	75%	97.5%
Mean	58.7	60.0	7.50	Y	53.8	58.5	59.6	61.5	66.1
StdDev	38.0	36.7	7.50	Y	30.5	34.3	36.5	38.9	42.4
Skew	1.027	1.125	0.75	Y	0.567	0.860	1.040	1.344	1.988
Corr	-0.046	0.029	0.20	Y	-0.143	-0.018	0.031	0.083	0.185
Max	3.547	3.582	10.00	Y	2.531	3.125	3.491	3.864	5.140
Min	0.000	0.089	10.00	Y	0.005	0.049	0.080	0.122	0.199
Zero	0.800	0.008	5.00	Y	0.000	0.000	0.000	0.000	0.000

May

Parameter	Hist	Mean	Tol	Y/N	2.5%	25%	50%	75%	97.5%
Mean	58.0	60.6	7.50	Y	56.7	58.4	60.2	62.3	65.4
StdDev	27.8	30.4	7.50	N	26.1	28.6	30.3	31.8	35.2
Skew	0.532	0.899	0.75	Y	0.425	0.648	0.877	1.107	1.549
Corr	-0.016	0.023	0.20	Y	-0.162	-0.048	0.018	0.081	0.211
Max	2.592	3.071	10.00	N	2.310	2.734	3.036	3.369	4.072
Min	0.069	0.177	10.00	N	0.063	0.129	0.178	0.222	0.287
Zero	0.000	0.000	5.00	Y	0.000	0.000	0.000	0.000	0.000

Jun

Parameter	Hist	Mean	Tol	Y/N	2.5%	25%	50%	75%	97.5%
Mean	49.8	52.9	7.50	Y	47.4	51.3	53.0	54.2	57.1
StdDev	23.7	24.4	7.50	Y	21.2	22.8	24.4	25.4	27.9
Skew	0.672	0.810	0.75	Y	0.272	0.635	0.791	0.939	1.447
Corr	-0.094	0.018	0.20	Y	-0.138	-0.039	0.021	0.072	0.165
Max	2.083	2.449	10.00	N	1.929	2.221	2.381	2.638	3.152
Min	0.146	0.191	10.00	N	0.054	0.144	0.184	0.231	0.321
Zero	0.000	0.000	5.00	Y	0.000	0.000	0.000	0.000	0.000

Jul

Parameter	Hist	Mean	Tol	Y/N	2.5%	25%	50%	75%	97.5%
Mean	48.3	50.9	7.50	Y	46.1	49.5	50.7	51.9	55.4
StdDev	22.9	25.0	7.50	N	20.3	23.5	24.6	26.5	30.3
Skew	2.008	1.207	0.75	N	0.543	0.940	1.197	1.417	2.069
Corr	0.056	0.017	0.20	Y	-0.165	-0.048	0.010	0.078	0.186
Max	3.245	2.735	10.00	N	1.979	2.318	2.685	2.920	3.768
Min	0.171	0.196	10.00	N	0.086	0.153	0.196	0.240	0.323
Zero	0.000	0.000	5.00	Y	0.000	0.000	0.000	0.000	0.000

Aug

Parameter	Hist	Mean	Tol	Y/N	2.5%	25%	50%	75%	97.5%
Mean	50.4	53.1	7.50	Y	48.2	51.7	52.8	54.4	57.8
StdDev	20.8	24.5	7.50	N	20.5	22.8	24.3	25.9	29.1
Skew	0.592	1.102	0.75	Y	0.454	0.779	1.018	1.328	2.192
Corr	-0.039	0.018	0.20	Y	-0.125	-0.048	0.003	0.076	0.190
Max	2.016	2.655	10.00	N	1.997	2.325	2.500	2.942	3.709
Min	0.226	0.213	10.00	Y	0.094	0.166	0.215	0.258	0.315
Zero	0.000	0.000	5.00	Y	0.000	0.000	0.000	0.000	0.000

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Sep

Parameter	Hist	Mean	Tol	Y/N	2.5%	25%	50%	75%	97.5%
Mean	58.9	61.1	7.50	Y	54.9	59.2	61.1	63.1	66.7
StdDev	28.8	29.2	7.50	Y	23.7	26.9	28.9	31.3	36.2
Skew	1.483	1.086	0.75	Y	0.555	0.830	1.057	1.250	1.854
Corr	0.069	0.026	0.20	Y	-0.150	-0.035	0.023	0.088	0.211
Max	3.668	3.103	10.00	N	2.365	2.718	3.056	3.347	4.006
Min	0.244	0.229	10.00	Y	0.077	0.176	0.227	0.271	0.371
Zero	0.000	0.000	5.00	Y	0.000	0.000	0.000	0.000	0.000

Oct

Parameter	Hist	Mean	Tol	Y/N	2.5%	25%	50%	75%	97.5%
Mean	68.3	71.1	7.50	Y	65.0	69.2	71.0	72.7	76.6
StdDev	33.7	34.2	7.50	Y	28.9	32.6	34.3	35.5	38.3
Skew	0.735	0.843	0.75	Y	0.415	0.691	0.819	0.993	1.278
Corr	0.173	0.019	0.20	Y	-0.159	-0.045	0.018	0.068	0.201
Max	3.517	3.407	10.00	Y	2.788	3.114	3.393	3.620	4.303
Min	0.136	0.225	10.00	N	0.066	0.176	0.211	0.277	0.357
Zero	0.000	0.000	5.00	Y	0.000	0.000	0.000	0.000	0.000

Nov

Parameter	Hist	Mean	Tol	Y/N	2.5%	25%	50%	75%	97.5%
Mean	59.5	61.0	7.50	Y	54.4	58.2	60.9	63.6	67.4
StdDev	37.0	35.3	7.50	Y	30.0	33.4	35.1	36.9	40.8
Skew	1.131	1.049	0.75	Y	0.589	0.846	1.018	1.177	1.713
Corr	0.200	0.015	0.20	Y	-0.183	-0.048	0.023	0.081	0.182
Max	3.749	3.449	10.00	Y	2.590	3.124	3.320	3.698	4.617
Min	0.118	0.117	10.00	Y	0.025	0.073	0.113	0.155	0.215
Zero	0.000	0.000	5.00	Y	0.000	0.000	0.000	0.000	0.000

Dec

Parameter	Hist	Mean	Tol	Y/N	2.5%	25%	50%	75%	97.5%
Mean	57.9	58.8	7.50	Y	52.5	57.0	58.6	60.8	64.9
StdDev	37.0	37.9	7.50	Y	32.5	35.6	38.0	39.7	43.6
Skew	0.987	1.214	0.75	Y	0.668	0.951	1.215	1.381	2.009
Corr	0.290	0.033	0.20	N	-0.141	-0.024	0.032	0.093	0.199
Max	3.320	3.701	10.00	N	2.679	3.216	3.580	4.022	5.201
Min	0.031	0.079	10.00	N	0.009	0.042	0.078	0.107	0.156
Zero	0.000	0.008	5.00	Y	0.000	0.000	0.000	0.000	0.000

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Daily Parameters

Jan

Parameter	Hist	Mean	Tol	Y/N	2.5%	25%	50%	75%	97.5%
#Wet	8.2	8.2	1.00	Y	7.6	8.0	8.2	8.4	8.8
Maximum	108.0	84.9	10.00	N	59.8	71.7	81.3	93.9	122.1
Mean	5.857	5.992	7.50	Y	5.405	5.821	5.981	6.159	6.500
StdDev	9.588	9.606	7.50	Y	8.699	9.147	9.565	10.001	10.645
Skew	3.485	3.207	0.75	Y	2.611	2.942	3.134	3.443	4.081
Wet0	3.899	3.853	0.75	Y	2.904	3.536	3.859	4.174	4.741
Wet1	5.664	6.142	0.75	Y	5.351	5.874	6.130	6.462	6.855
Wet2	8.605	8.218	0.75	Y	6.994	7.687	8.254	8.612	9.730
Corr	0.645	0.649	0.20	Y	0.578	0.620	0.648	0.674	0.707
DS_Mean	5.528	5.448	1.00	Y	4.937	5.300	5.437	5.601	5.901
DS_SD	4.974	4.784	1.00	Y	4.266	4.563	4.759	4.970	5.429
DS_Skew	1.938	1.965	0.75	Y	1.495	1.769	1.927	2.103	2.616
WS_Mean	1.896	1.880	0.50	Y	1.756	1.832	1.875	1.926	2.003
WS_SD	1.259	1.353	0.50	Y	1.221	1.295	1.346	1.386	1.521
WS_Skew	1.664	2.050	0.75	Y	1.520	1.832	1.983	2.227	2.733
DS_Max	31.000	33.190	5.00	Y	25.000	29.000	32.000	35.000	45.000
WS_Max	9.000	10.280	1.00	N	7.500	9.000	10.000	11.000	14.000

Feb

Parameter	Hist	Mean	Tol	Y/N	2.5%	25%	50%	75%	97.5%
#Wet	7.6	7.6	1.00	Y	7.0	7.4	7.6	7.8	8.1
Maximum	87.4	104.4	10.00	N	72.8	89.2	101.3	113.7	151.8
Mean	6.467	6.633	7.50	Y	5.924	6.360	6.637	6.892	7.315
StdDev	11.251	11.400	7.50	Y	9.968	10.865	11.283	11.956	12.816
Skew	3.551	3.593	0.75	Y	2.789	3.216	3.514	3.812	4.724
Wet0	3.594	3.830	0.75	Y	2.879	3.500	3.847	4.086	4.715
Wet1	5.690	6.450	0.75	N	5.490	6.082	6.446	6.780	7.418
Wet2	11.230	10.114	0.75	N	8.000	9.548	10.091	10.674	11.833
Corr	0.681	0.649	0.20	Y	0.560	0.622	0.651	0.675	0.727
DS_Mean	5.080	5.129	1.00	Y	4.664	4.958	5.134	5.300	5.627
DS_SD	4.100	4.490	1.00	Y	4.054	4.283	4.476	4.659	5.053
DS_Skew	1.417	1.886	0.75	Y	1.438	1.656	1.824	1.981	2.878
WS_Mean	1.914	1.952	0.50	Y	1.850	1.901	1.951	1.990	2.098
WS_SD	1.406	1.400	0.50	Y	1.257	1.343	1.380	1.462	1.592
WS_Skew	2.379	2.133	0.75	Y	1.618	1.901	2.043	2.279	2.809
DS_Max	26.000	30.880	5.00	Y	23.000	27.000	29.000	33.000	50.000
WS_Max	11.000	9.860	1.00	N	7.000	9.000	10.000	11.000	12.000

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Mar

Parameter	Hist	Mean	Tol	Y/N	2.5%	25%	50%	75%	97.5%
#Wet	9.4	9.5	1.00	Y	8.8	9.3	9.4	9.7	10.0
Maximum	90.2	89.5	10.00	Y	64.8	78.6	87.5	96.9	131.7
Mean	5.607	5.736	7.50	Y	5.099	5.484	5.758	5.932	6.347
StdDev	9.402	9.455	7.50	Y	8.282	8.986	9.462	9.835	10.565
Skew	3.545	3.526	0.75	Y	2.905	3.210	3.453	3.725	4.715
Wet0	3.384	3.483	0.75	Y	2.800	3.219	3.457	3.724	4.171
Wet1	4.993	5.609	0.75	Y	4.762	5.350	5.625	5.908	6.273
Wet2	9.684	8.586	0.75	N	7.285	8.135	8.570	8.963	9.938
Corr	0.623	0.652	0.20	Y	0.572	0.621	0.652	0.683	0.736
DS_Mean	4.066	4.234	1.00	Y	3.927	4.110	4.233	4.358	4.547
DS_SD	3.732	3.654	1.00	Y	3.285	3.471	3.655	3.822	4.055
DS_Skew	1.883	1.873	0.75	Y	1.444	1.682	1.840	2.004	2.472
WS_Mean	2.008	1.977	0.50	Y	1.843	1.920	1.971	2.031	2.114
WS_SD	1.260	1.409	0.50	Y	1.244	1.335	1.405	1.480	1.565
WS_Skew	2.300	2.269	0.75	Y	1.761	1.995	2.189	2.441	3.216
DS_Max	26.000	25.600	5.00	Y	19.000	23.000	26.000	27.000	34.000
WS_Max	11.000	10.050	1.00	Y	7.500	9.000	10.000	11.000	13.000

Apr

Parameter	Hist	Mean	Tol	Y/N	2.5%	25%	50%	75%	97.5%
#Wet	12.1	12.0	1.00	Y	11.2	11.7	12.0	12.2	12.6
Maximum	80.0	76.9	10.00	Y	54.8	63.7	73.4	85.9	119.4
Mean	4.856	5.002	7.50	Y	4.596	4.906	5.003	5.137	5.311
StdDev	7.725	7.752	7.50	Y	6.849	7.401	7.745	8.039	8.672
Skew	3.801	3.625	0.75	Y	2.908	3.304	3.516	3.807	4.990
Wet0	3.067	3.220	0.75	Y	2.641	3.032	3.177	3.433	3.766
Wet1	4.446	4.753	0.75	Y	4.275	4.572	4.738	4.901	5.271
Wet2	6.316	6.294	0.75	Y	5.492	5.970	6.316	6.567	6.943
Corr	0.643	0.674	0.20	Y	0.596	0.651	0.673	0.702	0.739
DS_Mean	3.576	3.401	1.00	Y	3.184	3.313	3.390	3.483	3.638
DS_SD	3.076	2.879	1.00	Y	2.615	2.773	2.869	2.954	3.189
DS_Skew	3.024	1.889	0.75	N	1.428	1.718	1.845	2.022	2.342
WS_Mean	2.417	2.465	0.50	Y	2.297	2.396	2.473	2.524	2.615
WS_SD	1.860	1.877	0.50	Y	1.642	1.785	1.879	1.938	2.116
WS_Skew	2.287	2.164	0.75	Y	1.664	1.932	2.111	2.319	2.918
DS_Max	35.000	20.260	5.00	N	14.500	18.000	20.000	22.000	26.500
WS_Max	14.000	12.920	1.00	N	10.000	11.000	13.000	14.000	18.500

May

Parameter	Hist	Mean	Tol	Y/N	2.5%	25%	50%	75%	97.5%
#Wet	15.2	15.3	1.00	Y	14.6	15.0	15.2	15.4	15.9
Maximum	51.2	52.4	10.00	Y	37.8	47.2	50.9	55.7	70.8
Mean	3.809	3.976	7.50	Y	3.685	3.877	3.956	4.063	4.228
StdDev	5.617	5.694	7.50	Y	5.176	5.481	5.683	5.866	6.381
Skew	3.284	3.121	0.75	Y	2.646	2.881	3.098	3.293	3.791
Wet0	2.313	2.584	0.75	Y	2.130	2.417	2.564	2.713	3.134
Wet1	3.575	3.690	0.75	Y	3.308	3.578	3.674	3.832	4.040
Wet2	4.622	4.808	0.75	Y	4.308	4.653	4.788	4.928	5.316
Corr	0.707	0.717	0.20	Y	0.650	0.699	0.716	0.737	0.768

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WS_SD	2.223	2.140	0.50	Y	1.908	2.066	2.132	2.229	2.367
WS_Skew	2.191	2.030	0.75	Y	1.586	1.854	1.963	2.167	2.556
DS_Max	13.000	15.950	5.00	Y	12.000	14.000	16.000	17.000	21.500
WS_Max	18.000	15.460	1.00	N	11.500	14.000	15.000	17.000	22.500
DS_Mean	2.679	2.699	1.00	Y	2.513	2.639	2.692	2.758	2.883
DS_SD	2.273	2.183	1.00	Y	1.926	2.109	2.183	2.255	2.448
DS_Skew	1.805	1.951	0.75	Y	1.571	1.791	1.909	2.083	2.415
WS_Mean	2.738	2.748	0.50	Y	2.556	2.684	2.733	2.815	2.929

