WGEN: A Model for Generating Daily Weather Variables

By

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The CMLS94 model of Nofziger and Hornsby incorporates WGEN to generate weather sequences needed in Monte Carlo simulation of pesticide movement in unsaturated soils. We think some model users will want to understand the basis of WGEN and to use the manual and software developed by the authors to determine weather parameters for weather stations of interest to them. Since copies of this publication are no longer available from the authors or from the Agricultural Research Service, the authors have granted us permission to make the manual available in this form. The pages which follow contain the text, tables, figures, and program listings available in the original publication. No editing was done. However, slight differences in the placement of text within a page exist due to differences in fonts. We thank the authors for their cooperation.

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ABSTRACT

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A computer simulation model called WGEN (Weather Generator) that provides daily values for precipitation, maximum temperature, minimum temperature, and solar radiation is described. The model accounts for the persistence of each variable, the dependence among the variables, and the seasonal characteristics of each variable. Its parameters are defined for locations in the United States, enabling use of the model in the 48 contiguous States without reference to actual data. Examples of model applications are given, and weather data generated by the model are compared with actual data.

KEYWORDS: weather, climate, precipitation, solar radiation, temperature, simulation model, Markov chain

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C.W. Richardson and D.A. Wright 1/

INTRODUCTION

Daily weather data are required for many applications. Weather data are frequently needed to aid in the design of hydraulic structures; to evaluate the effects of watershed changes on hydrology, water quality, or erosion; or to assess alternative crop or range management strategies. Mathematical models of the physical processes involved are often used to make these evaluations. In addressing the response of these processes to weather inputs, it is seldom sufficient to examine only responses to observed weather events. Use of only observed sequences gives a solution which is based on only one realization of the weather process. For some locations no weather data are available to make the desired assessment. It is desirable to have the capability of generating synthetic weather data with the same statistical characteristics as the actual weather at the location. Therefore, the purpose of this paper is to provide a method for generating samples of daily weather variables.

A computer simulation model called WGEN (Weather Generator) has been developed to generate daily values for precipitation, maximum temperature, minimum temperature, and solar radiation. The model is based on the procedure described by Richardson (1981); however, several assumptions have been made that simplify the use of the model. The model parameters that are required to generate new sequences of the weather variables have been determined for locations in the 48 contiguous States of the United States and are given in Appendix A.

Several other models have been developed for generating sequences of daily weather variables (Jones et al. 1972, Bond 1979, Nicks and Harp 1980, Bruhn et al. 1980, Larsen and Pense 1981). These models are based on sound statistical principles; however, they lack the general applicability and ease of use that is afforded by WGEN, and the model parameters given in the appendix.

MODEL DESCRIPTION

WGEN provides daily generated values of precipitation (p), maximum temperature (t_{max}), minimum temperature (t_{min}), and solar radiation (r) for an n-year period at a given location. The occurrence of rain on a given day has a major influence on temperature and solar radiation for the day. The approach that is used is to generate precipitation for a given day independently of the other variables. Maximum temperature, minimum temperature, and solar radiation are then generated according to whether a wet day or dry day was previously generated. The model is designed to preserve the dependence in time, the correlation between variables, and the seasonal characteristics in actual weather data for the location.

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Precipitation

The precipitation component of WGEN is a Markov chain-gamma model. A first-order Markov chain is used to generate the occurrence of wet or dry days. When a wet day is generated, the two-parameter gamma distribution is used to generate the precipitation amount.

With the first-order Markov chain model, the probability of rain on a given day is conditioned on the wet or dry status of the previous day. A wet day is defined as a day with 0.01 inch or rain or more. Let P_i (W/W) be the probability of a wet day on day i given a wet day on day i-1, and let P_i(W/D) be the probability of a wet day on day i given a dry day on day i-1. Then,

$$P_i(D/W) = 1 - P_i(W/W) \qquad (1)$$
$$P_i(D/D) = 1 = P_i(W/D)$$

where P_i(D/W) and P_i(D/D) are the probabilities of a dry day given a wet day on day i-1 and the probability of a dry day given a dry day on day i-1, respectively. Therefore, the transition probabilities are fully defined given P_i(W/W) and P_i(W/D).

Several probability density functions have been used to describe the distribution of rainfall amounts (Smith and Schreiber 1974, Woolhiser and Roldan 1982). For this application, a distribution with a minimum number of parameters was needed to minimize the problem of defining the parameters for a large number of locations. Richardson (1982a) has shown the two-parameter gamma distribution to be significantly better for describing daily precipitation amounts than the simple one-parameter exponential distribution. The density function of the two-parameter gamma distribution is given by

$$f(p) = \frac{p^{\alpha-1} e^{-p/\beta}}{\beta^{\alpha}\Gamma(\alpha)}, \quad p, \alpha, \beta > 0 \qquad (2)$$

where f(p) is the density function of p, α, and β are distribution parameters, $\Gamma(\alpha)$ is the gamma function of α, and e is the base of natural logarithms. The α and β are shape and scale parameters, respectively. For $0 < \alpha < 1$, f(p) decreases with increasing p. The shape is appropriate for preon whewewhere f(p) is the density function of p, α, and β are distribution parameters, $\Gamma(\alpha)$ is the gamma function of α, and e is the base of natural logarithms. The α and β are shape and scale parameters, respectively. For $0 < \alpha < 1$, f(p) decreases with increasing p. The shape is appropriate for precipitation amounts since small amounts occur more frequently than larger amounts.

The values of P(W/W), P(W/D), α, and β vary continuously during the year for most locations. In WGEN, each of the four precipitation parameters are constant for a given month but are varied from month to month.

The values of each of the four parameters were determined by month for 139 stations in the United States, as shown in figure 1. The parameters were defined using 20 years (1951-1970) of daily rainfall data for each station. The rainfall parameter values are given for each of the 139 stations in table A1. Rainfall parameters for other locations may be obtained by interpolation of values given in the same table. The parameters are used with a Markov chain generation procedure, and the gamma generation procedure described by Haan (1977) to generate daily precipitation values.

Temperature and Solar Radiation.

The procedure that is used in WGEN for generating daily values of t_{max}, t_{min}, and r is that described by Richardson (1981). The procedure is based on the weakly stationary generating process given by Matalas (1967). The equation is

$$\chi_i(j) = A\chi_{i-1}(j) + B\varepsilon_i(j) \qquad (3)$$

where $\chi_i(j)$ is a 3 X 1 matrix for day i whose elements are residuals of t_{max} (j = 1), t_{min} (j = 2), and r (j = 3), ε_i is a 3 X 1 matrix of independent random components, and A and B are 3 X 3 matrices whose elements are defined such that the new sequences have the desired serial-correlation and cross-correlation coefficients. The A and B matrices are given by

$$A = M_1 M_0^{-1} \qquad (4)$$

$$BB^T = M_0 - M_1 M_0^{-1} M_1^T \qquad (5)$$

where the superscripts -1 and T denote the inverse and transpose of the matrix. M_0 and M_1 are defined as

$$M_0 = \begin{bmatrix} 1 & \rho_0(1,2) & \rho_0(1,3) \\ \rho_0(1,2) & 1 & \rho_0(2,3) \\ \rho_0(1,3) & \rho_0(2,3) & 1 \end{bmatrix} \qquad (6)$$

$$M_1 = \begin{bmatrix} \rho_1(1) & \rho_1(1,2) & \rho_1(1,3) \\ \rho_1(2,1) & \rho_1(2) & \rho_1(2,3) \\ \rho_1(3,1) & \rho_1(3,2) & \rho_1(3) \end{bmatrix} \qquad (7)$$

where ρ_0 (j,k) is the correlation coefficient between variables j and k on the same day, ρ_1(j,k) is the correlation coefficient between variables j and k with variable k lagged 1 day with respect to variable j, and ρ_1(j) is the lag 1 serial-correlation coefficient for variable j.