Jun

Parameter	Hist	Mean	Tol	Y/N	2.5%	25%	50%	75%	97.5%
#Wet	15.9	16.0	1.00	Y	15.4	15.8	16.0	16.2	16.6
Maximum	44.2	44.2	10.00	Y	31.2	37.6	42.5	47.8	65.1
Mean	3.124	3.311	7.50	Y	3.034	3.241	3.320	3.389	3.555
StdDev	4.388	4.508	7.50	Y	4.139	4.371	4.484	4.640	4.906
Skew	3.087	2.859	0.75	Y	2.294	2.634	2.794	3.025	3.692
Wet0	1.996	2.284	0.75	Y	1.955	2.158	2.280	2.404	2.599
Wet1	2.904	3.043	0.75	Y	2.686	2.963	3.050	3.148	3.310
Wet2	3.774	3.973	0.75	Y	3.543	3.825	3.973	4.146	4.358
Corr	0.714	0.726	0.20	Y	0.676	0.705	0.723	0.747	0.775
DS_Mean	2.317	2.372	1.00	Y	2.246	2.321	2.365	2.420	2.495
DS_SD	1.830	1.822	1.00	Y	1.633	1.758	1.821	1.887	1.995
DS_Skew	1.839	2.093	0.75	Y	1.597	1.813	2.007	2.279	2.915
WS_Mean	2.778	2.732	0.50	Y	2.552	2.664	2.733	2.806	2.914
WS_SD	2.167	2.165	0.50	Y	1.893	2.070	2.145	2.261	2.411
WS_Skew	1.930	2.023	0.75	Y	1.529	1.822	1.959	2.262	2.610
DS_Max	14.000	14.150	5.00	Y	10.000	12.000	14.000	16.000	21.000
WS_Max	17.000	15.660	1.00	N	12.000	14.000	15.000	17.000	20.500

Jul

Parameter	Hist	Mean	Tol	Y/N	2.5%	25%	50%	75%	97.5%
#Wet	16.6	16.6	1.00	Y	15.9	16.4	16.5	16.8	17.2
Maximum	74.4	68.3	10.00	Y	43.7	53.4	64.0	78.0	116.7
Mean	2.906	3.070	7.50	Y	2.816	3.002	3.071	3.128	3.284
StdDev	4.715	4.796	7.50	Y	4.099	4.522	4.761	5.040	5.534
Skew	5.288	4.915	0.75	Y	3.418	4.051	4.579	5.277	8.158
Wet0	1.735	1.989	0.75	Y	1.632	1.877	1.983	2.100	2.344
Wet1	2.636	2.767	0.75	Y	2.466	2.667	2.763	2.847	3.034
Wet2	3.663	3.846	0.75	Y	3.402	3.706	3.853	3.980	4.273
Corr	0.621	0.698	0.20	Y	0.628	0.675	0.701	0.724	0.753
DS_Mean	2.304	2.297	1.00	Y	2.144	2.248	2.297	2.340	2.410
DS_SD	1.695	1.733	1.00	Y	1.561	1.653	1.728	1.809	1.916
DS_Skew	1.852	2.058	0.75	Y	1.570	1.819	2.038	2.192	2.706
WS_Mean	2.619	2.644	0.50	Y	2.454	2.580	2.647	2.700	2.828
WS_SD	2.146	2.102	0.50	Y	1.873	2.015	2.083	2.176	2.342
WS_Skew	2.064	2.120	0.75	Y	1.603	1.860	2.078	2.327	2.868
DS_Max	12.000	13.250	5.00	Y	10.000	11.000	13.000	15.000	18.000
WS_Max	15.000	16.380	1.00	N	12.000	14.000	16.000	19.000	23.000

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Aug

Parameter	Hist	Mean	Tol	Y/N	2.5%	25%	50%	75%	97.5%
#Wet	16.4	16.3	1.00	Y	15.7	16.1	16.3	16.5	16.9
Maximum	54.4	52.4	10.00	Y	33.1	43.3	50.7	58.5	78.9
Mean	3.078	3.252	7.50	Y	3.026	3.179	3.222	3.332	3.458
StdDev	4.241	4.382	7.50	Y	3.886	4.241	4.352	4.528	4.857
Skew	4.014	3.590	0.75	Y	2.628	3.090	3.461	3.916	5.040
Wet0	2.185	2.433	0.75	Y	2.077	2.321	2.429	2.503	2.789
Wet1	2.865	2.991	0.75	Y	2.707	2.902	2.989	3.076	3.250
Wet2	3.622	3.831	0.75	Y	3.460	3.683	3.815	3.985	4.192
Corr	0.671	0.726	0.20	Y	0.644	0.708	0.727	0.746	0.775
DS_Mean	2.436	2.468	1.00	Y	2.295	2.405	2.477	2.527	2.622
DS_SD	1.982	1.904	1.00	Y	1.673	1.818	1.899	1.972	2.148
DS_Skew	4.399	2.078	0.75	N	1.654	1.873	2.053	2.256	2.581
WS_Mean	2.695	2.704	0.50	Y	2.544	2.640	2.693	2.767	2.887
WS_SD	1.941	2.155	0.50	Y	1.911	2.084	2.148	2.216	2.377
WS_Skew	1.503	2.005	0.75	Y	1.506	1.765	1.913	2.186	2.774
DS_Max	29.000	14.340	5.00	N	10.000	13.000	14.000	16.000	18.500
WS_Max	13.000	16.290	1.00	N	12.000	14.000	15.000	18.000	24.500

Sep

Parameter	Hist	Mean	Tol	Y/N	2.5%	25%	50%	75%	97.5%
#Wet	15.1	15.1	1.00	Y	14.2	14.8	15.1	15.3	15.6
Maximum	58.7	67.2	10.00	N	46.2	56.5	64.8	76.1	104.1
Mean	3.894	4.062	7.50	Y	3.751	3.939	4.087	4.169	4.397
StdDev	5.680	5.760	7.50	Y	4.982	5.464	5.762	5.958	6.654
Skew	3.891	3.870	0.75	Y	2.888	3.452	3.795	4.135	5.208
Wet0	2.757	3.176	0.75	Y	2.635	2.965	3.156	3.359	3.932
Wet1	3.652	3.882	0.75	Y	3.474	3.778	3.862	3.995	4.301
Wet2	4.616	4.615	0.75	Y	4.073	4.415	4.573	4.823	5.239
Corr	0.637	0.695	0.20	Y	0.619	0.673	0.698	0.717	0.751
DS_Mean	2.661	2.644	1.00	Y	2.447	2.583	2.641	2.692	2.858
DS_SD	2.110	2.088	1.00	Y	1.902	2.014	2.073	2.142	2.349
DS_Skew	2.197	2.097	0.75	Y	1.638	1.905	2.053	2.236	2.718
WS_Mean	2.676	2.607	0.50	Y	2.428	2.553	2.599	2.671	2.757
WS_SD	1.939	2.048	0.50	Y	1.829	1.957	2.059	2.129	2.282
WS_Skew	1.898	2.050	0.75	Y	1.626	1.817	2.017	2.229	2.579
DS_Max	19.000	16.050	5.00	Y	12.000	15.000	15.000	17.000	21.000
WS_Max	12.000	16.020	1.00	N	11.000	14.000	16.000	18.000	24.000

Oct

Parameter	Hist	Mean	Tol	Y/N	2.5%	25%	50%	75%	97.5%
#Wet	14.4	14.4	1.00	Y	13.9	14.2	14.3	14.5	15.0
Maximum	61.0	67.0	10.00	Y	47.0	57.5	65.2	73.9	96.1
Mean	4.748	4.939	7.50	Y	4.614	4.822	4.920	5.060	5.236
StdDev	6.585	6.695	7.50	Y	5.982	6.434	6.676	6.952	7.342
Skew	3.189	3.125	0.75	Y	2.462	2.883	3.086	3.311	3.930
Wet0	3.314	3.435	0.75	Y	2.855	3.291	3.452	3.595	3.936

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WS_Mean	2.397	2.428	0.50	Y	2.281	2.365	2.428	2.479	2.600
WS_SD	1.844	1.878	0.50	Y	1.697	1.776	1.870	1.951	2.108
WS_Skew	1.974	1.996	0.75	Y	1.518	1.743	1.958	2.179	2.698
DS_Max	23.000	18.820	5.00	Y	13.000	16.000	18.000	20.000	28.000
WS_Max	16.000	14.670	1.00	N	10.500	13.000	14.000	16.000	20.000
Wet1	4.366	4.605	0.75	Y	4.236	4.404	4.588	4.749	5.049
Wet2	5.940	6.100	0.75	Y	5.510	5.825	6.097	6.370	6.656
Corr	0.674	0.732	0.20	Y	0.679	0.718	0.729	0.745	0.786
DS_Mean	2.912	2.917	1.00	Y	2.758	2.856	2.905	2.969	3.101
DS_SD	2.374	2.384	1.00	Y	2.146	2.304	2.383	2.453	2.601
DS_Skew	2.562	2.189	0.75	Y	1.581	1.956	2.130	2.358	3.222

Nov

Parameter	Hist	Mean	Tol	Y/N	2.5%	25%	50%	75%	97.5%
#Wet	11.9	11.8	1.00	Y	11.3	11.6	11.8	12.0	12.5
Maximum	72.6	80.5	10.00	N	52.1	67.1	79.1	89.8	118.5
Mean	5.019	5.157	7.50	Y	4.710	5.004	5.180	5.327	5.502
StdDev	7.610	7.688	7.50	Y	6.646	7.323	7.722	8.015	8.569
Skew	3.491	3.581	0.75	Y	2.677	3.188	3.517	3.825	4.763
Wet0	3.535	3.853	0.75	Y	3.078	3.619	3.853	4.127	4.580
Wet1	4.629	5.011	0.75	Y	4.584	4.821	5.002	5.208	5.420
Wet2	6.720	6.318	0.75	Y	5.498	6.004	6.308	6.621	7.023
Corr	0.627	0.650	0.20	Y	0.575	0.618	0.652	0.678	0.730
DS_Mean	3.554	3.489	1.00	Y	3.227	3.397	3.499	3.567	3.725
DS_SD	3.115	2.954	1.00	Y	2.661	2.837	2.959	3.074	3.264
DS_Skew	2.778	2.140	0.75	Y	1.649	1.856	2.084	2.349	2.838
WS_Mean	2.127	2.146	0.50	Y	2.017	2.099	2.155	2.187	2.262
WS_SD	1.513	1.591	0.50	Y	1.434	1.536	1.593	1.656	1.753
WS_Skew	1.629	1.984	0.75	Y	1.461	1.750	1.938	2.154	2.746
DS_Max	28.000	22.380	5.00	N	17.000	19.000	22.000	24.000	30.500
WS_Max	10.000	13.020	1.00	N	9.000	11.000	13.000	14.000	20.000

Dec

Parameter	Hist	Mean	Tol	Y/N	2.5%	25%	50%	75%	97.5%
#Wet	10.6	10.6	1.00	Y	10.1	10.4	10.6	10.8	11.2
Maximum	99.6	93.4	10.00	Y	65.4	79.4	89.9	102.7	144.7
Mean	5.460	5.551	7.50	Y	5.052	5.418	5.535	5.685	5.966
StdDev	8.844	8.846	7.50	Y	7.946	8.398	8.825	9.181	9.820
Skew	3.919	3.878	0.75	Y	3.005	3.465	3.721	4.229	5.368
Wet0	3.462	3.955	0.75	Y	3.293	3.692	3.910	4.276	4.690
Wet1	5.334	5.415	0.75	Y	4.888	5.183	5.409	5.593	6.039
Wet2	7.647	7.308	0.75	Y	6.248	6.851	7.256	7.668	8.527
Corr	0.591	0.632	0.20	Y	0.557	0.609	0.631	0.661	0.701
DS_Mean	4.069	4.143	1.00	Y	3.876	4.019	4.145	4.246	4.430
DS_SD	3.897	3.753	1.00	Y	3.309	3.593	3.742	3.874	4.240
DS_Skew	2.943	2.327	0.75	Y	1.748	2.124	2.245	2.536	3.001
WS_Mean	2.032	2.004	0.50	Y	1.883	1.959	2.003	2.049	2.131
WS_SD	1.370	1.451	0.50	Y	1.262	1.385	1.440	1.516	1.627
WS_Skew	2.000	2.021	0.75	Y	1.569	1.791	1.937	2.135	2.694
DS_Max	40.000	30.080	5.00	N	22.000	26.000	29.000	33.000	41.000
WS_Max	10.000	11.080	1.00	N	8.000	10.000	11.000	12.000	15.500

```
Annual parameters     na =   11 (out of  13)
Monthly parameters    nm =   64 (out of  84)
Dailly parameters     nd =  180 (out of 204)

Generated data is considered GOOD
```

D4 Annual Climate Model

D4.1 Program annclim_mvm

Purpose: Generation of annual climate data using a first order autoregressive multivariate model with Wilson-Hilferty transformation

Input: Model specification file

Historical annual climate data

Output: Generated annual climate data

Parameter diagnostic file containing statistics from generated and historical data

D4.2 Specification File

Record 1 Name of historical annual climate data file (input file)

Record 2 Name of parameter diagnostic file (output file)

Record 3 Name of generated annual climate data file (output file)

Record 4 Number of replicates and length of each replicate

D4.3 Sample Files

Sample input specification file (annclim_mvm.par):

```
009034annclim.dat
009034annclim.out
009034annclim.gen
100 20
```

Sample historical annual climate data file (009034annclim.dat):

Record 1 Header

Record 2 Number of climate variables and length of data

Record 3 Name of climate variable 1

Record 4 Name of climate variable 2

Record 5 Name of climate variable 3

Record 6 …Year and climate values for the year

```
9034 PERTH REGIONAL OFFICE
  3 20
Rainfall
Evaporation
Max Temperature
  1972       611.4       1910.4      24.8
  1973       973.8       1813.5      23.4
  1974       938.1       1769.9      24.0
  …          …           …           …
  …          …           …           …
  …          …           …           …
  1989       738.2       1593.6      24.2
  1990       786.2       1473.3      23.6
  1991       918.2       1378.2      23.9
```

Sample generated annual climate data file (009034annclim.gen):

Record 1 Header

Record 2 Number of replicates, length of replicate and number of climate variables

Record 3 Replicate number

Record 4 …Year and generated values of climate variables

```
9034 PERTH REGIONAL OFFICE
             100         20          3
               1
    1       927.04     1664.40     23.56
    2       919.50     1723.00     23.70
    3       858.16     1534.15     24.24
    …          …          …          …

    …          …          …          …
    …          …          …          …
   17       793.56     1775.24     23.80
   18       829.98     1376.44     23.43
   19       867.79     1616.49     24.27
   20       762.40     1553.06     24.15
               2
    1       833.92     1672.59     24.21
    2       758.99     1644.12     23.89
    3       643.88     1802.41     24.47
    …                     …          …
    …          …          …          …
    …          …          …          …
   18       681.92     1909.57     24.53
   19       664.19     1754.47     24.33
   20       958.28     1794.07     24.46
              100
    1       575.17     1536.70     23.71
    2       905.09     1564.61     24.43
    3       712.60     1469.55     23.84
    …          …          …          …
    …          …          …          …
    …          …          …          …
   18       831.80     1809.57     24.20
   19       808.73     1789.50     23.59
   20       734.25     1943.74     24.80
```

Sample diagnostic file (009034annclim.out):

```
9034 PERTH REGIONAL OFFICE
1.Rainfall

Parameter   Hist     Mean     Tol      Y/N     2.5%     25%      50%      75%     97.5%
Mean       795.62   796.13    5.00      Y     740.77   778.18   797.32   813.48   842.12
StdDev     121.89   115.89    5.00      Y      81.41   104.45   115.36   127.51   151.23
Skew       -0.410   -0.150    0.50      Y     -1.106   -0.434   -0.151    0.087    0.674
Corr       -0.320   -0.314    0.15      Y     -0.708   -0.430   -0.303   -0.198   -0.012
Maximum     1.224    1.264   10.00      Y      1.141    1.219    1.260    1.304    1.424
Minimum     0.703    0.708   10.00      Y      0.536    0.648    0.710    0.762    0.868

2.Evaporation

Parameter   Hist     Mean     Tol      Y/N     2.5%     25%      50%      75%     97.5%
Mean      1700.66  1707.11    5.00      Y    1608.51  1664.98  1708.97  1741.37  1794.61
StdDev     131.24   120.83    5.00      N      77.55   103.23   117.30   134.25   183.39
Skew       -0.623   -0.276    0.50      Y     -1.737   -0.510   -0.246   -0.002    0.929
Corr        0.595    0.449    0.15      Y      0.061    0.321    0.466    0.580    0.812
Maximum     1.123    1.121   10.00      Y      1.047    1.097    1.123    1.147    1.184
Minimum     0.810    0.860   10.00      Y      0.729    0.818    0.874    0.904    0.947

3.Max Temperature

Parameter   Hist     Mean     Tol      Y/N     2.5%     25%      50%      75%     97.5%
Mean       24.09    24.08    5.00      Y     23.90    24.00    24.07    24.14    24.29
StdDev      0.53     0.53    5.00      Y      0.37     0.47     0.53     0.58     0.71
Skew        0.164    0.068   0.50      Y     -1.063   -0.287    0.074    0.411    0.980
Corr       -0.035   -0.088   0.15      Y     -0.474   -0.279   -0.081    0.071    0.333
Maximum     1.042    1.043   10.00      Y      1.021    1.034    1.042    1.051    1.069
Minimum     0.963    0.959   10.00      Y      0.931    0.953    0.960    0.967    0.977

Cross correlations

Parameter   Hist     Mean     Tol      Y/N     2.5%     25%      50%      75%     97.5%
Corr1-2    -0.231   -0.209    0.20      Y     -0.543   -0.353   -0.246   -0.077    0.231
Corr1-3    -0.325   -0.299    0.20      Y     -0.667   -0.463   -0.298   -0.146    0.087
Corr2-3     0.453    0.443    0.20      Y      0.064    0.329    0.470    0.563    0.727

Annual parameters within tolerance  na =   20 (out of 21)
Overall assessment of the generated data: GOOD
```

D5 Monthly Climate Model

D5.1 Program monclim_mfm

Purpose: Generation of monthly climate data using a first order autoregressive multivariate model with Wilson-Hilferty transformation to generate annual climate data and then disaggregate into monthly data by the modified method of fragments

Input: Model specification file
Historical monthly climate data

Output: Generated monthly climate data
Parameter diagnostic file containing statistics from generated and historical data

D5.2 Specification File for Program monclim_mfm

Record 1 Name of historical monthly climate data file (input file)

Record 2 Name of parameter diagnostic file (output file)

Record 3 Name of generated monthly climate data file (output file)

Record 4 Number of replicates and length of each replicate in years

D5.3 Sample Files

Sample input specification file (monclim_mfm.par):

```
094029monclim.dat
094029monclim.out
094029monclim.gen
100 22
```

Sample historical monthly climate data file (094029monclim.dat):

Record 1 Header

Record 2 Number of climate variables and length of data in years

Record 3 Name of climate variable 1

Record 4 Name of climate variable 2

Record 5 Name of climate variable 3

Record 6 …Year, month and climate values for the year

```
94029 HOBART (ELLERSLIE ROAD)
 3 22
 Rainfall
 Evaporation
 Max Temperature
   1972      1      56.7    149.1    20.2
   1972      2      44.9    142.4    24.1
   1972      3      11.0    124.2    20.6
     …       …        …       …        …
     …       …        …       …        …
     …       …        …       …        …
   1993      10     49.6    106.4    18.1
   1993      11     69.2    111.8    18.2
   1993      12    198.8    140.8    20.0
```

Sample generated monthly climate rainfall data file (094029monclim.gen):

Record 1 Header

Record 2 First climate variable

Record 3 Second climate variable

Record 4 Third climate variable

Record 5 Number of replicates, length of replicate, number of climate variables and the mean annual values (divided by 12) of the climate variables

Record 6 Replicate number

Record 7…Year, month and generated values of climate variables for the month

```
94029 HOBART (ELLERSLIE ROAD)
  1.   Rainfall
  2.   Evaporation
  3.   Max Temperature
  100   22     3    47.99    81.79    17.23
   1
   1       1    119.12   123.99    20.36
   1       2     24.87   116.09    21.18
   …       …       …        …         …
   …       …       …        …         …
   …       …       …        …         …
   22      10   109.82    87.21    16.68
   22      11    17.35   112.01    19.03
   2
   1       1     7.90   155.31    19.81
   1       2    26.70   156.39    20.81
   …       …       …        …         …
   …       …       …        …         …
   …       …       …        …         …
   22      10   110.50    89.68    16.69
   22      11    17.46   115.19    19.04
          100
   1       1    62.32   147.39    22.37
   1       2    16.19   126.63    22.47
   …       …       …        …         …
   …       …       …        …         …
   …       …       …        …         …
   22      10    92.06    71.18    16.22
   22      11    31.01   117.75    19.02
   22      12    86.05   134.91    19.92
```

Sample diagnostic output file is given (094029monclim.out):

```
94029 HOBART (ELLERSLIE ROAD)

Monthly parameters

1.   Rainfall

Jan

Parameter   Hist     Mean     Tol      Y/N     2.5%     25%      50%      75%     97.5%
Mean       43.100   44.598   7.50       Y     32.512   40.655   44.331   49.097   56.057
Stdev      23.699   25.423   7.50       Y     18.961   22.904   25.322   28.068   31.636
Skew        0.589    0.471   0.75       Y     -0.442    0.116    0.401    0.820    1.475
Corr        0.517    0.518   0.20       Y      0.029    0.409    0.551    0.684    0.797
Max         104.4    101.3   10.00      Y       70.3     88.7    100.0    115.4    135.3
Min         8.400    8.867   10.00      Y      7.785    8.050    8.390    9.210   11.870

Feb

Parameter   Hist     Mean     Tol      Y/N     2.5%     25%      50%      75%     97.5%
Mean       29.818   27.221   7.50       Y     20.778   24.534   26.724   30.034   34.539
Stdev      19.708   15.637   7.50       Y     11.168   14.282   15.262   16.521   21.127
Skew        1.155    0.790   0.75       Y     -0.072    0.469    0.737    1.053    1.800
Corr       -0.132   -0.323   0.20       Y     -0.681   -0.443   -0.320   -0.207   -0.042
Max        86.600   59.269   10.00      Y     49.025   52.810   53.340   53.970   89.200
Min         6.400    7.814   10.00      Y      6.105    6.320    6.500    9.280   12.920

Mar

Parameter   Hist     Mean     Tol      Y/N     2.5%     25%      50%      75%     97.5%
Mean       44.268   40.905   7.50       Y     31.640   36.974   40.049   43.539   52.485
Stdev      30.018   22.325   7.50       Y     12.718   19.085   22.896   25.704   29.661
Skew        1.068    0.823   0.75       Y     -0.727    0.344    0.887    1.317    2.192
Corr       -0.438   -0.199   0.20       N     -0.514   -0.330   -0.213   -0.072    0.140
Max         112.6     96.3   10.00      Y       54.5     81.3     97.9    111.4    123.4
Min         4.600    7.276   10.00      Y      4.335    4.570    4.750    5.030   19.445

Apr

Parameter   Hist     Mean     Tol      Y/N     2.5%     25%      50%      75%     97.5%
Mean       40.200   43.036   7.50       Y     33.893   38.987   42.633   45.831   55.093
Stdev      23.864   26.255   7.50       Y     17.011   23.476   25.945   29.166   33.698
Skew        1.037    0.983   0.75       Y      0.131    0.734    0.956    1.231    1.995
Corr       -0.206   -0.205   0.20       Y     -0.517   -0.312   -0.203   -0.130    0.125
Max         106.0    104.3   10.00      Y       69.9    104.0    109.3    113.9    116.9
Min        10.200   11.203   10.00      Y      9.365    9.910   10.120   10.530   18.785

May

Parameter   Hist     Mean     Tol      Y/N     2.5%     25%      50%      75%     97.5%
Mean       39.455   41.260   7.50       Y     31.298   37.182   41.669   44.977   51.354
Stdev      27.752   29.074   7.50       Y     21.977   26.423   28.863   31.855   34.678
Skew        0.963    0.940   0.75       Y      0.254    0.668    0.879    1.158    1.735
Corr       -0.032    0.055   0.20       Y     -0.324   -0.038    0.047    0.180    0.377
Max          98.7    100.3   10.00      Y       83.9     97.8    100.2    102.1    119.7
Min         4.800    7.138   10.00      Y      4.420    4.530    4.630    4.860   19.690
```

Continued next page

Jun

Parameter	Hist	Mean	Tol	Y/N	2.5%	25%	50%	75%	97.5%
Mean	40.050	44.644	7.50	Y	36.485	41.780	44.843	46.945	52.758
Stdev	18.874	19.164	7.50	Y	13.806	16.995	19.082	21.459	25.362
Skew	0.352	0.462	0.75	Y	-0.511	0.180	0.449	0.821	1.186
Corr	0.031	-0.132	0.20	Y	-0.433	-0.226	-0.142	-0.020	0.149
Max	84.600	85.694	10.00	Y	71.095	82.990	87.250	90.940	93.320
Min	1.800	11.220	10.00	Y	1.275	1.770	16.440	21.180	24.105

Jul

Parameter	Hist	Mean	Tol	Y/N	2.5%	25%	50%	75%	97.5%
Mean	59.314	61.389	7.50	Y	46.720	54.420	60.096	67.454	78.070
Stdev	36.247	39.782	7.50	Y	23.524	33.653	39.977	45.164	51.757
Skew	1.125	1.178	0.75	Y	0.284	0.906	1.138	1.423	2.087
Corr	0.124	0.253	0.20	Y	-0.519	0.063	0.296	0.476	0.663
Max	156.8	156.8	10.00	Y	108.4	153.8	161.7	168.6	173.0
Min	11.800	13.351	10.00	Y	8.340	11.600	12.180	12.490	29.195

Aug

Parameter	Hist	Mean	Tol	Y/N	2.5%	25%	50%	75%	97.5%
Mean	60.864	58.971	7.50	Y	40.645	54.397	59.800	64.847	70.713
Stdev	39.530	37.452	7.50	Y	24.887	34.322	37.628	41.006	47.634
Skew	0.674	0.769	0.75	Y	-0.019	0.493	0.714	1.032	1.653
Corr	-0.031	-0.093	0.20	Y	-0.458	-0.230	-0.100	0.010	0.232
Max	147.8	138.5	10.00	Y	103.4	118.5	146.4	152.1	161.0
Min	9.000	13.657	10.00	Y	6.905	8.840	9.860	18.590	20.020

Sep

Parameter	Hist	Mean	Tol	Y/N	2.5%	25%	50%	75%	97.5%
Mean	48.605	45.203	7.50	Y	36.662	42.454	44.851	48.197	52.900
Stdev	25.328	17.163	7.50	Y	10.699	15.161	16.956	19.477	23.542
Skew	1.677	1.062	0.75	Y	0.082	0.682	1.006	1.353	2.255
Corr	-0.072	-0.013	0.20	Y	-0.368	-0.147	-0.014	0.129	0.299
Max	127.8	86.6	10.00	Y	64.4	77.4	87.6	92.3	127.0
Min	14.000	22.762	10.00	Y	14.000	22.940	24.000	24.690	30.405

Oct

Parameter	Hist	Mean	Tol	Y/N	2.5%	25%	50%	75%	97.5%
Mean	59.700	65.647	7.50	Y	52.171	60.802	64.836	70.684	78.269
Stdev	36.774	35.401	7.50	Y	24.096	31.587	35.447	39.039	46.158
Skew	1.155	0.958	0.75	Y	0.131	0.656	0.955	1.228	1.730
Corr	-0.197	-0.467	0.20	Y	-0.709	-0.554	-0.459	-0.397	-0.232
Max	149.4	147.3	10.00	Y	105.8	145.9	150.3	154.3	157.4
Min	8.600	17.421	10.00	Y	6.600	8.440	9.420	23.930	32.975

Nov

Parameter	Hist	Mean	Tol	Y/N	2.5%	25%	50%	75%	97.5%
Mean	50.850	46.267	7.50	Y	36.228	43.073	45.837	50.059	54.662
Stdev	24.966	22.671	7.50	Y	16.239	20.639	22.542	24.777	27.839
Skew	0.361	0.440	0.75	Y	-0.235	0.165	0.437	0.672	1.203
Corr	0.299	0.241	0.20	Y	-0.321	0.129	0.271	0.374	0.594
Max	100.2	92.7	10.00	Y	69.9	86.1	95.0	99.1	109.9
Min	17.000	16.818	10.00	Y	12.870	16.250	16.770	17.220	20.455

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Dec

Parameter	Hist	Mean	Tol	Y/N	2.5%	25%	50%	75%	97.5%
Mean	59.609	60.482	7.50	Y	39.865	54.112	60.597	66.129	80.012
Stdev	51.206	46.122	7.50	Y	20.280	38.541	48.260	54.386	63.487
Skew	2.129	2.021	0.75	Y	0.246	1.731	2.077	2.427	3.065
Corr	0.119	0.246	0.20	Y	-0.146	0.136	0.230	0.367	0.573
Max	206.4	194.0	10.00	Y	82.4	195.0	202.7	210.0	222.5
Min	11.600	15.083	10.00	Y	10.855	11.830	12.320	14.870	27.140

2. Evaporation

Jan

Parameter	Hist	Mean	Tol	Y/N	2.5%	25%	50%	75%	97.5%
Mean	149.1	149.9	7.50	Y	140.2	147.7	149.8	153.0	157.7
Stdev	17.277	17.767	7.50	Y	11.414	16.437	17.597	19.309	23.338
Skew	0.383	0.034	0.75	Y	-0.794	-0.248	0.015	0.266	0.952
Corr	0.682	0.365	0.20	Y	-0.008	0.252	0.388	0.467	0.653
Max	191.7	183.8	10.00	Y	168.5	178.6	183.2	189.5	203.0
Min	116.2	116.9	10.00	Y	101.5	111.9	116.7	121.8	132.9

Feb

Parameter	Hist	Mean	Tol	Y/N	2.5%	25%	50%	75%	97.5%
Mean	127.8	128.2	7.50	Y	120.6	125.1	127.9	131.1	135.6
Stdev	13.992	14.370	7.50	Y	9.195	12.391	14.018	15.797	20.460
Skew	-0.339	0.000	0.75	Y	-1.065	-0.414	0.044	0.310	1.086
Corr	0.447	0.564	0.20	Y	0.130	0.482	0.591	0.656	0.818
Max	149.4	156.5	10.00	Y	140.3	150.1	155.9	162.8	174.3
Min	99.8	100.5	10.00	Y	83.6	94.1	101.0	106.0	114.5

Mar

Parameter	Hist	Mean	Tol	Y/N	2.5%	25%	50%	75%	97.5%
Mean	96.5	96.0	7.50	Y	89.4	94.2	96.0	98.0	101.9
Stdev	12.111	12.392	7.50	Y	8.593	11.091	12.243	13.373	16.539
Skew	0.570	0.343	0.75	Y	-0.715	-0.032	0.334	0.608	1.413
Corr	0.356	0.498	0.20	Y	0.114	0.387	0.518	0.607	0.770
Max	124.2	123.0	10.00	Y	109.4	116.8	122.5	129.3	137.0
Min	79.800	73.812	10.00	Y	63.355	70.490	73.250	77.970	82.915