The correlation coefficients in equations (6) and (7) were determined by season from 20 years of temperature and solar radiation data for 31 locations in the United States (fig 1.). The seasonal and regional patterns of the correlation coefficients were described by Richardson (1982b). The seasonal and spatial variation in the correlation coefficients were relatively small. If the small variations are neglected and the average values of the correlation coefficients given by Richardson (1982b) are used, the M_0 and M_1 matrices become

$$M_0 = \begin{bmatrix} 1.000 & 0.633 & 0.186 \\ 0.633 & 1.000 & -0.193 \\ 0.186 & -0.193 & 1.000 \end{bmatrix} \qquad (8)$$

$$M_1 = \begin{bmatrix} 0.621 & 0.445 & 0.087 \\ 0.563 & 0.674 & -0.100 \\ 0.015 & -0.091 & 0.251 \end{bmatrix} \quad \backslash\underline{2} \qquad (9)$$

Using equations (4) and (5) the A and B matrices become

$$A = \begin{bmatrix} 0.567 & 0.086 & -0.002 \\ 0.253 & 0.504 & -0.050 \\ -0.006 & -0.039 & 0.244 \end{bmatrix} \qquad (10)$$

$$B = \begin{bmatrix} 0.781 & 0 & 0 \\ 0.328 & 0.637 & 0 \\ 0.238 & -0.341 & 0.873 \end{bmatrix} \qquad (11)$$

The A and B matrices given in equations (10) and (11) are used with equation (3) in WGEN to generate new sequences of the residuals of t_{max}, t_{min}, and r that are serially correlated and cross-correlated with the correlations being constant at all locations.

2/ The off-diagonal elements were calculated but not reported by Richardson (1982b).

The final daily generated values of t_{max}, t_{min}, and r are determined by multiplying the residual elements generated with equation (3) by a seasonal standard deviation and adding seasonal mean using the equation

$$t_i(j) = \chi_i(j) \cdot s_i(j) + m_i(j) \qquad (12)$$

where $t_i(j)$is the daily value of t_{max} (j = 1), t_{min} (j = 2), and r (j = 3), s_i (j) is the standard deviation and m_i(j) is the mean for day i. The values of m_i (j) and s_i (j) are conditioned on the wet or dry status as determined from the precipitation component of the model. By expressing equation (12) in terms of the coefficient of variation (c= s/m) rather than the standard deviation, the equation becomes

$$t_i(j) = m_i(j)\left[\chi_i(j) \cdot c_i(j) + 1\right] \qquad (13)$$

The seasonal change in the means and coefficients of variation may be described by

$$u_i = \bar{u} + C\cos(0.0172(i - T)), \quad i = 1, \ldots, 365 \qquad (14)$$

where u_i is the value of the m_i (j) or c_i (j) on day i, u is the mean of u_i, C is the amplitude of the harmonic, and T is the position of the harmonic in days (fig.2). Values of u , C, and T must be determined for the mean and coefficient of variation of each weather variable (t_{max}, t_{min}, and r) and for the wet or dry condition. These values were determined from the 20 years of daily weather data for the 31 locations and are given in tables 1-5. There were no detectable differences in the means and coefficients of variation for t_{min} on wet or dry days; therefore, the values u , C and T given in table 3 describe the seasonal variation in the mean and coefficient of variation of t_{min} for both wet or dry days.

Some of the parameters in tables 1-5 are strongly location dependent while other parameters do not change significantly with location. The values of T for all the descriptors of temperature (means and coefficients of variation of t_{max}, t_{min}) were near 200 days for all locations. Similarly, the T values for r were about 172 days (summer solstice) for all locations. Therefore, in WGEN all the T values for temperature are assumed to be 200 days, and all the T values for solar radiation are assumed to be 172 days.

Most of the u and C values in tables 1-5 were location dependent. The variable names that will be used for those parameters are given in table 6. The variables are defined graphically in figure 3. Contour maps for the parameters that had spatial trends are shown in Appendix A.

The map of u for the mean of t_{max} on dry days is shown in figure A1. The amplitude (C) of the mean of t_{max} for a given location was not significantly different on wet or dry days. The map of C for the mean of t_{max} (wet or dry) is given in figure A2. The u 's for the coefficient of variation of t_{max} are given in figure A3. The C's for the coefficient of variation of t_{max} are given in figure A4. The values in figure A4 are negative because t_{max} is less variable in the summer when the mean t_{max} is greatest. The values of u and C for the coefficients of variation of t_{max} were the same for either wet or dry days.

The u values for the mean of t_{max} on wet days was significantly less than for dry days and are mapped in figure A5. Maps of the other parameters for t_{max} on wet days were not required since they were not significantly different from the parameters for t_{max} on dry days.

The maps of u and C for the means and coefficients of variation of t_{min} are shown in figures A6-A9. All these parameters had a strong regional pattern.

The map of u for the mean of r on dry days is given in figure A10. Similar to t_{max}, C for the mean of r was not significantly different on wet or dry days. The map of C for the mean of r (wet or dry) is given in figure A11. The map ofu for the mean of r on wet days is given in figure A12.

The values of u and C for the coefficients of variation of r given in table 5 showed no relationship to station location. The variation in each of the four parameters among the 31 locations was assumed to be sampling error. In WGEN the value of the four parameters are assumed to be constant at the average values given in table 5.

Precipitation and Temperature Correction

For most locations, the data generated with these procedures will have mean monthly precipitation and temperatures that are very close to the means obtained from actual data. In some cases, there will be differences caused by the temporal and spatial smoothing that is inherent in the model or topographic features of the location or other factors. Procedures have been developed that provide for the correction of these differences if actual mean monthly values are available and the user chooses to make these corrections. Use of the correction options provides generated daily values that compare very closely with the monthly means derived from the actual observations. Use of the correction procedure requires that the actual monthly means for the variable to be corrected be input to the generation program. Mean monthly precipitation and/or temperatures for selected locations are available from many sources, such as Climatic Atlas of the United States (U.S. Department of Commerce, 1968).

The precipitation correction factor for a given month is calculated as the mean monthly precipitation from actual data divided by the mean monthly precipitation theoretically generated with the Markov chain-gamma model. The generated daily precipitation amounts are multiplied by the precipitation correction factor for the appropriate month to obtain a corrected precipitation amount.

The temperature correction may be based on either the actual mean monthly temperature or mean maximum temperature and mean minimum temperature, depending on which type of data are available for the location. For the actual mean monthly temperature, the temperature correction factor is calculated as the difference between the actual mean monthly temperature for the location and the mean monthly temperature theoretically generated using the parameters for the location. The generated daily maximum and minimum temperatures are both corrected by adding the correction factor to the generated temperatures. When mean monthly maximum and minimum temperatures are available, correction factors for maximum temperature and minimum temperature are computed independently.

The WGEN Program

The WGEN program can be used to generate daily values of precipitation, maximum temperature, minimum temperature, and solar radiation. The inputs required for WGEN, input formats, and the source of each input is given in appendix B. The Fortran program of WGEN is given in appendix C. The program contains two major options. If option 1 is chosen, the program will generate daily values of p (inches), t_{max} (^{o}F), t_{min} (^{o}F), and r (ly) for the number of years specified by the user. If option 2 is chosen, the program will read actual precipitation supplied by the user and generate corresponding values of t_{max}, t_{min}, and r. Option 2 is provided because frequently a user will have a long record of actual precipitation data with corresponding data for daily temperature or solar radiation.

Options are also provided that enable the user to correct generated precipitation and temperature based on actual data. The user may choose to (1) make no corrections, (2) correct both precipitation and temperature, (3) correct only precipitation, or (4) correct only temperature. The codes that are required for the various options are given in the list of inputs in appendix B.

The WGEN program will print daily values of the four variables. A summary of the monthly and annual amounts will be printed at the end of each year. At the end of the n-year run, the mean monthly and mean annual amounts will be printed.

The WGEN PAR Program

To generate weather data for a location outside the 48 contiguous states, or to develop generation parameters for actual data from a specific location, the WGEN PAR program given in appendix D may be used. The WGEN PAR program reads daily values of p, t_{max}, t_{min}, and r and writes the generation parameters that are required by WGEN. The number of years of weather data required to develop parameters representative of a particular location vary with the climate. In general, at least 20 years of precipitation and 10 years of temperature and radiation are required. Longer records of precipitation may be required for arid locations.

RESULTS AND DISCUSSION

The WGEN model has been subjected to extensive testing. The results will be illustrated by applying the model at five locations with a wide variety of climates and comparing the results with recorded data. The locations are Columbia, MO; Boise, ID; Miami, FL; Phoenix, AZ; and Boston, MA. The rainfall parameters were obtained from table A1, and the temperature and solar radiation parameters were obtained from figures A1-A12 for each location. A 30-year sample of weather data was generated for each location without correcting precipitation and temperature based on actual monthly means.

Several statistics were selected in comparing the generated weather data with observed data. The following statistics were compared for each month and for the year;

1) Mean precipitation amount.
2) Mean number of wet days ($p \geq 0.01$ inches).
3) Mean run of wet days (maximum length of consecutive wet days).
4) Mean number of days with $p > 2.0$ inches.
5) Mean daily solar radiation.
6) Mean daily maximum temperature.
7) Mean daily minimum temperature.
8) Mean monthly and annual maximum temperature.
9) Mean monthly and annual minimum temperature.
10) Mean number of days with $t_{max} > 95^{o}F$.
11) Mean number of days with $t_{min} < 32^{o}F$.

The results of the comparisons are given in tables 7-11.

The Markov chain-gamma model that was used for generating daily precipitation amounts gave results that compared well with the observed data. The precipitation amounts and the season distribution of precipitation were accurately represented in the generated data. No significant differences occurred between the observed and generated mean monthly or annual precipitation amounts for any of the five locations. The mean number of wet days per month was also accurately simulated at all five locations. The persistence of wet days as indicated by the maximum length of consecutive wet days for each month and the frequency of occurrence of daily precipitation in excess of 2.0 inches also compared favorably with the observed data.

The mean daily solar radiation generated with WGEN was not significantly different from the observed data for any month at any of the five locations.

The daily maximum and minimum temperature generation procedure also produced results that are good representations of the observed data. Mean daily maximum and mean daily minimum temperature by month were significantly different in only 20 of the 130 cases. In most instances, the differences were due to the actual data not having a simple sinusoidal shape as assumed in the model (fig. 3). This problem can be corrected by use of the local average temperature correction previously described.

The statistics that reflect temperature extremes did not compare as well with the observed data as did the other statistics. This result could be expected because the extremes are not as directly related to the generation procedure as mean monthly temperatures. In general, however, the temperature extremes are adequate for most applications.

The precipitation and temperature correction procedures offer an opportunity to make adjustments in the generation procedure when the parameters from table A1 and figures A1-A9 are not adequate due to some physical effect (such as topography), or when a more precise definition of precipitation and/or temperature is needed. As an example of the application of the correction procedure, a 30-year record of weather data was generated for a site on Reynolds Mountain,[3] south of Boise, ID. Boise was the nearest location for which precipitation parameters could be obtained from table A1. The elevation at the Reynolds Mountain site is 7,100 feet while the elevation at Boise is only 2,840 feet. The precipitation regime on Reynolds Mountain is considerably different from that in Boise because of the elevation difference and related factors. Similarly, actual temperature at the Reynolds Mountain site are much lower than would be generated using the parameters from figures A1-A9 since the parameters were developed for sites at lower elevations such as Boise. To adjust these differences, the precipitation and temperature correction options were used. The mean monthly precipitation, maximum temperature, and minimum temperature were calculated from actual data from Reynolds Mountain. These means were input to the WGEN program along with the generation parameters obtained from table A1 and figures A1-A12 for Boise.

3/ The weather data for Reynolds Mountain were obtained by the USDA-ARS Northwest Watershed Research Center and supplied by C.L. Hanson

The results of the generation are shown in table 12. The mean monthly precipitation amounts from the generated data are an excellent representation of the observed data. However, the wet days generated by WGEN are less than the observed number because only the rainfall amounts are changed with the correction procedure. The daily maximum and minimum temperatures generated using the correction procedure also compare closely with the observed data for Reynolds Mountain and are much lower than would be generated without the correction procedure (see table 8).

SUMMARY

The WGEN model is designed for use in generating daily values of precipitation, maximum temperature, minimum temperature, and solar radiation that are representative of the weather at a specific site. The generation procedure is designed to account for the dependence structure of the four variables. The serial dependence of p is described using a first-order Markov chain. The t_{max}, t_{min}, and r values are related to p by conditioning the values on the wet or dry status of the day. The persistence of t_{max}, t_{min}, and r is preserved using the serial-correlation of each variable. The dependence among the three variables is preserved using the cross-correlation coefficients. The generation procedure is also designed to describe the seasonal characteristics of the variables. The basic structure of the model is simple and several assumptions are made to enable general application of the model.

Two major generation options are available with WGEN. The user may choose (1) generate daily values of all four variables or (2) use actual precipitation data and generate the other three variables. In addition to the two major options, the user may choose to apply correction factors to precipitation and/or temperature based on actual mean monthly values.

A Fortran program of WGEN is given in appendix C. Application of WGEN to a particular site requires that 48 precipitation parameters and 12 temperature and radiation parameters be defined. The precipitation parameters have been defined for 139 location in the United States and are given in table A1. The temperature and radiation parameters have been mapped and are given in figures A1-A12. A description of the input format for WGEN is given in appendix B. A Fortran program is given in appendix D that can be used to define the generation parameters derived from actual weather data for a particular site.

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Table 1. Values ofu , C, and T for the mean maximum temperature on wet or dry days for 31 locations in the United States.