Apr

Parameter	Hist	Mean	Tol	Y/N	2.5%	25%	50%	75%	97.5%
Mean	62.695	63.006	7.50	Y	58.959	61.657	62.737	64.417	67.067
Stdev	8.614	9.336	7.50	Y	5.950	8.332	9.430	10.457	11.710
Skew	-0.174	-0.397	0.75	Y	-1.452	-0.745	-0.446	-0.091	0.673
Corr	0.158	0.252	0.20	Y	-0.124	0.152	0.263	0.366	0.466
Max	76.700	79.219	10.00	Y	72.580	76.560	78.370	81.480	86.920
Min	47.700	42.601	10.00	Y	35.005	38.770	41.120	44.590	55.035

May

Parameter	Hist	Mean	Tol	Y/N	2.5%	25%	50%	75%	97.5%
Mean	37.468	36.762	7.50	Y	33.175	35.776	36.828	37.817	39.187
Stdev	7.133	6.647	7.50	Y	4.798	5.947	6.732	7.247	8.011
Skew	0.134	0.400	0.75	Y	-0.358	0.194	0.393	0.611	1.050
Corr	0.434	0.469	0.20	Y	-0.015	0.393	0.488	0.568	0.713
Max	51.400	50.131	10.00	Y	43.885	48.620	50.350	52.010	54.955
Min	26.000	26.307	10.00	Y	23.150	25.010	26.120	27.330	29.410

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Jun

Parameter	Hist	Mean	Tol	Y/N	2.5%	25%	50%	75%	97.5%
Mean	22.964	23.931	7.50	Y	20.820	23.125	24.102	24.738	26.023
Stdev	5.930	4.845	7.50	Y	3.273	4.370	4.818	5.264	6.108
Skew	0.164	0.285	0.75	Y	-0.460	0.056	0.290	0.516	0.907
Corr	0.379	0.429	0.20	Y	-0.096	0.292	0.445	0.593	0.713
Max	34.600	33.114	10.00	Y	28.910	31.990	33.050	34.250	36.630
Min	12.400	15.843	10.00	Y	12.325	14.500	15.650	17.300	19.650

Jul

Parameter	Hist	Mean	Tol	Y/N	2.5%	25%	50%	75%	97.5%
Mean	27.568	27.807	7.50	Y	23.728	26.642	27.931	28.937	31.017
Stdev	7.479	7.179	7.50	Y	5.451	6.616	7.259	7.768	8.637
Skew	0.191	0.041	0.75	Y	-0.865	-0.196	0.090	0.276	0.634
Corr	0.483	0.511	0.20	Y	0.219	0.423	0.516	0.613	0.730
Max	44.800	41.542	10.00	Y	34.245	39.500	41.770	43.460	47.545
Min	14.600	15.511	10.00	Y	12.360	14.290	15.470	16.230	19.240

Aug

Parameter	Hist	Mean	Tol	Y/N	2.5%	25%	50%	75%	97.5%
Mean	43.945	44.223	7.50	Y	40.461	42.666	44.021	45.405	48.187
Stdev	7.880	7.859	7.50	Y	5.858	6.937	7.738	8.784	10.156
Skew	0.774	0.485	0.75	Y	-0.301	0.189	0.474	0.727	1.366
Corr	-0.069	0.045	0.20	Y	-0.407	-0.121	0.071	0.183	0.418
Max	64.000	61.271	10.00	Y	53.590	58.230	61.260	63.790	69.135
Min	32.000	31.216	10.00	Y	24.890	28.890	31.120	33.320	36.710

Sep

Parameter	Hist	Mean	Tol	Y/N	2.5%	25%	50%	75%	97.5%
Mean	65.927	65.941	7.50	Y	60.683	64.187	65.732	68.141	70.708
Stdev	13.908	11.225	7.50	Y	8.744	10.310	10.961	12.235	13.981
Skew	0.397	0.105	0.75	Y	-0.731	-0.168	0.073	0.371	0.766
Corr	0.317	0.363	0.20	Y	-0.021	0.252	0.361	0.497	0.670
Max	96.000	86.450	10.00	Y	77.185	83.370	86.630	88.710	94.430
Min	45.400	46.919	10.00	Y	38.330	44.370	47.330	49.090	52.400

Oct

Parameter	Hist	Mean	Tol	Y/N	2.5%	25%	50%	75%	97.5%
Mean	95.1	95.2	7.50	Y	89.4	91.9	94.8	97.9	102.8
Stdev	15.105	14.953	7.50	Y	11.031	13.614	14.758	16.441	18.620
Skew	-0.041	0.174	0.75	Y	-0.565	-0.141	0.123	0.449	1.021
Corr	0.487	0.388	0.20	Y	-0.031	0.265	0.399	0.502	0.663
Max	121.6	124.9	10.00	Y	109.7	119.2	125.1	129.4	138.4
Min	64.600	68.614	10.00	Y	54.920	64.250	68.710	72.790	80.325

Nov

Parameter	Hist	Mean	Tol	Y/N	2.5%	25%	50%	75%	97.5%
Mean	114.3	114.5	7.50	Y	106.6	111.9	114.1	117.0	121.8
Stdev	14.336	15.538	7.50	Y	9.656	13.160	15.098	17.898	21.462
Skew	-0.025	0.213	0.75	Y	-1.004	-0.225	0.196	0.749	1.360
Corr	0.526	0.435	0.20	Y	-0.080	0.311	0.458	0.566	0.737
Max	148.6	148.6	10.00	Y	130.3	138.9	144.5	159.8	171.8
Min	79.2	85.4	10.00	Y	68.3	80.5	85.8	89.7	101.3

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Dec

Parameter	Hist	Mean	Tol	Y/N	2.5%	25%	50%	75%	97.5%
Mean	138.1	137.1	7.50	Y	127.4	134.2	136.9	139.6	144.8
Stdev	20.613	17.177	7.50	Y	12.078	15.533	17.075	19.057	21.444
Skew	-0.367	0.057	0.75	Y	-0.837	-0.308	0.037	0.364	1.159
Corr	0.324	0.379	0.20	Y	-0.008	0.266	0.363	0.499	0.642
Max	178.2	171.9	10.00	Y	153.1	164.0	169.6	178.4	193.0
Min	88.8	104.1	10.00	N	84.9	98.4	104.8	110.2	117.5

3. Max Temperature

Jan

Parameter	Hist	Mean	Tol	Y/N	2.5%	25%	50%	75%	97.5%
Mean	21.959	22.169	7.50	Y	21.598	21.994	22.159	22.366	22.580
Stdev	1.534	1.386	7.50	Y	1.066	1.278	1.400	1.502	1.683
Skew	-0.214	-0.683	0.75	Y	-1.562	-0.936	-0.676	-0.475	-0.061
Corr	0.156	0.202	0.20	Y	-0.226	0.064	0.208	0.345	0.610
Max	24.700	24.090	10.00	Y	23.465	23.830	24.090	24.320	24.825
Min	19.300	19.424	10.00	Y	18.585	19.180	19.420	19.680	20.165

Feb

Parameter	Hist	Mean	Tol	Y/N	2.5%	25%	50%	75%	97.5%
Mean	22.091	21.883	7.50	Y	21.266	21.746	21.890	22.020	22.308
Stdev	1.136	1.075	7.50	Y	0.696	0.976	1.086	1.176	1.371
Skew	0.290	-0.405	0.75	Y	-1.281	-0.676	-0.435	-0.161	0.496
Corr	0.086	0.401	0.20	N	0.026	0.247	0.401	0.559	0.736
Max	24.400	23.701	10.00	Y	22.890	23.310	23.620	23.890	25.065
Min	20.500	19.609	10.00	Y	18.715	19.270	19.550	19.900	20.635

Mar

Parameter	Hist	Mean	Tol	Y/N	2.5%	25%	50%	75%	97.5%
Mean	20.173	20.276	7.50	Y	19.817	20.137	20.275	20.437	20.716
Stdev	0.891	1.191	7.50	Y	0.797	1.077	1.186	1.279	1.534
Skew	0.547	0.187	0.75	Y	-0.615	-0.064	0.168	0.442	0.828
Corr	-0.294	0.140	0.20	N	-0.233	0.031	0.153	0.286	0.422
Max	22.400	22.700	10.00	Y	21.635	22.300	22.740	23.070	23.660
Min	18.500	18.196	10.00	Y	17.325	17.990	18.200	18.420	18.850

Apr

Parameter	Hist	Mean	Tol	Y/N	2.5%	25%	50%	75%	97.5%
Mean	18.141	18.246	7.50	Y	17.809	18.120	18.234	18.366	18.560
Stdev	0.942	0.927	7.50	Y	0.641	0.848	0.920	1.010	1.160
Skew	-0.184	-0.217	0.75	Y	-1.019	-0.450	-0.212	0.058	0.443
Corr	-0.133	0.163	0.20	N	-0.148	0.045	0.168	0.280	0.492
Max	19.600	19.820	10.00	Y	19.125	19.610	19.850	20.010	20.440
Min	16.500	16.512	10.00	Y	15.745	16.270	16.500	16.740	17.165

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May

Parameter	Hist	Mean	Tol	Y/N	2.5%	25%	50%	75%	97.5%
Mean	15.159	15.080	7.50	Y	14.804	14.995	15.077	15.158	15.396
Stdev	0.693	0.668	7.50	Y	0.472	0.576	0.660	0.749	0.874
Skew	0.436	0.357	0.75	Y	-0.881	-0.120	0.378	0.789	1.491
Corr	0.527	0.636	0.20	Y	0.351	0.569	0.650	0.723	0.802
Max	16.800	16.525	10.00	Y	15.715	16.200	16.470	16.900	17.320
Min	13.900	13.884	10.00	Y	13.115	13.700	13.920	14.100	14.425

Jun

Parameter	Hist	Mean	Tol	Y/N	2.5%	25%	50%	75%	97.5%
Mean	12.400	12.424	7.50	Y	11.902	12.262	12.395	12.601	12.800
Stdev	1.009	1.007	7.50	Y	0.844	0.920	1.004	1.076	1.184
Skew	0.157	0.134	0.75	Y	-0.527	-0.078	0.090	0.343	0.711
Corr	0.086	0.172	0.20	Y	-0.203	0.030	0.182	0.294	0.551
Max	14.100	14.174	10.00	Y	13.625	14.010	14.180	14.340	14.605
Min	10.900	10.748	10.00	Y	10.205	10.520	10.750	10.950	11.265

Jul

Parameter	Hist	Mean	Tol	Y/N	2.5%	25%	50%	75%	97.5%
Mean	12.114	12.209	7.50	Y	11.879	12.133	12.213	12.290	12.516
Stdev	0.787	0.630	7.50	Y	0.413	0.541	0.636	0.699	0.841
Skew	0.617	-0.061	0.75	Y	-0.899	-0.314	-0.090	0.205	0.898
Corr	0.477	0.310	0.20	Y	-0.049	0.164	0.317	0.457	0.627
Max	13.700	13.405	10.00	Y	12.850	13.250	13.380	13.610	13.870
Min	10.800	10.970	10.00	Y	10.425	10.720	10.950	11.130	11.670

Aug

Parameter	Hist	Mean	Tol	Y/N	2.5%	25%	50%	75%	97.5%
Mean	13.400	13.275	7.50	Y	12.929	13.135	13.249	13.390	13.710
Stdev	1.135	0.968	7.50	Y	0.587	0.846	0.922	1.107	1.313
Skew	0.198	0.573	0.75	Y	-0.232	0.253	0.550	0.816	1.572
Corr	-0.131	-0.139	0.20	Y	-0.518	-0.336	-0.156	0.047	0.321
Max	15.700	15.432	10.00	Y	14.415	14.960	15.320	15.960	16.435
Min	11.100	11.664	10.00	Y	10.950	11.400	11.600	11.830	12.470

Sep

Parameter	Hist	Mean	Tol	Y/N	2.5%	25%	50%	75%	97.5%
Mean	15.286	15.195	7.50	Y	14.900	15.062	15.184	15.289	15.571
Stdev	1.181	0.922	7.50	Y	0.675	0.858	0.922	0.998	1.136
Skew	-0.256	-0.285	0.75	Y	-1.168	-0.595	-0.282	0.030	0.423
Corr	0.261	0.239	0.20	Y	-0.168	0.105	0.242	0.408	0.595
Max	17.300	16.698	10.00	Y	16.155	16.490	16.690	16.890	17.235
Min	12.700	13.368	10.00	Y	12.720	13.150	13.370	13.630	13.985

Oct

Parameter	Hist	Mean	Tol	Y/N	2.5%	25%	50%	75%	97.5%
Mean	17.268	17.250	7.50	Y	16.860	17.095	17.225	17.390	17.703
Stdev	1.074	1.031	7.50	Y	0.708	0.918	1.037	1.130	1.361
Skew	-1.132	-0.323	0.75	N	-1.330	-0.718	-0.395	-0.033	0.995
Corr	0.361	0.176	0.20	Y	-0.230	-0.022	0.188	0.320	0.520
Max	18.900	19.016	10.00	Y	18.295	18.790	18.980	19.230	19.585
Min	14.100	14.990	10.00	Y	13.910	14.480	14.750	15.580	16.225

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Nov

Parameter	Hist	Mean	Tol	Y/N	2.5%	25%	50%	75%	97.5%
Mean	18.700	18.592	7.50	Y	18.100	18.443	18.571	18.753	19.114
Stdev	1.093	1.148	7.50	Y	0.795	1.046	1.149	1.244	1.454
Skew	-0.111	0.062	0.75	Y	-0.933	-0.192	0.033	0.303	0.874
Corr	0.211	0.230	0.20	Y	-0.108	0.114	0.244	0.351	0.498
Max	20.800	20.800	10.00	Y	19.780	20.310	20.820	21.180	21.775
Min	16.600	16.451	10.00	Y	15.390	16.130	16.420	16.710	17.390

Dec

Parameter	Hist	Mean	Tol	Y/N	2.5%	25%	50%	75%	97.5%
Mean	20.086	20.122	7.50	Y	19.745	20.005	20.129	20.224	20.444
Stdev	0.958	0.898	7.50	Y	0.641	0.802	0.894	0.988	1.159
Skew	-0.567	-0.244	0.75	Y	-0.955	-0.550	-0.227	0.048	0.525
Corr	-0.179	0.080	0.20	N	-0.452	-0.095	0.080	0.267	0.552
Max	21.500	21.690	10.00	Y	21.040	21.490	21.660	21.910	22.270
Min	17.600	18.276	10.00	Y	17.345	17.910	18.270	18.720	19.155

Rainfall-Evaporation

Month	Hist	Mean	Tol	Y/N	2.5%	25%	50%	75%	97.5%
Jan	-0.454	-0.304	0.20	Y	-0.647	-0.419	-0.324	-0.158	0.076
Feb	-0.268	-0.283	0.20	Y	-0.595	-0.392	-0.296	-0.186	0.032
Mar	-0.094	-0.120	0.20	Y	-0.587	-0.294	-0.134	0.065	0.341
Apr	-0.181	-0.262	0.20	Y	-0.726	-0.516	-0.297	-0.126	0.377
May	-0.079	-0.107	0.20	Y	-0.544	-0.243	-0.085	0.014	0.302
Jun	-0.082	-0.257	0.20	Y	-0.567	-0.372	-0.255	-0.171	0.045
Jul	0.290	0.115	0.20	Y	-0.404	-0.049	0.078	0.300	0.677
Aug	-0.511	-0.296	0.20	N	-0.700	-0.483	-0.315	-0.155	0.157
Sep	-0.417	-0.471	0.20	Y	-0.756	-0.580	-0.483	-0.379	-0.123
Oct	-0.263	-0.256	0.20	Y	-0.612	-0.373	-0.254	-0.121	0.055
Nov	-0.574	-0.517	0.20	Y	-0.804	-0.649	-0.551	-0.425	-0.194
Dec	-0.456	-0.354	0.20	Y	-0.734	-0.513	-0.374	-0.250	0.049