	Dry Days			Wet Days		
u Location	(°F)	C (°F)	Tu (days)	(°F)	C (°F)	T (days)
Albuquerque, NM	71.0	23.1	195.9	64.8	24.4	200.6
Atlanta, GA	71.8	19.3	197.1	69.8	17.2	197.1
Bismarck, ND	55.5	32.4	201.7	48.8	32.1	199.4
Boise, ID	63.7	26.1	198.3	59.4	20.6	202.9
Boston, MA	59.3	24.0	202.9	58.2	20.7	209.2
Brownsville, TX	83.4	10.8	201.1	78.4	13.1	204.6
Caribou, ME	48.6	30.1	201.1	48.4	23.9	204.6
Charleston, SC	75.6	15.9	197.1	74.4	14.6	201.1
Cleveland, OH	60.0	25.3	203.5	58.6	25.1	201.1
Columbia, MO	66.0	25.5	200.6	64.0	23.8	201.1
Dodge City, KS	69.5	24.4	199.4	59.5	28.7	198.3
El Paso, TX	78.1	19.5	194.8	71.5	22.0	197.1
Ely, NV	62.5	23.5	203.5	54.5	23.1	206.3
Fresno, CA	76.7	21.0	200.6	69.4	16.8	208.1
Great Falls, MT	59.5	24.1	202.3	46.9	28.4	198.8
Grand Junction, CO	66.6	27.7	197.7	59.9	24.7	200.6
Greensboro, NC	69.8	20.5	197.7	67.6	19.2	196.5
Indianapolis, IN	62.3	26.4	200.0	62.0	23.5	200.6
Lander, WY	60.0	26.3	200.6	49.7	25.1	200.6
Little Rock, AR	73.7	21.8	198.3	70.6	19.9	199.4
Madison, WI	57.0	29.1	200.0	55.9	27.5	201.7
Medford, OR	68.3	22.6	198.3	60.9	16.3	203.5
Miami, FL	83.1	7.9	204.0	82.6	6.4	207.5
Nashville, TN	70.3	23.2	198.8	69.6	19.7	198.8
Oklahoma City, OK	72.6	22.4	199.4	66.1	24.1	200.0
Phoenix, AZ	85.5	19.8	200.6	76.8	20.7	205.8
Rapid City, SD	62.4	25.7	202.9	51.7	29.0	200.0
Salt Lake City, UT	65.3	27.3	199.4	59.6	23.5	204.6
San Antonio, TX	81.0	16.5	198.3	75.8	16.8	198.3
Sault Ste. Marie, MI	49.9	27.7	204.0	47.9	25.5	204.0
Spokane, WA	58.4	26.3	197.7	53.6	20.3	198.8
Mean	67.3	23.1	199.9	62.5	21.8	201.6
Std. dev.	9.5	5.2	2.4	9.8	5.3	3.4

Table 2. Values ofu , C, and T for coefficient of variation of maximum temperature on wet or dry days for 31 locations in the United States.

	Dry Days			Wet Days		
u Location		C	Tu (days)		C	T (days)
Albuquerque	0.11	-0.07	201.1	0.14	-0.07	201.1
Atlanta	0.12	-0.08	201.7	0.12	-0.06	198.8
Bismarck	0.30	-0.28	200.6	0.32	-0.28	197.7
Boise	0.15	-0.07	201.7	0.15	-0.03	194.2
Boston	0.16	-0.08	205.2	0.16	-0.06	215.6
Brownsville	0.07	-0.05	194.2	0.09	-0.06	193.1
Caribou	0.26	-0.23	200.6	0.21	-0.12	197.1
Charleston	0.10	-0.07	200.6	0.10	-0.06	205.8
Cleveland	0.22	-0.07	209.8	0.21	-0.13	205.8
Columbia	0.19	-0.13	200.6	0.19	-0.13	201.1
Dodge City	0.17	-0.11	204.0	0.23	-0.15	202.9
El Paso	0.09	-0.05	198.8	0.13	-0.07	202.3
Ely	0.15	-0.10	203.5	0.17	-0.06	198.3
Fresno	0.10	-0.03	204.6	0.10	-0.01	199.4
Great Falls	0.21	-0.14	201.7	0.40	-0.36	195.9
Grand Junction	0.14	-0.09	200.6	0.15	-0.06	195.4
Greensboro	0.13	-0.08	202.9	0.15	-0.07	202.3
Indianapolis	0.19	-0.14	200.6	0.18	-0.12	203.5
Lander	0.19	-0.14	195.9	0.25	-0.15	191.3
Little Rock	0.13	-0.09	199.4	0.14	-0.09	197.1
Madison	0.22	-0.17	199.4	0.21	-0.13	202.9
Medford	0.13	-0.04	202.3	0.13	-0.01	204.0
Miami	0.05	-0.03	204.0	0.05	-0.02	222.5
Nashville	0.15	-0.11	200.0	0.14	-0.08	200.0
Oklahoma City	0.15	-0.10	201.1	0.18	-0.12	198.3
Phoenix	0.08	-0.03	212.7	0.09	-0.02	194.2
Rapid City	0.22	-0.15	201.1	0.30	-0.22	197.7
Salt Lake City	0.15	-0.09	201.1	0.17	-0.07	197.1
San Antonio	0.09	-0.06	198.8	0.12	-0.07	197.7
Sault Ste. Marie	0.24	-0.18	204.6	0.22	-0.13	205.8
Spokane	0.16	-0.08	194.8	0.16	-0.05	195.4
Ave.	0.16	-0.10	201.5	0.17	-0.10	200.5
Std. dev.	0.06	.06	3.7	0.07	0.08	6.3

Table 3. Values ofu , C, and T for the mean and coefficient of variation of minimum temperature for 31 locations in the United States.

	Mean wet or dry days			Coef. of var. wet or dry days		
u Location	 (°F)	C (°F)	Tu (days)		C	T (days)
Albuquerque	43.5	21.0	200.6	0.17	-0.13	202.9
Atlanta	51.4	18.8	199.4	0.16	-0.13	198.3
Bismarck	29.3	28.7	199.4	0.65	-0.90	200.0
Boise	39.5	17.1	201.7	0.22	-0.06	187.9
Boston	43.6	21.0	207.5	0.20	-0.18	199.4
Brownsville	64.9	12.7	197.7	0.11	-0.08	196.5
Caribou	29.8	25.1	205.2	0.35	-0.50	207.5
Charleston	53.9	18.2	199.4	0.16	-0.12	195.9
Cleveland	41.3	21.3	205.2	0.29	-0.16	203.5
Columbia	44.7	23.3	200.6	0.26	-0.22	198.8
Dodge City	42.9	24.2	201.1	0.25	-0.20	201.7
El Paso	50.8	20.2	197.1	0.15	-0.11	199.4
Ely	28.1	18.2	200.6	0.45	-0.45	194.2
Fresno	48.7	13.3	201.7	0.12	-0.05	195.4
Great Falls	34.1	20.6	204.0	0.49	-0.56	199.4
Grand Junction	40.3	22.7	199.4	0.23	-0.20	196.5
Greensboro	47.0	20.2	199.4	0.20	-0.14	196.5
Indianapolis	42.3	22.6	200.0	0.28	-0.24	199.4
Lander	31.7	22.5	200.6	0.44	-0.48	195.9
Little Rock	51.4	20.5	197.1	0.18	-0.13	195.9
Madison	35.1	24.6	202.3	0.48	-0.55	200.6
Medford	40.6	11.7	204.0	0.16	-0.06	191.3
Miami	68.2	9.1	206.3	0.08	-0.06	204.0
Nashville	48.5	20.8	198.3	0.22	-0.17	198.8
Oklahoma City	49.0	22.3	199.4	0.19	-0.15	200.0
Phoenix	56.5	19.5	204.6	0.11	-0.05	202.3
Rapid City	34.5	23.8	202.3	0.42	-0.46	200.0
Salt Lake City	38.9	19.8	200.6	0.25	-0.18	194.2
San Antonio	58.0	17.7	197.7	0.15	-0.11	200.0
Sault Ste. Marie	31.1	23.3	209.8	0.61	-0.80	208.7
Spokane	37.4	16.2	201.1	0.23	-0.16	194.2
Ave.	43.8	20.0	201.4	0.27	-0.25	198.7
Std. dev.	10.1	4.2	3.1	0.15	0.22	4.3

Table 4. Values ofu , C, and T for the mean solar radiation on wet or dry days for 31 locations in the United States.

	Dry Days			Wet Days		
u Location	(ly)	C (ly)	Tu (days)	(ly)	C (ly)	T (days)
Albuquerque	520.4	224.6	171.1	285.2	226.7	180.9
Atlanta	448.1	174.0	166.5	259.4	161.7	177.4
Bismarck	401.0	266.1	171.7	271.1	181.2	174.0
Boise	429.2	276.0	173.4	282.7	209.3	179.2
Boston	388.0	218.5	168.2	201.9	142.5	176.9
Brownsville	480.5	175.1	180.9	291.4	157.1	191.9
Caribou	383.2	245.6	164.7	224.6	142.2	166.5
Charleston	462.7	176.2	165.3	283.0	159.2	176.3
Cleveland	383.6	244.4	171.1	244.0	176.7	175.1
Columbia	430.8	226.7	174.6	258.7	185.7	178.6
Dodge City	464.2	221.0	172.8	308.6	198.4	174.6
El Paso	545.3	206.7	168.2	419.8	227.7	172.2
Ely	486.4	241.5	172.2	341.4	174.6	171.7
Fresno	462.1	259.4	172.8	292.9	175.6	170.5
Great Falls	389.9	277.2	172.8	271.6	176.5	169.9
Grand Junction	478.7	235.8	172.8	329.5	183.1	175.7
Greensboro	434.4	184.2	168.2	263.2	170.8	172.2
Indianapolis	407.1	224.5	172.8	248.7	179.5	176.9
Lander	451.8	242.3	169.9	324.1	162.1	164.7
Little Rock	438.1	195.7	169.9	254.0	174.3	179.8
Madison	398.8	240.6	169.9	245.8	170.2	175.1
Medford	425.9	298.6	174.6	271.9	192.0	174.0
Miami	494.2	135.7	167.0	367.9	108.0	180.3
Nashville	431.0	207.8	170.5	255.3	186.2	179.8
Oklahoma City	449.3	194.3	174.6	270.1	180.6	178.6
Phoenix	516.0	208.9	165.9	360.7	195.7	180.3
Rapid City	414.0	238.4	171.1	293.8	173.7	168.8
Salt Lake City	462.8	267.2	172.2	309.1	200.1	176.9
San Antonio	466.5	168.9	181.5	292.0	166.7	183.8
Sault Ste. Marie	396.5	277.8	165.3	230.6	144.2	167.0
Spokane	394.3	296.7	172.8	255.1	200.8	171.1
Ave.	443.1	227.4	171.1	284.1	176.9	175.5
Std. dev.	43.0	40.0	4.0	45.5	24.5	5.5

Table 5. Values ofu , C, and T for the coefficient by variation of solar radiation on wet or dry days for 31 locations in the United States.

	Dry Days			Wet Days		
Location	u	C	Tu (days)	u	C	T (days)
Albuquerque	0.15	-0.05	190.7	0.32	-0.13	178.6
Atlanta	0.24	-0.06	197.7	0.56	-0.22	194.8
Bismarck	0.26	-0.07	190.2	0.46	-0.01	197.7
Boise	0.23	-0.12	189.6	0.44	-0.12	178.0
Boston	0.28	-0.05	182.1	0.70	-0.16	186.1
Brownsville	0.24	-0.11	204.0	0.52	-0.19	211.5
Caribou	0.28	-0.06	117.9	0.55	-0.08	90.2
Charleston	0.22	-0.06	190.2	0.52	-0.17	197.1
Cleveland	0.32	-0.12	180.3	0.56	-0.16	179.8
Columbia	0.28	-0.11	200.0	0.59	-0.22	189.6
Dodge City	0.23	-0.06	202.3	0.52	-0.13	181.5
El Paso	0.14	-0.04	175.1	0.33	-0.13	172.2
Ely	0.17	-0.04	197.7	0.33	-0.07	160.7
Fresno	0.21	-0.15	186.7	0.48	-0.12	156.1
Great Falls	0.26	-0.08	179.8	0.43	-0.04	111.6
Grand Junction	0.19	-0.04	205.2	0.38	-0.10	176.3
Greensboro	0.24	-0.05	193.1	0.55	-0.19	187.3
Indianapolis	0.29	-0.12	197.1	0.58	-0.23	183.8
Lander	0.18	-0.01	178.6	0.38	-0.02	118.5
Little Rock	0.26	-0.10	192.5	0.57	-0.24	196.5
Madison	0.30	-0.08	176.9	0.59	-0.13	179.2
Medford	0.26	-0.16	184.4	0.42	-0.10	163.6
Miami	0.19	-0.02	194.8	0.35	-0.05	222.0
Nashville	0.28	-0.12	192.5	0.56	-0.25	191.3
Oklahoma City	0.26	-0.07	200.6	0.58	-0.20	189.0
Phoenix	0.14	-0.04	169.9	0.40	-0.16	192.5
Rapid City	0.23	-0.04	192.5	0.43	-0.04	131.2
Salt Lake City	0.22	-0.10	184.4	0.42	-0.12	169.4
San Antonio	0.25	-0.12	210.4	0.53	-0.23	205.2
Sault Ste. Marie	0.29	-0.11	150.3	0.54	-0.04	111.5
Spokane	0.28	-0.14	178.0	0.44	-0.09	154.9
Ave.	0.24	-0.08	186.6	0.48	-0.13	172.8
Std. dev.	0.05	0.04	17.6	0.09	0.07	31.1

Table 6. Variable names for the means (u) and amplitude (C) of equation (14) for t_{max}, t_{min}, and r.

Variable name	Description
TXMD	mean of t_{max} (dry), °F
ATX	amplitude of t_{max} (wet or dry), °F
CVTX	mean coef. of var. of t_{max} (wet or dry)
ACVTX	amplitude of coef. of var. of t_{max} (wet or dry)
TXMW	mean of t_{max} (wet), °F
TN	mean of t_{min} (wet or dry), °F
ATN	amplitude of t_{min} (wet or dry), °F
CVTN	mean of coef. of var. of t_{min} (wet or dry)
ACVTN	amplitude of coef. of var. of t_{min} (wet or dry)
RMD	mean of r (dry), ly
AR	amplitude of r (dry), ly
CVRD	mean of coef. of var. of r (dry) (assumed to be 0.24 for all locations)
ACVRD	amplitude of coef. of var. of r (dry) (assumed to be -0.08 for all locations)
RMW	mean of r (wet), ly
CVRW	mean of coef. of var. of r (wet) (assumed to be 0.48 for all locations)
ACVRW	amplitude of coef. of var. of r (wet) (assumed to be -0.13 for all locations)

TABLE 7. COMPARISONS OF GENERATED AND OBSERVED WEATHER DATA, COLUMBIA, MO.