Rainfall - Max Temperature

Month	Hist	Mean	Tol	Y/N	2.5%	25%	50%	75%	97.5%
Jan	-0.290	-0.253	0.20	Y	-0.712	-0.413	-0.279	-0.082	0.182
Feb	-0.168	-0.118	0.20	Y	-0.510	-0.264	-0.109	0.004	0.274
Mar	-0.189	-0.234	0.20	Y	-0.672	-0.372	-0.260	-0.082	0.123
Apr	-0.137	-0.120	0.20	Y	-0.556	-0.290	-0.147	0.048	0.365
May	-0.148	-0.222	0.20	Y	-0.491	-0.316	-0.239	-0.123	0.055
Jun	-0.171	-0.084	0.20	Y	-0.424	-0.227	-0.101	0.054	0.279
Jul	-0.099	-0.200	0.20	Y	-0.565	-0.365	-0.199	-0.053	0.132
Aug	-0.757	-0.699	0.20	Y	-0.848	-0.771	-0.722	-0.653	-0.447
Sep	-0.493	-0.509	0.20	Y	-0.818	-0.661	-0.532	-0.371	-0.161
Oct	-0.384	-0.448	0.20	Y	-0.651	-0.527	-0.468	-0.370	-0.231
Nov	-0.241	-0.442	0.20	Y	-0.759	-0.557	-0.434	-0.324	-0.115
Dec	-0.348	-0.319	0.20	Y	-0.690	-0.443	-0.316	-0.225	0.000

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Evaporation - Max Temperature

Month	Hist	Mean	Tol	Y/N	2.5%	25%	50%	75%	97.5%
Jan	0.631	0.663	0.20	Y	0.316	0.589	0.691	0.746	0.833
Feb	0.576	0.584	0.20	Y	0.163	0.463	0.606	0.727	0.849
Mar	0.577	0.666	0.20	Y	0.176	0.587	0.696	0.778	0.871
Apr	0.599	0.592	0.20	Y	0.305	0.520	0.609	0.678	0.775
May	0.508	0.561	0.20	Y	0.203	0.489	0.576	0.644	0.783
Jun	0.631	0.468	0.20	Y	0.190	0.387	0.476	0.565	0.694
Jul	0.584	0.596	0.20	Y	0.260	0.482	0.603	0.698	0.842
Aug	0.702	0.625	0.20	Y	0.365	0.526	0.637	0.727	0.822
Sep	0.847	0.812	0.20	Y	0.622	0.766	0.816	0.868	0.922
Oct	0.815	0.796	0.20	Y	0.621	0.735	0.811	0.861	0.920
Nov	0.608	0.730	0.20	Y	0.475	0.662	0.732	0.805	0.895
Dec	0.780	0.708	0.20	Y	0.502	0.647	0.711	0.771	0.850

Annual parameters

Rainfall

Parameter	Hist	Mean	Tol	Y/N	2.5%	25%	50%	75%	97.5%
Mean	575.8	579.6	5.00	Y	532.0	562.9	580.2	594.9	623.0
Stdev	107.2	102.5	5.00	Y	66.6	89.2	100.8	112.9	139.1
Skew	0.237	0.131	0.50	Y	-0.657	-0.197	0.109	0.376	1.072
Corr	0.235	0.170	0.15	Y	-0.226	0.053	0.175	0.307	0.497
Max	827.8	785.7	10.00	Y	679.2	743.1	778.3	819.1	907.5
Min	390.2	388.6	10.00	Y	270.5	357.4	394.3	421.2	469.7

Evaporation

Parameter	Hist	Mean	Tol	Y/N	2.5%	25%	50%	75%	97.5%
Mean	981.5	982.7	5.00	Y	929.4	965.4	981.5	1000.2	1024.5
Stdev	87.2	83.6	5.00	Y	56.6	73.0	82.1	92.7	117.3
Skew	-0.238	-0.144	0.50	Y	-1.086	-0.453	-0.132	0.216	0.610
Corr	0.438	0.352	0.15	Y	0.048	0.244	0.364	0.454	0.640
Max	1165.5	1135.7	10.00	Y	1063.7	1112.1	1135.5	1159.2	1225.8
Min	791.2	816.7	10.00	N	702.4	786.5	821.9	857.7	889.1

Max Temperature

Parameter	Hist	Mean	Tol	Y/N	2.5%	25%	50%	75%	97.5%
Mean	17.231	17.227	5.00	Y	17.065	17.168	17.227	17.284	17.378
Stdev	0.432	0.426	5.00	Y	0.262	0.388	0.421	0.468	0.568
Skew	-0.277	-0.142	0.50	Y	-1.043	-0.468	-0.248	0.175	0.905
Corr	0.164	0.100	0.15	Y	-0.323	-0.035	0.104	0.243	0.422
Max	17.992	18.017	10.00	Y	17.603	17.861	18.016	18.153	18.420
Min	16.375	16.379	10.00	Y	15.825	16.247	16.412	16.530	16.740

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Cross correlations
Rainfall - Evaporation

Hist      Mean      Tol       Y/N       2.5%      25%       50%       75%       97.5%
-0.380    -0.394    0.20      Y         -0.753    -0.555    -0.390    -0.258    -0.047

Rainfall - Max Temperature

Hist      Mean      Tol       Y/N       2.5%      25%       50%       75%       97.5%
-0.325    -0.302    0.20      Y         -0.755    -0.444    -0.312    -0.171    0.068

Evaporation -Max Temperature

Hist      Mean      Tol       Y/N       2.5%      25%       50%       75%       97.5%
0.769     0.762     0.20      Y         0.559     0.711     0.778     0.832     0.885


Annual parameters     na =   20 (out of   21)
Monthly parameters    nm =  244 (out of  252)

Generated data is considered GOOD
```

D6 Daily Climate Model

D6.1 Program dayclim_dma

Purpose: Generation of daily climate data using a first order autoregressive multivariate model with Wilson-Hilferty transformation to generate daily climate data conditioned on the rainfall state of the day and nested in monthly and annual models

Input: Model specification file
Historical daily climate data

Output: Generated daily climate data
Parameter diagnostic file containing statistics from generated and historical data.

D6.2 Specification File

Record 1 Name of historical daily climate data file (input file)

Record 2 Name of parameter diagnostic file (output file)

Record 3 Name of generated daily climate data file (output file)

Record 4 Number of replicates and length of each replicate in years

D6.3 Sample Files

Sample input specification file (dayclim_dma.par):

```
094029dayclim.dat
094029dayclim.out
094029dayclim.gen
100 22
```

Sample historical daily climate data file (094029dayclim.dat):

Record 1 Header

Record 2 Number of lines of text

Record 3 Text 1 (Year)

Record 4 Text 2 (Month)

Record 5 Text 3 (Day)

Record 6 Name of climate variable 1 (Rainfall)

Record 7 Name of climate variable 2 (Evaporation)

Record 8 Name of climate variable 3 (Maximum temperature)

Record 9 Number of years of data and the start year

Record 10…Year, month, day and daily climate values for the day

```
94029 HOBART (ELLERSLIE ROAD)
   6
YEAR
MONTH
DAY
RAINFALL
EVAPORATION
MAX TEMPERATURE
 22  1972
  1972   1   1     2.0    4.6    14.9
  1972   1   2     0.8    2.8    17.7
  1972   1   3     0.3    4.1    17.6
  1972   1   4     0.5    8.1    21.2
  1972   1   5     0.0    4.3    17.1
    …    …   …      …
    …    …   …      …
    …    …   …      …
  1993   12  28    47.2   2.8    14.0
  1993   12  29    56.4   0.4    13.0
  1993   12  30     0.0   2.2    16.7
  1993   12  31     1.0   1.6    15.8
```

Sample generated daily climate data file (094029dayclim.gen):

Record 1 Header

Record 2 Number of replicates and length of each replicate in years

Record 3 Replicate number

Record 4… Year, month, day, and daily climate values for the day

```
94029 HOBART (ELLERSLIE ROAD)
          100            22
            1
  1972    1    1    0.1     2.7    24.2
  1972    1    2    0.0     8.7    23.3
  1972    1    3    0.0     6.3    30.9
  1972    1    4    0.1     3.8    27.1
    …     …    …     …
    …     …    …     …
    …     …    …     …
  1993   12   29    0.0     2.2    17.2
  1993   12   30    0.0     2.5    19.0
  1993   12   31    1.2     0.7    19.5
            2
  1972    1    1    0.0     3.8    21.4
  1972    1    2    0.0     3.7    16.9
  1972    1    3    0.0     5.4    23.1
    …     …    …     …
    …     …    …     …
    …     …    …     …
  1993   12   29    0.0     4.0    14.9
  1993   12   30    0.0     3.7    16.6
  1993   12   31    0.0     2.8    19.3
          100
  1972    1    1    0.0     4.2    18.5
  1972    1    2    0.0     4.4    23.8
  1972    1    3    2.2     2.8    22.1
    …     …    …     …
    …     …    …     …
    …     …    …     …
  1993   12   29    0.0     6.3    25.4
  1993   12   30    0.0     1.4    17.6
  1993   12   31    0.0     5.1    19.3
```

Sample diagnostic file (094209dayclim.out):

```
94029 HOBART (ELLERSLIE ROAD)