	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	ANN.
PRECIPITATION													
AMOUNT (IN)													
OBSERVED MEAN	1.41	1.68	2.51	3.63	4.45	4.15	3.95	2.84	4.00	3.12	1.58	1.66	34.98
GENERATED MEAN	1.27	1.68	2.97	3.40	4.12	4.79	4.43	3.14	3.94	3.36	1.73	1.86	36.69
NO. OF WET DAYS													
OBSERVED MEAN	7.15	7.60	10.40	11.40	10.50	10.30	9.25	7.55	7.95	7.55	6.20	8.25	104.10
GENERATED MEAN	6.10	7.27	10.80	11.03	10.60	10.87	9.40	7.03	7.27	7.07	6.10	8.57	102.10
RUN OF WET DAYS													
OBSERVED MEAN	2.65	2.90	3.50	3.70	3.85	3.80	3.30	2.55	3.15	2.85	2.80	2.85	5.70
GENERATED MEAN	2.37	2.80	3.63	3.77	3.90	3.93	3.47	2.53	2.93	2.83	2.47	3.37	6.23
NO. DAYS > 2.0 IN													
OBSERVED MEAN	0.00	0.00	0.05	0.10	0.10	0.25	0.15	0.20	0.40	0.15	0.00	0.05	1.45
GENERATED MEAN	0.00	0.00	0.00	0.00	0.17	0.27	0.27	0.23	0.30	0.17	0.00	0.00	1.40
RADIATION													
MEAN DAILY (LY)													
OBSERVED MEAN	185.6	261.3	348.0	440.1	531.4	570.6	583.7	522.8	427.3	322.2	212.0	160.6	381.1
GENERATED MEAN	192.9	257.7	342.6	452.2	541.4	581.3	577.8	515.9	403.2	286.8	206.9	162.9	377.4

TABLE 7. CONTINUED.

	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	ANN.
TEMPERATURE													
DAILY MAXIMUM (F)													
OBSERVED MEAN	38.24	43.24	51.57	66.15	75.71	83.99	88.77	87.48	80.46	69.28	54.13	42.02	65.18
GENERATED MEAN	39.46	42.04	49.90	63.94	75.17	86.77	89.80	87.06	78.12	65.80	52.90	44.00	64.70
DAILY MINIMUM (F)													
OBSERVED MEAN	19.73	24.25	31.42	44.59	54.40	63.32	67.51	65.65	57.49	46.77	34.20	24.88	44.60
GENERATED MEAN	20.77	22.49	30.35	43.75	54.30	63.91	67.18	64.62	56.20	44.62	32.89	24.79	43.94
MONTH/ANN. MAX (F)													
OBSERVED MEAN	65.16	65.32	77.46	86.26	89.19	94.05	98.40	97.32	93.25	86.34	74.10	66.64	100.04
GENERATED MEAN	60.97*	63.47	73.50	86.67	93.03*	98.97*	98.27	98.63	94.60	88.10	74.00	66.33	101.93
MONTH/ANN. MIN (F)													
OBSERVED MEAN	-2.69	4.66	12.39	29.00	37.91	50.30	56.05	52.96	41.58	30.41	15.49	4.90	-5.14
GENERATED MEAN	-0.40	0.30*	7.37*	21.13*	37.17	57.60*	64.77*	59.13*	42.73	24.07*	7.13*	2.80	-6.83
NO. DAYS > 95 F													
OBSERVED MEAN	0.00	0.00	0.00	0.00	0.00	1.95	5.35	4.75	1.50	0.00	0.00	0.00	13.55
GENERATED MEAN	0.00	0.00	0.00	0.10	0.90*	3.83*	4.83	3.77	0.87	0.10	0.00	0.00	14.40
NO. DAYS < 32 F													
OBSERVED MEAN	27.10	21.65	17.45	3.10	0.00	0.00	0.00	0.00	0.00	1.95	13.10	23.70	108.05
GENERATED MEAN	25.80	22.77	17.63	5.53*	0.30	0.00	0.00	0.00	0.10	4.20*	14.30	23.30	113.93*

* -- GENERATED VALUES SIGNIFICANTLY DIFFERENT FROM OBSERVED VALUES AT 5% LEVEL BY T-TEST

TABLE 8. COMPARISON OF GENERATED AND OBSERVED WEATHER DATA, BOISE, ID.

	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	ANN.
PRECIPITATION													
AMOUNT (IN)													
OBSERVED MEAN	1.69	1.05	0.91	1.20	1.31	1.01	0.19	0.39	0.45	0.71	1.29	1.30	11.52
GENERATED MEAN	1.62	1.28	0.96	1.16	1.36	0.88	0.20	0.53	0.33	0.65	1.32	1.32	11.62
NO. OF WET DAYS													
OBSERVED MEAN	13.50	9.90	9.05	7.90	8.40	6.70	2.05	2.75	3.55	6.20	9.25	11.55	90.80
GENERATED MEAN	11.87	11.70	8.80	7.77	8.40	6.07	1.73	3.10	2.97	5.90	8.70	11.97	88.97
RUN OF WET DAYS													
OBSERVED MEAN	6.00	4.70	3.45	3.00	3.40	3.00	1.45	1.90	2.25	2.40	4.35	4.10	7.80
GENERATED MEAN	4.50*	4.60	3.37	2.87	3.27	2.57	1.20	1.93	1.83	2.77	3.73	4.73	6.73
NO. DAYS > 2.0 IN													
OBSERVED MEAN	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GENERATED MEAN	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RADIATION													
MEAN DAILY (LY)													
OBSERVED MEAN	141.0	231.2	350.8	485.0	588.8	634.0	672.5	579.1	457.6	308.6	172.7	124.3	400.4
GENERATED MEAN	119.0	197.4	350.5	499.2	594.9	662.9	660.3	550.5	418.6	265.2	147.6	99.1	381.4

TABLE 8. CONTINUED.