Daily parameters

RAINFALL

Mean

Month      Hist     Mean      Tol      Y/N      2.5%      25%      50%      75%     97.5%
Jan       4.141    4.156     7.50       Y     3.137    3.806    4.183    4.520    4.952
Feb       3.792    3.821     7.50       Y     2.963    3.574    3.771    4.102    4.608
Mar       3.661    3.918     7.50       Y     2.821    3.615    3.901    4.261    4.887
Apr       3.402    3.390     7.50       Y     2.655    3.109    3.396    3.636    4.133
May       3.168    3.266     7.50       Y     2.447    2.951    3.205    3.593    4.279
Jun       3.070    3.048     7.50       Y     2.610    2.870    3.031    3.211    3.555
Jul       3.907    3.946     7.50       Y     2.851    3.664    3.943    4.209    4.749
Aug       4.120    4.189     7.50       Y     3.010    3.805    4.245    4.506    5.256
Sep       3.352    3.367     7.50       Y     2.718    3.188    3.327    3.568    3.918
Oct       4.143    4.283     7.50       Y     3.556    3.956    4.203    4.552    5.237
Nov       3.805    3.748     7.50       Y     3.055    3.507    3.779    3.967    4.306
Dec       4.650    5.054     7.50       N     3.759    4.541    5.080    5.463    6.428
```

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Stdev

Month	Hist	Mean	Tol	Y/N	2.5%	25%	50%	75%	97.5%
Jan	7.192	7.001	7.50	Y	5.155	6.412	6.833	7.580	8.994
Feb	5.655	5.720	7.50	Y	4.134	5.146	5.612	6.228	7.439
Mar	7.940	8.095	7.50	Y	5.347	7.063	8.037	8.865	11.050
Apr	5.322	5.371	7.50	Y	3.987	4.978	5.279	5.788	6.867
May	5.649	6.190	7.50	N	4.382	5.440	6.147	6.698	8.633
Jun	4.624	4.523	7.50	Y	3.554	4.133	4.545	4.851	5.553
Jul	5.792	6.240	7.50	N	4.590	5.674	6.176	6.872	7.752
Aug	7.314	7.642	7.50	Y	4.938	6.917	7.593	8.258	10.286
Sep	4.605	4.797	7.50	Y	3.590	4.436	4.817	5.086	5.952
Oct	6.103	6.627	7.50	N	5.089	5.950	6.479	7.263	8.570
Nov	6.099	6.012	7.50	Y	4.754	5.382	6.060	6.518	7.485
Dec	8.100	9.318	7.50	N	6.320	8.291	9.275	10.313	12.364

Skew

Month	Hist	Mean	Tol	Y/N	2.5%	25%	50%	75%	97.5%
Jan	2.862	3.152	0.75	Y	2.259	2.619	2.930	3.494	5.168
Feb	2.624	2.803	0.75	Y	1.812	2.343	2.613	3.209	4.619
Mar	5.893	3.750	0.75	N	2.637	3.249	3.555	4.136	5.551
Apr	2.933	3.085	0.75	Y	2.119	2.561	2.935	3.448	4.801
May	4.014	3.796	0.75	Y	2.447	3.109	3.549	4.075	6.336
Jun	2.530	2.816	0.75	Y	2.004	2.415	2.676	3.088	4.008
Jul	3.526	3.232	0.75	Y	2.000	2.756	3.030	3.582	4.995
Aug	4.409	3.565	0.75	N	2.575	2.997	3.439	3.852	6.315
Sep	2.783	2.922	0.75	Y	2.053	2.502	2.778	3.217	4.534
Oct	2.739	3.079	0.75	Y	1.970	2.651	3.001	3.374	4.589
Nov	3.179	3.173	0.75	Y	2.199	2.589	3.038	3.573	4.603
Dec	3.638	3.541	0.75	Y	2.489	2.962	3.451	3.860	5.306

Wet

Month	Hist	Mean	Tol	Y/N	2.5%	25%	50%	75%	97.5%
Jan	10.409	10.285	5.00	Y	9.227	10.000	10.227	10.636	11.477
Feb	7.864	7.890	5.00	Y	6.750	7.455	7.773	8.409	9.136
Mar	12.091	11.329	5.00	N	9.182	10.727	11.273	12.000	12.841
Apr	11.818	11.663	5.00	Y	10.023	11.136	11.682	12.227	13.250
May	12.455	12.197	5.00	Y	10.318	11.864	12.182	12.682	13.523
Jun	13.045	12.938	5.00	Y	11.523	12.409	12.864	13.364	14.386
Jul	15.182	14.716	5.00	Y	12.955	14.045	14.773	15.273	16.205
Aug	14.773	14.425	5.00	Y	12.295	13.864	14.500	15.045	15.773
Sep	14.500	14.418	5.00	Y	12.568	13.909	14.500	14.864	15.909
Oct	14.409	13.851	5.00	Y	12.000	13.273	13.955	14.409	15.295
Nov	13.364	13.414	5.00	Y	11.750	13.045	13.409	13.909	14.432
Dec	12.818	11.549	5.00	N	9.273	10.909	11.409	12.318	13.500

Max

Month	Hist	Mean	Tol	Y/N	2.5%	25%	50%	75%	97.5%
Jan	42.400	48.675	10.00	N	30.450	38.700	46.200	52.500	88.300
Feb	40.200	36.201	10.00	Y	21.350	29.200	33.300	40.800	59.250
Mar	74.000	61.077	10.00	N	33.550	47.900	57.600	71.500	95.000
Apr	36.000	38.084	10.00	Y	21.450	30.200	36.500	42.800	65.600
May	47.000	48.643	10.00	Y	28.950	37.800	46.600	55.800	79.000
Jun	26.000	30.870	10.00	N	18.200	25.500	29.500	34.400	47.750
Jul	55.800	48.063	10.00	N	28.300	37.600	45.300	54.200	81.450
Aug	64.8	59.7	10.00	Y	35.0	45.5	57.7	66.8	109.9
Sep	36.400	34.593	10.00	Y	22.850	28.100	32.700	37.500	54.500
Oct	43.800	48.564	10.00	N	30.150	38.700	46.400	56.000	77.900
Nov	41.000	44.012	10.00	Y	26.900	35.600	42.000	49.500	68.600
Dec	56.4	69.2	10.00	N	37.1	57.2	65.8	79.9	111.1

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EVAPORATION

Mean

Month	Hist	Mean	Tol	Y/N	2.5%	25%	50%	75%	97.5%
Jan	4.811	4.799	7.50	Y	4.393	4.668	4.795	4.927	5.248
Feb	4.522	4.512	7.50	Y	4.170	4.385	4.509	4.607	4.876
Mar	3.114	3.103	7.50	Y	2.875	3.040	3.085	3.175	3.337
Apr	2.090	2.085	7.50	Y	1.916	2.027	2.086	2.133	2.237
May	1.209	1.209	7.50	Y	1.094	1.162	1.205	1.252	1.331
Jun	0.765	0.762	7.50	Y	0.675	0.729	0.755	0.792	0.878
Jul	0.889	0.882	7.50	Y	0.771	0.850	0.877	0.926	0.974
Aug	1.418	1.405	7.50	Y	1.232	1.368	1.405	1.446	1.530
Sep	2.198	2.172	7.50	Y	1.916	2.084	2.163	2.260	2.404
Oct	3.067	3.051	7.50	Y	2.750	2.955	3.046	3.118	3.377
Nov	3.809	3.799	7.50	Y	3.443	3.669	3.800	3.926	4.096
Dec	4.456	4.428	7.50	Y	3.890	4.301	4.427	4.560	4.858

Stdev

Month	Hist	Mean	Tol	Y/N	2.5%	25%	50%	75%	97.5%
Jan	1.759	1.865	7.50	Y	1.683	1.796	1.852	1.918	2.073
Feb	1.718	1.791	7.50	Y	1.624	1.736	1.776	1.831	2.009
Mar	1.298	1.338	7.50	Y	1.229	1.298	1.338	1.377	1.433
Apr	1.101	1.108	7.50	Y	1.014	1.070	1.107	1.137	1.217
May	0.740	0.760	7.50	Y	0.687	0.723	0.757	0.787	0.842
Jun	0.624	0.643	7.50	Y	0.565	0.614	0.637	0.663	0.751
Jul	0.693	0.718	7.50	Y	0.628	0.688	0.716	0.740	0.808
Aug	0.801	0.819	7.50	Y	0.705	0.791	0.816	0.849	0.904
Sep	1.158	1.229	7.50	Y	1.065	1.178	1.239	1.282	1.362
Oct	1.423	1.499	7.50	Y	1.369	1.441	1.499	1.543	1.655
Nov	1.558	1.604	7.50	Y	1.467	1.563	1.596	1.640	1.768
Dec	1.767	1.882	7.50	Y	1.734	1.806	1.873	1.940	2.077

Skew

Month	Hist	Mean	Tol	Y/N	2.5%	25%	50%	75%	97.5%
Jan	0.403	0.559	0.75	Y	0.346	0.484	0.559	0.625	0.791
Feb	0.409	0.527	0.75	Y	0.325	0.446	0.510	0.594	0.750
Mar	0.349	0.468	0.75	Y	0.239	0.368	0.482	0.534	0.742
Apr	0.631	0.732	0.75	Y	0.510	0.628	0.703	0.815	1.004
May	1.076	1.208	0.75	Y	0.869	1.047	1.153	1.316	1.803
Jun	1.615	1.753	0.75	Y	1.268	1.566	1.714	1.919	2.327
Jul	1.754	1.864	0.75	Y	1.404	1.602	1.788	2.052	2.548
Aug	1.015	1.117	0.75	Y	0.814	0.967	1.095	1.246	1.454
Sep	0.952	1.155	0.75	Y	0.794	1.007	1.136	1.242	1.689
Oct	0.538	0.718	0.75	Y	0.461	0.612	0.706	0.821	1.023
Nov	0.122	0.311	0.75	Y	0.040	0.209	0.300	0.400	0.577
Dec	0.239	0.419	0.75	Y	0.191	0.333	0.420	0.502	0.655

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Corr

Month	Hist	Mean	Tol	Y/N	2.5%	25%	50%	75%	97.5%
Jan	0.194	0.217	0.20	Y	0.120	0.177	0.223	0.254	0.291
Feb	0.240	0.223	0.20	Y	0.113	0.191	0.221	0.255	0.296
Mar	0.277	0.282	0.20	Y	0.208	0.254	0.283	0.309	0.358
Apr	0.254	0.250	0.20	Y	0.176	0.221	0.247	0.274	0.337
May	0.249	0.285	0.20	Y	0.191	0.250	0.290	0.316	0.368
Jun	0.230	0.252	0.20	Y	0.143	0.222	0.251	0.280	0.350
Jul	0.341	0.339	0.20	Y	0.251	0.308	0.340	0.372	0.419
Aug	0.218	0.239	0.20	Y	0.156	0.212	0.235	0.268	0.317
Sep	0.268	0.323	0.20	Y	0.229	0.292	0.326	0.355	0.402
Oct	0.225	0.246	0.20	Y	0.148	0.216	0.249	0.275	0.333
Nov	0.301	0.295	0.20	Y	0.192	0.266	0.298	0.325	0.375
Dec	0.293	0.324	0.20	Y	0.245	0.281	0.322	0.358	0.420

Max

Month	Hist	Mean	Tol	Y/N	2.5%	25%	50%	75%	97.5%
Jan	12.000	12.299	10.00	Y	10.050	11.200	12.000	13.100	15.650
Feb	11.800	11.795	10.00	Y	9.700	10.900	11.700	12.400	14.200
Mar	7.800	8.388	10.00	Y	7.200	7.800	8.300	8.800	10.250
Apr	7.600	6.989	10.00	Y	5.650	6.300	6.800	7.400	9.100
May	4.400	5.160	10.00	N	3.950	4.400	5.000	5.600	7.300
Jun	4.400	4.542	10.00	Y	3.400	4.100	4.400	5.000	6.350
Jul	5.100	5.303	10.00	Y	3.750	4.500	5.000	6.000	7.750
Aug	6.000	5.544	10.00	Y	4.250	5.000	5.400	5.900	7.550
Sep	8.000	8.475	10.00	Y	6.550	7.700	8.300	8.900	11.200
Oct	8.400	9.682	10.00	N	7.650	8.800	9.400	10.500	11.950
Nov	9.800	9.998	10.00	Y	8.400	9.400	9.900	10.600	11.900
Dec	11.000	11.742	10.00	Y	9.650	10.800	11.600	12.700	14.100

Min

Month	Hist	Mean	Tol	Y/N	2.5%	25%	50%	75%	97.5%
Jan	0.200	0.680	10.00	N	0.300	0.500	0.700	0.800	1.050
Feb	0.000	0.128	10.00	N	0.000	0.000	0.000	0.200	0.700
Mar	0.000	0.007	10.00	N	0.000	0.000	0.000	0.000	0.150
Apr	0.000	0.000	10.00	N	0.000	0.000	0.000	0.000	0.000
May	0.000	0.000	10.00	N	0.000	0.000	0.000	0.000	0.000
Jun	0.000	0.000	10.00	N	0.000	0.000	0.000	0.000	0.000
Jul	0.000	0.008	10.00	N	0.000	0.000	0.000	0.000	0.100
Aug	0.000	0.000	10.00	N	0.000	0.000	0.000	0.000	0.000
Sep	0.000	0.003	10.00	N	0.000	0.000	0.000	0.000	0.050
Oct	0.000	0.001	10.00	N	0.000	0.000	0.000	0.000	0.000
Nov	0.000	0.000	10.00	N	0.000	0.000	0.000	0.000	0.000
Dec	0.000	0.011	10.00	N	0.000	0.000	0.000	0.000	0.200

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MAX TEMPERATURE

Mean

Month	Hist	Mean	Tol	Y/N	2.5%	25%	50%	75%	97.5%
Jan	21.950	21.930	7.50	Y	21.248	21.732	21.888	22.096	22.660
Feb	22.089	22.078	7.50	Y	21.516	21.893	22.027	22.298	22.609
Mar	20.180	20.157	7.50	Y	19.725	20.007	20.175	20.304	20.494
Apr	18.148	18.117	7.50	Y	17.699	17.981	18.088	18.279	18.478
May	15.160	15.140	7.50	Y	14.823	15.003	15.124	15.278	15.523
Jun	12.384	12.379	7.50	Y	12.008	12.231	12.365	12.512	12.815
Jul	12.117	12.100	7.50	Y	11.731	11.973	12.098	12.218	12.459
Aug	13.395	13.358	7.50	Y	12.870	13.176	13.350	13.529	13.916
Sep	15.295	15.262	7.50	Y	14.589	15.067	15.265	15.437	15.709
Oct	17.268	17.227	7.50	Y	16.695	17.060	17.217	17.388	17.682
Nov	18.701	18.678	7.50	Y	17.984	18.493	18.681	18.853	19.206
Dec	20.095	20.061	7.50	Y	19.655	19.934	20.056	20.177	20.478

Stdev

Month	Hist	Mean	Tol	Y/N	2.5%	25%	50%	75%	97.5%
Jan	4.380	4.522	7.50	Y	4.092	4.382	4.549	4.668	4.981
Feb	4.459	4.467	7.50	Y	4.105	4.317	4.448	4.602	4.878
Mar	3.936	3.914	7.50	Y	3.660	3.822	3.894	3.989	4.227
Apr	3.636	3.613	7.50	Y	3.366	3.514	3.596	3.713	3.848
May	2.786	2.771	7.50	Y	2.544	2.703	2.772	2.845	2.965
Jun	2.621	2.678	7.50	Y	2.469	2.609	2.665	2.742	2.909
Jul	2.481	2.491	7.50	Y	2.296	2.423	2.480	2.556	2.654
Aug	2.708	2.821	7.50	Y	2.620	2.737	2.826	2.902	3.014
Sep	3.332	3.432	7.50	Y	3.121	3.335	3.419	3.510	3.749
Oct	3.745	3.794	7.50	Y	3.572	3.704	3.773	3.870	4.068
Nov	4.285	4.282	7.50	Y	3.857	4.170	4.256	4.387	4.708
Dec	3.991	3.980	7.50	Y	3.574	3.866	3.969	4.077	4.299

Skew

Month	Hist	Mean	Tol	Y/N	2.5%	25%	50%	75%	97.5%
Jan	1.118	1.106	0.75	Y	0.838	0.999	1.106	1.204	1.371
Feb	0.996	0.945	0.75	Y	0.648	0.834	0.933	1.054	1.207
Mar	0.771	0.752	0.75	Y	0.546	0.659	0.734	0.826	1.045
Apr	0.547	0.532	0.75	Y	0.256	0.447	0.516	0.603	0.784
May	0.438	0.449	0.75	Y	0.242	0.364	0.433	0.516	0.727
Jun	0.014	0.049	0.75	Y	-0.214	-0.016	0.055	0.117	0.218
Jul	0.201	0.213	0.75	Y	-0.003	0.140	0.202	0.278	0.444
Aug	0.148	0.200	0.75	Y	-0.049	0.108	0.212	0.264	0.433
Sep	0.725	0.736	0.75	Y	0.460	0.606	0.713	0.829	1.023