TEMPERATURE	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	ANN.
DAILY MAXIMUM (F)													
OBSERVED MEAN	37.73	44.02	51.56	60.81	70.79	79.26	90.84	87.55	77.73	64.51	49.19	39.17	62.87
GENERATED MEAN	33.06	36.22*	45.58*	58.98	72.24	82.79	86.94	83.90	75.32	61.78	47.64	38.33	60.36
DAILY MINIMUM (F)													
OBSERVED MEAN	23.12	27.33	30.35	35.94	44.00	51.83	58.73	56.84	48.83	39.02	30.50	24.86	39.35
GENERATED MEAN	21.75	24.47	29.62	37.48	46.37	52.89	54.95*	53.72	48.20	39.30	30.91	25.71	38.86
MONTH/ANN. MAX (F)													
OBSERVED MEAN	52.05	57.60	68.25	77.95	88.85	96.95	102.00	100.80	92.70	81.80	64.45	54.55	103.85
GENERATED MEAN	48.20*	51.47*	62.73*	78.97	89.43	95.83	99.13*	98.03*	93.10	80.77	65.73	54.57	101.33
MONTH/ANN. MIN (F)													
OBSERVED MEAN	4.30	14.30	18.10	24.10	30.70	39.35	46.40	44.60	34.55	25.95	16.90	9.95	1.35
GENERATED MEAN	6.37	10.07*	12.67*	19.93*	32.23	42.40*	46.10	42.50*	33.63	23.60	14.20	10.40	3.43
NO. DAYS > 95 F													
OBSERVED MEAN	0.00	0.00	0.00	0.00	0.10	2.15	9.65	6.20	0.65	0.00	0.00	0.00	18.75
GENERATED MEAN	0.00	0.00	0.00	0.00	0.13	1.60	4.13*	2.47*	0.77	0.00	0.00	0.00	9.10*
NO. DAYS < 32 F													
OBSERVED MEAN	25.35	21.20	19.95	9.50	1.90	0.00	0.00	0.00	0.60	5.70	17.50	26.30	128.00
GENERATED MEAN	28.63*	23.67*	19.27	8.80	1.23	0.03	0.00	0.00	0.77	6.37	16.67	23.83	129.27

* -- GENERATED VALUES SIGNIFICANTLY DIFFERENT FROM OBSERVED VALUES AT 5% LEVEL BY T-TEST

TABLE 9. COMPARISONS OF GENERATED AND OBSERVED WEATHER DATA, MIAMI, FL.

	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	ANN.
PRECIPITATION													
AMOUNT (IN)													
OBSERVED MEAN	2.27	2.20	2.05	2.65	6.49	9.84	6.21	6.61	8.62	8.37	2.63	1.69	59.65
GENERATED MEAN	2.22	2.39	2.09	2.12	7.68	10.02	6.45	6.18	8.70	8.65	2.40	1.54	60.45
NO. OF WET DAYS													
OBSERVED MEAN	6.60	6.00	6.05	5.90	9.90	15.85	15.70	15.85	17.10	14.85	7.05	5.65	126.50
GENERATED MEAN	6.27	6.30	5.50	5.30	10.40	15.33	14.93	14.70	15.00	12.97	6.63	5.07	118.40
RUN OF WET DAYS													
OBSERVED MEAN	2.40	2.30	2.55	2.20	5.35	6.45	5.75	5.95	7.85	6.00	2.75	2.35	10.25
GENERATED MEAN	2.37	2.53	2.07	2.63	4.87	5.53	5.47	5.10	6.10	5.03	2.63	1.97	8.47
NO. DAYS > 2.0 IN													
OBSERVED MEAN	0.05	0.15	0.10	0.10	0.85	1.05	0.35	0.40	0.70	1.15	0.25	0.10	5.25
GENERATED MEAN	0.07	0.03	0.03	0.13	1.00	1.13	0.37	0.23	0.70	1.00	0.07	0.03	4.80
RADIATION													
MEAN DAILY (LY)													
OBSERVED MEAN	332.2	409.3	479.8	546.9	548.9	516.3	544.1	517.2	442.3	394.5	355.1	323.3	452.2
GENERATED MEAN	332.4	384.3	449.4	522.6	554.4	565.2	543.1	498.6	435.6	373.3	333.4	314.3	442.4

TABLE 9. CONTINUED.

TEMPERATURE	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	ANN.
DAILY MAXIMUM (F)													
OBSERVED MEAN	74.86	76.20	79.12	82.50	85.17	87.54	88.97	89.94	88.13	84.38	79.71	75.96	82.74
GENERATED MEAN	73.83	75.32	78.07	82.04	86.58	90.00*	91.33*	90.43	86.92	82.56	79.45	75.33	82.69
DAILY MINIMUM (F)													
OBSERVED MEAN	58.37	59.69	63.24	67.83	71.32	74.14	75.87	76.15	75.36	71.21	64.68	59.66	68.17
GENERATED MEAN	55.12*	56.73	60.31	65.17*	70.86	75.12	76.85*	75.65	71.38*	66.32*	61.95	57.04	66.09
MONTH/ANN. MAX (F)													
OBSERVED MEAN	82.75	85.10	87.30	89.80	90.40	92.30	92.85	93.65	92.00	89.15	85.35	82.95	94.60
GENERATED MEAN	87.53*	89.10*	90.03*	91.10	92.37*	93.40*	93.43	93.53	92.80	91.57*	90.77*	88.80*	95.63
MONTH/ANN. MIN (F)													
OBSERVED MEAN	40.00	44.70	46.70	56.70	62.65	69.40	71.90	72.30	71.50	61.25	49.75	42.75	37.90
GENERATED MEAN	42.80*	43.23	48.13	55.87	63.77	70.73*	74.57*	71.57*	64.90*	57.97*	50.77	43.67	40.03*
NO. DAYS > 95 F													
OBSERVED MEAN	0.00	0.00	0.00	0.00	0.00	0.05	0.20	1.10	0.05	0.00	0.00	0.00	1.40
GENERATED MEAN	0.03	0.07	0.13	0.13	0.03	0.13	0.03	0.03	0.17	0.17	0.37	0.03	1.33
NO. DAYS < 32 F													
OBSERVED MEAN	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GENERATED MEAN	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

* -- GENERATED VALUES SIGNIFICANTLY DIFFERENT FROM OBSERVED VALUES AT 5% LEVEL BY T-TEST

TABLE 10. COMPARISONS OF GENERATED AND OBSERVED WEATHER DATA, PHOENIX, AZ.

	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	ANN.
PRECIPITATION													
AMOUNT (IN)													
OBSERVED MEAN	0.73	0.53	0.76	0.30	0.10	0.15	0.73	1.20	0.68	0.51	0.49	0.85	7.03
GENERATED MEAN	0.62	0.50	0.91	0.23	0.07	0.10	0.72	1.20	1.10	0.46	0.40	0.84	7.15
NO. OF WET DAYS													
OBSERVED MEAN	3.95	3.45	3.15	1.70	0.80	0.90	4.15	5.50	2.75	2.40	2.45	3.55	34.75
GENERATED MEAN	2.80	3.53	3.53	1.67	0.57	0.60	4.00	5.43	3.70	2.30	2.33	3.13	33.60
RUN OF WET DAYS													
OBSERVED MEAN	2.20	2.45	1.85	1.40	1.25	1.25	2.10	2.30	2.05	1.75	1.60	2.10	4.15
GENERATED MEAN	1.87	2.13	2.07	1.33	1.17	1.17	2.13	2.13	2.17	1.73	1.67	1.80	3.93
NO. DAYS > 2.0 IN													
OBSERVED MEAN	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.05	0.00	0.00	0.00	0.10
GENERATED MEAN	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.03	0.07
RADIATION													
MEAN DAILY (LY)													
OBSERVED MEAN	296.9	399.8	507.4	636.9	708.6	722.8	641.2	591.3	530.5	438.9	325.9	268.2	501.0
GENERATED MEAN	289.9	361.8	471.9	587.7	665.8	703.0	665.6	581.4	490.0	392.8	313.7	268.9	483.3

TABLE 10. CONTINUED.