Oct	0.624	0.633	0.75	Y	0.367	0.553	0.631	0.699	0.878
Nov	1.150	1.123	0.75	Y	0.830	1.004	1.119	1.227	1.445
Dec	1.032	1.027	0.75	Y	0.722	0.905	1.007	1.120	1.355

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Corr

Month	Hist	Mean	Tol	Y/N	2.5%	25%	50%	75%	97.5%
Jan	0.315	0.319	0.20	Y	0.245	0.286	0.319	0.350	0.398
Feb	0.265	0.236	0.20	Y	0.150	0.215	0.236	0.257	0.314
Mar	0.377	0.331	0.20	Y	0.260	0.301	0.326	0.354	0.410
Apr	0.456	0.428	0.20	Y	0.351	0.401	0.429	0.457	0.493
May	0.502	0.475	0.20	Y	0.391	0.452	0.474	0.499	0.538
Jun	0.581	0.595	0.20	Y	0.530	0.571	0.591	0.615	0.668
Jul	0.550	0.533	0.20	Y	0.461	0.510	0.533	0.556	0.595
Aug	0.506	0.498	0.20	Y	0.438	0.477	0.494	0.520	0.559
Sep	0.449	0.413	0.20	Y	0.325	0.389	0.412	0.445	0.482
Oct	0.381	0.354	0.20	Y	0.271	0.328	0.357	0.385	0.416
Nov	0.357	0.332	0.20	Y	0.250	0.304	0.336	0.355	0.400
Dec	0.337	0.294	0.20	Y	0.226	0.264	0.294	0.318	0.385

Max

Month	Hist	Mean	Tol	Y/N	2.5%	25%	50%	75%	97.5%
Jan	40.800	43.452	10.00	Y	37.800	42.000	44.100	45.200	46.700
Feb	39.200	42.043	10.00	Y	37.150	40.500	42.000	44.100	44.900
Mar	35.600	37.471	10.00	Y	33.350	35.300	37.200	38.800	43.450
Apr	30.200	32.660	10.00	Y	29.100	30.700	32.000	34.000	38.900
May	24.600	25.613	10.00	Y	23.350	24.400	25.400	26.200	28.850
Jun	20.500	20.909	10.00	Y	19.250	20.300	20.900	21.500	22.700
Jul	21.000	20.682	10.00	Y	18.800	19.900	20.500	21.300	23.800
Aug	24.500	23.390	10.00	Y	21.050	22.200	23.300	24.100	26.650
Sep	31.000	30.426	10.00	Y	25.750	28.300	30.200	32.000	36.750
Oct	31.000	33.318	10.00	Y	29.550	31.400	33.100	34.500	39.050
Nov	35.800	39.429	10.00	N	33.900	36.900	38.900	41.900	44.850
Dec	36.800	39.393	10.00	Y	34.000	37.000	38.900	41.900	44.500

Min

Month	Hist	Mean	Tol	Y/N	2.5%	25%	50%	75%	97.5%
Jan	13.800	13.827	10.00	Y	13.100	13.500	13.900	14.100	14.600
Feb	13.200	11.672	10.00	N	10.100	11.100	11.700	12.200	13.300
Mar	12.100	11.346	10.00	Y	10.150	11.000	11.300	11.800	12.300
Apr	9.200	9.473	10.00	Y	8.400	9.000	9.500	9.800	10.600
May	6.900	8.098	10.00	N	6.750	7.700	8.000	8.600	9.000
Jun	4.300	4.339	10.00	Y	2.150	3.800	4.300	4.900	6.050
Jul	5.900	5.277	10.00	N	3.600	4.900	5.400	5.700	6.300
Aug	5.500	5.253	10.00	Y	3.200	4.700	5.200	5.900	6.600
Sep	7.600	8.155	10.00	Y	7.500	7.900	8.200	8.400	8.750
Oct	8.600	7.750	10.00	Y	6.150	7.200	7.900	8.300	9.200
Nov	10.400	10.556	10.00	Y	9.950	10.300	10.500	10.700	11.450
Dec	11.900	13.044	10.00	Y	12.600	12.900	13.000	13.200	13.450

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Cross correlation

EVAPORATION- MAX TEMPERATURE

Month	Hist	Mean	Tol	Y/N	2.5%	25%	50%	75%	97.5%
Jan	0.520	0.491	0.20	Y	0.403	0.465	0.495	0.518	0.561
Feb	0.581	0.570	0.20	Y	0.512	0.553	0.569	0.588	0.613
Mar	0.524	0.511	0.20	Y	0.447	0.488	0.514	0.534	0.571
Apr	0.441	0.427	0.20	Y	0.354	0.404	0.428	0.448	0.491
May	0.377	0.368	0.20	Y	0.293	0.342	0.371	0.391	0.429
Jun	0.392	0.384	0.20	Y	0.299	0.359	0.383	0.406	0.461
Jul	0.379	0.360	0.20	Y	0.269	0.331	0.365	0.387	0.433
Aug	0.384	0.376	0.20	Y	0.296	0.352	0.377	0.401	0.448
Sep	0.538	0.528	0.20	Y	0.468	0.504	0.527	0.550	0.606
Oct	0.537	0.537	0.20	Y	0.479	0.518	0.536	0.559	0.588
Nov	0.537	0.522	0.20	Y	0.449	0.501	0.522	0.542	0.580
Dec	0.536	0.512	0.20	Y	0.442	0.483	0.508	0.536	0.591

Monthly parameters

RAINFALL

Mean

Month	Hist	Mean	Tol	Y/N	2.5%	25%	50%	75%	97.5%
Jan	43.100	42.700	7.50	Y	32.977	39.473	42.777	46.245	51.927
Feb	29.818	30.120	7.50	Y	21.530	27.282	30.559	32.564	36.520
Mar	44.268	44.366	7.50	Y	30.500	40.082	43.932	48.464	56.243
Apr	40.200	39.586	7.50	Y	29.573	35.268	40.000	42.732	50.016
May	39.455	39.859	7.50	Y	27.336	35.168	39.768	43.700	53.605
Jun	40.050	39.425	7.50	Y	31.373	37.459	39.273	41.864	46.405
Jul	59.314	58.144	7.50	Y	38.414	52.155	58.927	63.559	71.368
Aug	60.864	60.482	7.50	Y	39.977	54.459	61.041	66.177	74.780
Sep	48.605	48.540	7.50	Y	38.586	44.909	48.205	51.727	57.191
Oct	59.700	59.345	7.50	Y	45.923	53.968	58.355	65.050	75.743
Nov	50.850	50.300	7.50	Y	38.395	46.568	50.486	53.927	59.825
Dec	59.609	58.506	7.50	Y	37.075	51.505	57.105	65.595	79.789

Stdev

Month	Hist	Mean	Tol	Y/N	2.5%	25%	50%	75%	97.5%
Jan	23.699	23.818	7.50	Y	14.986	20.244	23.440	28.118	32.239
Feb	19.708	19.264	7.50	Y	12.498	16.806	19.353	21.760	25.018
Mar	30.018	29.331	7.50	Y	18.520	25.317	28.858	33.121	40.229
Apr	23.864	23.030	7.50	Y	14.858	20.059	22.837	25.135	32.105
May	27.752	27.596	7.50	Y	17.953	23.066	26.277	31.461	39.754
Jun	18.874	18.278	7.50	Y	12.398	16.069	18.049	20.179	24.196
Jul	36.247	35.256	7.50	Y	21.520	31.133	34.188	38.745	49.060
Aug	39.530	37.593	7.50	Y	24.326	32.809	36.723	42.293	53.672
Sep	25.328	24.939	7.50	Y	15.519	22.319	24.473	27.137	33.152
Oct	36.774	36.481	7.50	Y	24.770	31.901	35.601	40.511	50.201
Nov	24.966	24.725	7.50	Y	16.176	21.275	24.937	27.915	33.402
Dec	51.206	45.667	7.50	N	31.782	39.433	44.071	52.642	61.650

Skew

Month	Hist	Mean	Tol	Y/N	2.5%	25%	50%	75%	97.5%
Jan	0.589	0.731	0.75	Y	-0.319	0.313	0.674	1.096	1.938
Feb	1.155	0.767	0.75	Y	-0.093	0.421	0.629	1.109	1.830
Mar	1.068	0.809	0.75	Y	-0.056	0.447	0.756	1.029	1.903

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Apr	1.037	0.556	0.75	Y	-0.281	0.224	0.507	0.788	1.660
May	0.963	0.808	0.75	Y	-0.053	0.418	0.758	1.125	1.948
Jun	0.352	0.641	0.75	Y	-0.240	0.295	0.574	0.867	1.744
Jul	1.125	0.709	0.75	Y	-0.111	0.312	0.600	0.980	1.958
Aug	0.674	0.705	0.75	Y	-0.336	0.296	0.630	1.063	2.074
Sep	1.677	0.537	0.75	N	-0.566	0.154	0.574	0.866	1.457
Oct	1.155	0.603	0.75	Y	-0.264	0.234	0.614	0.881	1.678
Nov	0.361	0.605	0.75	Y	-0.383	0.220	0.616	0.899	1.404
Dec	2.129	0.777	0.75	N	-0.227	0.348	0.681	1.157	1.864

Corr

Month	Hist	Mean	Tol	Y/N	2.5%	25%	50%	75%	97.5%
Jan	0.517	0.495	0.20	Y	-0.079	0.385	0.506	0.634	0.780
Feb	-0.132	-0.115	0.20	Y	-0.533	-0.277	-0.142	0.055	0.315
Mar	-0.438	-0.422	0.20	Y	-0.723	-0.587	-0.441	-0.310	0.005
Apr	-0.206	-0.209	0.20	Y	-0.604	-0.395	-0.255	-0.027	0.270
May	-0.032	-0.020	0.20	Y	-0.470	-0.159	-0.055	0.129	0.356
Jun	0.031	0.019	0.20	Y	-0.364	-0.152	0.003	0.143	0.465
Jul	0.124	0.107	0.20	Y	-0.319	-0.041	0.111	0.232	0.506
Aug	-0.031	-0.078	0.20	Y	-0.521	-0.220	-0.070	0.068	0.329
Sep	-0.072	-0.066	0.20	Y	-0.523	-0.217	-0.093	0.084	0.378
Oct	-0.197	-0.196	0.20	Y	-0.590	-0.322	-0.196	-0.103	0.256
Nov	0.299	0.312	0.20	Y	-0.240	0.211	0.324	0.435	0.688
Dec	0.119	0.104	0.20	Y	-0.321	-0.043	0.109	0.221	0.472

Max

Month	Hist	Mean	Tol	Y/N	2.5%	25%	50%	75%	97.5%
Jan	104.4	99.7	10.00	Y	60.6	83.5	92.9	114.4	146.4
Feb	86.6	76.0	10.00	N	46.0	63.9	74.9	85.7	106.9
Mar	112.6	115.9	10.00	Y	74.1	98.1	112.1	130.3	173.9
Apr	106.0	91.3	10.00	N	59.8	80.4	88.6	98.5	129.4
May	98.7	106.2	10.00	Y	70.5	90.3	101.9	116.9	176.6
Jun	84.6	81.5	10.00	Y	60.1	71.8	78.2	89.0	121.7
Jul	156.8	141.1	10.00	N	96.8	116.5	137.2	160.9	206.4
Aug	147.8	148.3	10.00	Y	103.3	128.5	142.6	170.2	221.6
Sep	127.8	104.8	10.00	N	67.6	94.8	102.5	115.6	142.0
Oct	149.4	142.7	10.00	Y	91.5	120.0	137.2	165.7	203.6
Nov	100.2	107.0	10.00	Y	75.4	93.8	104.1	117.8	144.1
Dec	206.4	167.5	10.00	N	110.3	135.6	157.9	190.3	248.4

Min

Month	Hist	Mean	Tol	Y/N	2.5%	25%	50%	75%	97.5%
Jan	8.400	7.866	10.00	Y	0.000	2.400	6.900	11.800	19.250
Feb	6.400	2.919	10.00	N	0.000	0.000	2.400	4.800	9.150
Mar	4.600	2.934	10.00	N	0.000	0.000	0.000	3.900	17.650
Apr	10.200	4.546	10.00	N	0.000	0.000	3.600	7.700	14.850
May	4.800	2.621	10.00	N	0.000	0.000	0.700	4.900	11.800
Jun	1.800	11.595	10.00	N	3.750	8.300	11.200	14.700	21.100
Jul	11.800	5.466	10.00	N	0.000	0.000	1.800	9.300	21.700
Aug	9.000	5.294	10.00	N	0.000	0.000	2.900	8.800	17.400
Sep	14.000	8.368	10.00	N	0.000	2.000	7.600	12.400	22.200
Oct	8.600	4.674	10.00	N	0.000	0.000	2.100	7.700	19.100
Nov	17.000	13.156	10.00	N	0.250	8.100	11.700	17.400	28.100
Dec	11.600	0.850	10.00	N	0.000	0.000	0.000	0.000	12.050

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EVAPORATION

Mean

Month	Hist	Mean	Tol	Y/N	2.5%	25%	50%	75%	97.5%
Jan	149.1	148.8	7.50	Y	136.2	144.7	148.6	152.7	162.7
Feb	127.8	127.6	7.50	Y	117.9	124.0	127.5	130.2	137.9
Mar	96.5	96.2	7.50	Y	89.1	94.3	95.6	98.4	103.5
Apr	62.695	62.543	7.50	Y	57.480	60.795	62.568	63.986	67.107
May	37.468	37.474	7.50	Y	33.927	36.018	37.350	38.800	41.273
Jun	22.964	22.850	7.50	Y	20.261	21.873	22.650	23.773	26.355
Jul	27.568	27.350	7.50	Y	23.900	26.341	27.200	28.718	30.209
Aug	43.945	43.564	7.50	Y	38.191	42.395	43.568	44.818	47.436
Sep	65.927	65.159	7.50	Y	57.470	62.532	64.891	67.809	72.132
Oct	95.1	94.6	7.50	Y	85.3	91.6	94.4	96.7	104.7
Nov	114.3	114.0	7.50	Y	103.3	110.1	114.0	117.8	122.9
Dec	138.1	137.3	7.50	Y	120.6	133.3	137.2	141.4	150.6

Stdev

Month	Hist	Mean	Tol	Y/N	2.5%	25%	50%	75%	97.5%
Jan	17.277	22.204	7.50	N	14.481	19.389	22.317	24.252	29.441
Feb	13.992	17.674	7.50	N	11.552	15.691	17.206	19.479	23.202
Mar	12.111	13.813	7.50	N	9.943	12.114	13.689	15.193	17.456
Apr	8.614	9.337	7.50	N	6.543	8.327	9.336	10.502	11.778
May	7.133	7.435	7.50	Y	5.373	6.516	7.303	8.186	9.879
Jun	5.930	6.158	7.50	Y	4.435	5.379	6.149	6.739	8.184
Jul	7.479	7.919	7.50	Y	5.867	7.017	7.662	8.756	10.760
Aug	7.880	8.354	7.50	Y	5.821	7.513	8.154	9.268	10.915
Sep	13.908	15.013	7.50	N	10.673	13.501	15.114	16.377	19.614
Oct	15.105	17.600	7.50	N	12.724	15.367	17.345	19.385	22.905
Nov	14.336	16.864	7.50	N	12.367	14.695	16.679	18.595	21.811
Dec	20.613	24.065	7.50	N	16.956	20.934	23.988	26.799	31.156

Skew

Month	Hist	Mean	Tol	Y/N	2.5%	25%	50%	75%	97.5%
Jan	0.383	0.160	0.75	Y	-1.095	-0.142	0.190	0.461	1.266
Feb	-0.339	0.135	0.75	Y	-0.703	-0.144	0.122	0.346	1.010
Mar	0.570	0.148	0.75	Y	-0.741	-0.274	0.129	0.457	1.338
Apr	-0.174	0.128	0.75	Y	-0.708	-0.229	0.132	0.480	0.796
May	0.134	0.221	0.75	Y	-0.609	-0.108	0.190	0.538	1.087
Jun	0.164	0.281	0.75	Y	-0.897	-0.057	0.282	0.572	1.179
Jul	0.191	0.334	0.75	Y	-0.475	-0.020	0.278	0.604	1.223
Aug	0.774	0.162	0.75	Y	-0.729	-0.205	0.136	0.385	1.319
Sep	0.397	0.213	0.75	Y	-0.784	-0.113	0.208	0.455	1.104
Oct	-0.041	0.174	0.75	Y	-1.011	-0.194	0.135	0.497	1.402
Nov	-0.025	0.164	0.75	Y	-0.882	-0.150	0.140	0.444	1.100
Dec	-0.367	0.061	0.75	Y	-0.856	-0.269	0.097	0.335	0.803

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Corr

Month	Hist	Mean	Tol	Y/N	2.5%	25%	50%	75%	97.5%
Jan	0.682	0.683	0.20	Y	0.375	0.606	0.703	0.769	0.840
Feb	0.447	0.615	0.20	Y	0.236	0.552	0.627	0.724	0.843
Mar	0.356	0.523	0.20	Y	0.016	0.420	0.549	0.646	0.768
Apr	0.158	0.314	0.20	Y	-0.118	0.170	0.351	0.451	0.656
May	0.434	0.490	0.20	Y	0.055	0.370	0.507	0.611	0.794
Jun	0.379	0.419	0.20	Y	-0.016	0.334	0.439	0.534	0.675
Jul	0.483	0.513	0.20	Y	0.156	0.417	0.514	0.635	0.781
Aug	-0.069	-0.022	0.20	Y	-0.488	-0.185	-0.057	0.176	0.392
Sep	0.317	0.376	0.20	Y	-0.105	0.293	0.417	0.507	0.646
Oct	0.487	0.553	0.20	Y	0.241	0.454	0.568	0.656	0.804
Nov	0.526	0.618	0.20	Y	0.316	0.527	0.632	0.711	0.822
Dec	0.324	0.463	0.20	Y	0.074	0.334	0.490	0.608	0.746

Max

Month	Hist	Mean	Tol	Y/N	2.5%	25%	50%	75%	97.5%
Jan	191.7	193.9	10.00	Y	171.5	184.2	193.5	199.9	231.0
Feb	149.4	163.6	10.00	Y	146.6	154.4	161.6	171.0	185.5
Mar	124.2	124.7	10.00	Y	111.1	118.3	123.4	129.0	142.9
Apr	76.700	81.020	10.00	Y	71.850	77.200	80.300	84.400	92.400
May	51.400	52.792	10.00	Y	44.600	49.400	52.100	55.100	66.050
Jun	34.600	36.076	10.00	Y	29.950	33.300	34.900	37.900	44.700
Jul	44.800	44.197	10.00	Y	35.750	40.500	44.300	46.500	53.650
Aug	64.000	60.529	10.00	Y	51.000	57.300	60.200	64.200	71.200
Sep	96.0	96.0	10.00	Y	80.8	89.0	94.6	101.2	116.8
Oct	121.6	130.0	10.00	Y	109.1	123.4	129.0	137.4	151.6
Nov	148.6	148.1	10.00	Y	128.6	140.9	147.5	154.8	170.3
Dec	178.2	185.1	10.00	Y	162.4	173.6	182.4	192.1	220.3

Min

Month	Hist	Mean	Tol	Y/N	2.5%	25%	50%	75%	97.5%
Jan	116.2	108.0	10.00	Y	87.2	101.4	108.6	115.4	124.5
Feb	99.8	94.6	10.00	Y	71.5	90.3	94.6	99.7	108.5
Mar	79.800	70.020	10.00	N	55.900	65.900	69.100	74.800	82.400
Apr	47.700	45.490	10.00	Y	34.650	42.800	45.700	48.800	53.400
May	26.000	24.181	10.00	Y	17.550	21.700	24.500	26.400	30.050
Jun	12.400	11.948	10.00	Y	5.600	10.000	12.200	13.800	16.950
Jul	14.600	13.647	10.00	Y	7.400	11.800	13.500	15.300	19.150
Aug	32.000	28.117	10.00	N	20.700	25.100	28.300	30.900	35.150
Sep	45.400	38.053	10.00	N	25.150	34.500	37.500	42.600	51.250
Oct	64.600	62.580	10.00	Y	42.750	57.000	61.700	68.700	79.900
Nov	79.200	83.351	10.00	Y	64.600	78.500	83.800	88.800	99.300
Dec	88.8	92.8	10.00	Y	63.0	85.4	94.7	101.1	111.1

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MAX TEMERATURE

Mean

Month	Hist	Mean	Tol	Y/N	2.5%	25%	50%	75%	97.5%
Jan	21.950	21.930	7.50	Y	21.248	21.732	21.888	22.096	22.660
Feb	22.093	22.079	7.50	Y	21.514	21.894	22.028	22.299	22.602
Mar	20.180	20.157	7.50	Y	19.725	20.007	20.175	20.304	20.494
Apr	18.148	18.117	7.50	Y	17.699	17.981	18.088	18.279	18.478
May	15.160	15.140	7.50	Y	14.823	15.003	15.124	15.278	15.523
Jun	12.384	12.379	7.50	Y	12.008	12.231	12.365	12.512	12.815
Jul	12.117	12.100	7.50	Y	11.731	11.973	12.098	12.218	12.459
Aug	13.395	13.358	7.50	Y	12.870	13.176	13.350	13.529	13.916
Sep	15.295	15.262	7.50	Y	14.589	15.067	15.265	15.437	15.709
Oct	17.268	17.227	7.50	Y	16.695	17.060	17.217	17.388	17.682
Nov	18.701	18.678	7.50	Y	17.984	18.493	18.681	18.853	19.206
Dec	20.095	20.061	7.50	Y	19.655	19.934	20.056	20.177	20.478

Stdev

Month	Hist	Mean	Tol	Y/N	2.5%	25%	50%	75%	97.5%
Jan	1.531	1.514	7.50	Y	1.040	1.330	1.502	1.679	1.972
Feb	1.127	1.166	7.50	Y	0.785	1.039	1.138	1.313	1.502
Mar	0.893	0.904	7.50	Y	0.610	0.800	0.889	1.006	1.190
Apr	0.951	0.971	7.50	Y	0.719	0.853	0.974	1.069	1.290
May	0.691	0.739	7.50	Y	0.511	0.666	0.754	0.814	0.966
Jun	1.009	1.046	7.50	Y	0.694	0.930	1.032	1.136	1.429
Jul	0.792	0.845	7.50	Y	0.575	0.759	0.850	0.922	1.154
Aug	1.139	1.170	7.50	Y	0.835	1.051	1.161	1.278	1.497
Sep	1.180	1.223	7.50	Y	0.823	1.089	1.216	1.362	1.590
Oct	1.083	1.142	7.50	Y	0.833	1.012	1.119	1.254	1.462
Nov	1.089	1.130	7.50	Y	0.727	0.997	1.144	1.244	1.481
Dec	0.957	0.972	7.50	Y	0.653	0.863	0.974	1.065	1.279

Skew

Month	Hist	Mean	Tol	Y/N	2.5%	25%	50%	75%	97.5%
Jan	-0.226	0.206	0.75	Y	-0.812	-0.111	0.165	0.454	1.178
Feb	0.297	0.241	0.75	Y	-0.790	-0.160	0.271	0.596	1.237
Mar	0.532	0.120	0.75	Y	-0.767	-0.185	0.115	0.393	0.891
Apr	-0.182	0.202	0.75	Y	-0.693	-0.199	0.173	0.520	1.248
May	0.456	0.045	0.75	Y	-0.906	-0.365	0.041	0.411	0.941
Jun	0.144	-0.024	0.75	Y	-0.880	-0.358	0.017	0.245	0.996
Jul	0.609	0.016	0.75	Y	-1.245	-0.257	0.026	0.324	0.794
Aug	0.193	0.103	0.75	Y	-0.994	-0.221	0.040	0.459	1.247
Sep	-0.243	0.172	0.75	Y	-0.827	-0.118	0.174	0.473	1.220
Oct	-1.132	0.071	0.75	N	-0.724	-0.267	0.052	0.466	0.897
Nov	-0.066	0.145	0.75	Y	-0.907	-0.205	0.133	0.435	1.128
Dec	-0.602	0.245	0.75	N	-0.800	-0.105	0.197	0.603	1.265

Continued next page

Corr

Month	Hist	Mean	Tol	Y/N	2.5%	25%	50%	75%	97.5%
Jan	0.150	0.155	0.20	Y	-0.391	0.040	0.186	0.304	0.449
Feb	0.089	0.183	0.20	Y	-0.203	0.048	0.172	0.304	0.586
Mar	-0.284	-0.205	0.20	Y	-0.620	-0.350	-0.194	-0.083	0.220
Apr	-0.121	-0.053	0.20	Y	-0.489	-0.202	-0.038	0.080	0.353
May	0.521	0.552	0.20	Y	0.183	0.457	0.578	0.653	0.784
Jun	0.098	0.199	0.20	Y	-0.279	0.052	0.202	0.347	0.591
Jul	0.492	0.528	0.20	Y	0.171	0.451	0.529	0.628	0.766
Aug	-0.139	-0.087	0.20	Y	-0.534	-0.263	-0.098	0.090	0.402
Sep	0.250	0.314	0.20	Y	-0.115	0.186	0.325	0.458	0.625
Oct	0.355	0.418	0.20	Y	0.010	0.314	0.427	0.533	0.687
Nov	0.211	0.322	0.20	Y	-0.086	0.194	0.362	0.448	0.580
Dec	-0.194	-0.081	0.20	Y	-0.502	-0.247	-0.118	0.109	0.356

Max

Month	Hist	Mean	Tol	Y/N	2.5%	25%	50%	75%	97.5%
Jan	24.694	24.976	10.00	Y	23.369	24.371	24.913	25.358	26.740
Feb	24.354	24.503	10.00	Y	23.220	24.028	24.421	24.829	25.982
Mar	22.394	21.989	10.00	Y	20.931	21.558	21.916	22.335	23.108
Apr	19.647	20.146	10.00	Y	19.248	19.720	20.097	20.510	21.357
May	16.806	16.605	10.00	Y	15.797	16.284	16.574	16.861	17.605
Jun	14.063	14.445	10.00	Y	13.518	13.950	14.430	14.830	15.533
Jul	13.726	13.693	10.00	Y	12.773	13.339	13.684	13.923	14.858
Aug	15.748	15.725	10.00	Y	14.698	15.287	15.697	16.116	16.865
Sep	17.307	17.733	10.00	Y	16.513	17.250	17.650	18.100	19.093
Oct	18.923	19.454	10.00	Y	18.544	18.984	19.406	19.897	20.671
Nov	20.843	20.973	10.00	Y	19.670	20.520	20.847	21.283	22.628
Dec	21.487	22.108	10.00	Y	21.076	21.587	22.003	22.545	23.729

Min

Month	Hist	Mean	Tol	Y/N	2.5%	25%	50%	75%	97.5%
Jan	19.255	19.270	10.00	Y	17.884	18.700	19.374	19.829	20.579
Feb	20.529	20.007	10.00	Y	18.670	19.661	20.029	20.439	21.009
Mar	18.513	18.479	10.00	Y	17.631	18.165	18.523	18.719	19.087
Apr	16.467	16.336	10.00	Y	15.258	16.060	16.297	16.623	17.255
May	13.923	13.754	10.00	Y	13.015	13.484	13.755	13.987	14.445
Jun	10.870	10.297	10.00	Y	9.237	9.847	10.317	10.623	11.287
Jul	10.790	10.520	10.00	Y	9.695	10.184	10.503	10.829	11.195
Aug	11.055	11.159	10.00	Y	10.102	10.797	11.135	11.513	12.115
Sep	12.730	13.014	10.00	Y	11.638	12.677	13.093	13.440	13.870
Oct	14.074	15.117	10.00	Y	13.906	14.771	15.139	15.445	15.906
Nov	16.617	16.597	10.00	Y	15.500	16.230	16.650	16.950	17.477
Dec	17.597	18.281	10.00	Y	17.334	17.977	18.310	18.561	19.011

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Cross Correlation

RAINFALL-EVAPORATION

Month	Hist	Mean	Tol	Y/N	2.5%	25%	50%	75%	97.5%
Jan	-0.454	-0.187	0.20	N	-0.530	-0.322	-0.203	-0.071	0.176
Feb	-0.268	-0.096	0.20	Y	-0.521	-0.251	-0.093	0.023	0.268
Mar	-0.094	-0.080	0.20	Y	-0.550	-0.276	-0.064	0.062	0.398
Apr	-0.181	-0.093	0.20	Y	-0.560	-0.275	-0.124	0.052	0.434
May	-0.079	-0.065	0.20	Y	-0.516	-0.222	-0.061	0.096	0.344
Jun	-0.082	0.009	0.20	Y	-0.537	-0.100	0.004	0.126	0.403
Jul	0.290	0.015	0.20	N	-0.368	-0.134	-0.003	0.150	0.447
Aug	-0.511	-0.022	0.20	N	-0.454	-0.197	-0.014	0.170	0.327
Sep	-0.417	-0.083	0.20	N	-0.476	-0.222	-0.068	0.049	0.256
Oct	-0.263	-0.128	0.20	Y	-0.521	-0.288	-0.113	-0.015	0.266
Nov	-0.574	-0.098	0.20	N	-0.535	-0.240	-0.094	0.022	0.298
Dec	-0.456	-0.141	0.20	N	-0.534	-0.302	-0.143	-0.034	0.270

RAINFALL-MAX TEMPERATURE

Month	Hist	Mean	Tol	Y/N	2.5%	25%	50%	75%	97.5%
Jan	-0.281	-0.073	0.20	N	-0.546	-0.243	-0.078	0.097	0.279
Feb	-0.162	-0.018	0.20	Y	-0.514	-0.159	0.004	0.113	0.372
Mar	-0.182	-0.026	0.20	Y	-0.484	-0.209	-0.048	0.138	0.376
Apr	-0.131	-0.043	0.20	Y	-0.513	-0.203	-0.017	0.122	0.294
May	-0.165	-0.068	0.20	Y	-0.482	-0.194	-0.078	0.061	0.308
Jun	-0.171	-0.023	0.20	Y	-0.586	-0.148	-0.002	0.121	0.395
Jul	-0.101	-0.066	0.20	Y	-0.527	-0.246	-0.079	0.092	0.376
Aug	-0.762	-0.050	0.20	N	-0.424	-0.200	-0.033	0.076	0.358
Sep	-0.494	-0.079	0.20	N	-0.553	-0.193	-0.080	0.058	0.248
Oct	-0.383	-0.028	0.20	N	-0.474	-0.174	-0.053	0.123	0.415
Nov	-0.233	0.006	0.20	N	-0.432	-0.167	-0.017	0.153	0.407
Dec	-0.340	-0.023	0.20	N	-0.467	-0.172	-0.003	0.115	0.424

EVAPORATION-MAX TEMPERATURE

Month	Hist	Mean	Tol	Y/N	2.5%	25%	50%	75%	97.5%
Jan	0.630	0.437	0.20	Y	0.049	0.308	0.463	0.545	0.701
Feb	0.583	0.566	0.20	Y	0.164	0.496	0.591	0.667	0.802
Mar	0.579	0.452	0.20	Y	0.126	0.333	0.458	0.566	0.720
Apr	0.595	0.505	0.20	Y	0.112	0.412	0.527	0.621	0.751
May	0.512	0.546	0.20	Y	0.121	0.459	0.562	0.651	0.807
Jun	0.628	0.576	0.20	Y	0.150	0.470	0.585	0.718	0.823
Jul	0.584	0.597	0.20	Y	0.239	0.499	0.615	0.713	0.827
Aug	0.702	0.543	0.20	Y	0.181	0.441	0.552	0.664	0.775
Sep	0.847	0.679	0.20	Y	0.354	0.617	0.692	0.756	0.849
Oct	0.814	0.654	0.20	Y	0.359	0.565	0.673	0.747	0.837
Nov	0.609	0.599	0.20	Y	0.304	0.517	0.596	0.694	0.798
Dec	0.782	0.540	0.20	N	0.131	0.406	0.579	0.673	0.792

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Annual Parametres

RAINFALL

Parameter	Hist	Mean	Tol	Y/N	2.5%	25%	50%	75%	97.5%
Mean	575.8	571.4	5.00	Y	513.7	552.0	568.9	593.6	635.5
Stdev	107.2	102.2	5.00	Y	66.0	91.1	102.4	113.4	135.3
Skew	0.237	0.174	0.50	Y	-0.648	-0.152	0.154	0.502	1.160
Corr	0.235	0.188	0.15	Y	-0.171	0.079	0.195	0.304	0.513
Max	827.8	775.5	10.00	Y	658.1	726.3	764.8	822.3	889.8
Min	390.2	385.3	10.00	Y	251.9	356.7	384.5	415.4	487.7

EVAPORATION

Parameter	Hist	Mean	Tol	Y/N	2.5%	25%	50%	75%	97.5%
Mean	981.5	977.3	5.00	Y	906.2	958.2	976.8	998.2	1045.3
Stdev	87.2	92.8	5.00	N	57.3	79.7	93.1	106.8	124.5
Skew	-0.238	0.015	0.50	Y	-0.877	-0.217	0.036	0.229	0.884
Corr	0.438	0.383	0.15	Y	0.023	0.258	0.379	0.510	0.679
Max	1165.5	1152.5	10.00	Y	1055.7	1104.6	1150.9	1183.6	1273.8
Min	791.2	805.1	10.00	Y	683.9	769.3	801.3	845.2	897.2

MAX TEMPERATURE

Parameter	Hist	Mean	Tol	Y/N	2.5%	25%	50%	75%	97.5%
Mean	17.232	17.207	5.00	Y	16.982	17.132	17.200	17.285	17.399
Stdev	0.433	0.433	5.00	Y	0.308	0.378	0.431	0.479	0.584
Skew	-0.298	0.057	0.50	Y	-0.933	-0.253	0.055	0.389	1.041
Corr	0.155	0.084	0.15	Y	-0.377	-0.043	0.089	0.229	0.481
Max	17.985	18.060	10.00	Y	17.632	17.902	18.077	18.169	18.525
Min	16.362	16.385	10.00	Y	15.751	16.261	16.417	16.527	16.753

Cross correlation

RAINFALL- EVAPORATION

Hist	Mean	Tol	Y/N	2.5%	25%	50%	75%	97.5%
-0.380	-0.126	0.20	N	-0.570	-0.306	-0.147	0.063	0.357

RAINFALL- MAX TEMPERATURE

Hist	Mean	Tol	Y/N	2.5%	25%	50%	75%	97.5%
-0.327	-0.049	0.20	N	-0.580	-0.185	-0.044	0.077	0.423

EVAPORATION- MAX TEMPERATURE

Hist	Mean	Tol	Y/N	2.5%	25%	50%	75%	97.5%
0.771	0.546	0.20	Y	0.283	0.431	0.566	0.665	0.784

Annual parameters na = 18 (out of 21)
Monthly parameters nm = 230 (out of 252)
Daily parameters nm = 189 (out of 228)

Generated data is considered GOOD

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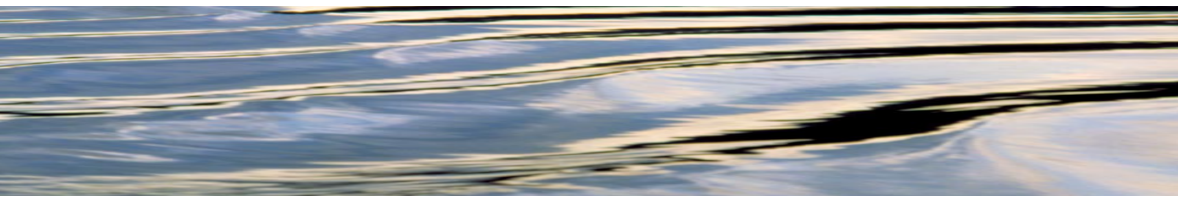

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COOPERATIVE RESEARCH CENTRE FOR
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