	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	ANN.
TEMPERATURE													
DAILY MAXIMUM (F)													
OBSERVED MEAN	64.91	68.84	74.05	82.77	92.42	101.37	104.35	101.58	97.75	87.63	74.03	65.90	84.71
GENERATED MEAN	62.33	63.94*	71.18	81.37	90.86	99.80	101.12	98.80	92.07*	83.15	72.64	64.92	81.95
DAILY MINIMUM (F)													
OBSERVED MEAN	38.61	41.29	45.54	52.31	60.57	69.13	78.50	76.85	69.73	57.60	46.28	39.24	56.39
GENERATED MEAN	35.83	37.02	44.08	53.06	61.72	69.72	71.59*	70.39*	63.78*	54.93	44.77	38.33	53.86
MONTH/ANN. MAX (F)													
OBSERVED MEAN	76.20	80.55	87.05	94.95	103.90	111.15	112.00	108.40	105.55	97.85	85.60	77.25	112.95
GENERATED MEAN	78.80	78.63	87.17	95.60	103.80	109.90	110.67	108.73	103.83	97.93	87.50	81.60	112.13
MONTH/ANN. MIN (F)													
OBSERVED MEAN	28.05	31.00	34.05	42.15	49.15	59.20	70.35	68.60	58.85	45.85	34.75	29.45	25.90
GENERATED MEAN	25.10*	27.00*	31.70*	41.40	49.77	59.47	63.10*	60.07*	53.03*	42.70*	33.47	27.30*	22.67*
NO. DAYS > 95 F													
OBSERVED MEAN	0.00	0.00	0.00	1.55	14.95	25.30	30.05	28.40	22.45	5.95	0.00	0.00	128.65
GENERATED MEAN	0.00	0.00	0.07	1.37	9.53*	25.07	27.50*	23.80*	11.47*	2.60*	0.20	0.00	101.60*
NO. DAYS < 32 F													
OBSERVED MEAN	5.35	2.70	0.65	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.65	3.80	13.15
GENERATED MEAN	8.53*	6.03*	1.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.83	5.13	21.77*

* -- GENERATED VALUES SIGNIFICANTLY DIFFERENT FROM OBSERVED VALUES AT 5% LEVEL BY T-TEST

TABLE 11. COMPARISONS OF GENERATED AND OBSERVED WEATHER DATA, MIAMI, FL.

	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	ANN.
PRECIPITATION													
AMOUNT (IN)													
OBSERVED MEAN	3.73	3.97	4.43	3.91	3.58	3.08	2.71	3.71	3.45	3.31	4.61	4.72	45.21
GENERATED MEAN	3.94	4.67	4.68	3.98	3.99	3.42	2.57	3.50	3.02	2.40*	4.66	4.17	45.01
NO. OF WET DAYS													
OBSERVED MEAN	11.85	11.35	12.00	11.45	11.40	10.60	9.10	10.00	8.65	9.15	11.75	10.85	128.15
GENERATED MEAN	11.33	11.20	11.90	10.70	11.43	10.50	8.53	9.40	7.63	7.90	10.90	9.80	121.23*
RUN OF WET DAYS													
OBSERVED MEAN	3.85	3.40	3.90	3.80	4.25	3.40	3.10	3.00	2.90	3.55	3.70	3.05	6.70
GENERATED MEAN	4.07	3.90	4.17	3.90	3.27	3.50	3.40	2.60	2.73	2.73	3.70	3.23	6.33
NO. DAYS > 2.0 IN													
OBSERVED MEAN	0.00	0.20	0.10	0.10	0.15	0.05	0.15	0.25	0.40	0.20	0.25	0.15	2.00
GENERATED MEAN	0.07	0.17	0.10	0.10	0.00	0.07	0.00*	0.10	0.13	0.03	0.17	0.17	1.10*
RADIATION													
MEAN DAILY (LY)													
OBSERVED MEAN	147.7	212.8	301.7	386.2	485.8	504.4	499.1	430.9	359.6	253.2	151.6	127.9	322.8
GENERATED MEAN	138.3	197.7	292.4	413.0	497.8	537.6	525.1	457.4	364.4	245.6	151.0	128.4	329.7

TABLE 11. CONTINUED.

	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	ANN.
TEMPERATURE													
DAILY MAXIMUM (F)													
OBSERVED MEAN	36.04	37.86	43.96	56.14	66.87	76.66	81.72	79.63	72.26	62.76	51.40	39.54	58.85
GENERATED MEAN	32.66	36.15	44.60	55.94	68.38	78.43	82.11	79.16	70.29	58.61	47.74	37.06	57.71
DAILY MINIMUM (F)													
OBSERVED MEAN	22.17	23.32	30.68	40.27	49.47	59.09	65.05	63.31	56.55	47.22	38.14	26.36	43.58
GENERATED MEAN	19.27	22.38	30.13	40.18	51.12	59.74	63.05*	60.53*	52.66*	42.27*	32.86*	23.40	41.57
MONTH/ANN. MAX (F)													
OBSERVED MEAN	54.75	55.25	64.65	77.85	87.10	93.65	94.40	92.30	89.80	80.60	67.95	59.10	95.85
GENERATED MEAN	49.87*	54.07	63.33	75.07	83.87*	88.53*	91.57*	90.83	85.73*	77.10*	65.60	54.60	93.47
MONTH/ANN. MIN (F)													
OBSERVED MEAN	3.85	5.15	16.40	29.65	39.65	49.75	57.35	54.55	43.80	34.00	24.50	9.15	0.30
GENERATED MEAN	5.33	8.93*	15.13	23.97*	39.10	52.87*	61.23*	54.90	41.03*	27.00*	16.60*	9.23	3.67
NO. DAYS > 95 F													
OBSERVED MEAN	0.00	0.00	0.00	0.00	0.00	0.55	1.25	0.65	0.10	0.00	0.00	0.00	2.55
GENERATED MEAN	0.00	0.00	0.00	0.00	0.03	0.00*	0.17*	0.20	0.00	0.00	0.00	0.00	0.40*
NO. DAYS < 32 F													
OBSERVED MEAN	26.00	23.10	16.75	1.95	0.00	0.00	0.00	0.00	0.00	0.35	6.70	22.00	96.85
GENERATED MEAN	30.07*	25.20*	18.40	5.73*	0.00	0.00	0.00	0.00	0.00	3.33*	14.00*	27.17*	123.90*

* -- GENERATED VALUES SIGNIFICANTLY DIFFERENT FROM OBSERVED VALUES AT 5% LEVEL BY T-TEST

TABLE 12. Comparisons of data generated for Reynolds Mountain using precipitation and temperature correction procedure with observed weather data*

Item	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	ANN.
PRECIPITATION													
Amount (in)													
Observed Mean	8.03	4.68	4.60	3.87	2.62	2.30	0.67	1.17	1.31	2.48	5.52	6.09	43.34
Generated Mean	7.66	5.83	4.87	3.77	2.70	2.06	0.69	1.65	0.98	2.29	5.58	6.15	44.25
No. wet days													
Observed Mean	16.8	13.3	15.1	12.9	10.6	10.0	4.7	6.0	5.4	8.9	13.3	16.6	133.5
Generated Mean	12.5	12.2	9.2	8.1	8.6	6.3	1.8	3.3	3.3	6.1	8.9	12.3	92.6
TEMPERATURE													
Daily Maximum (°F)													
Observed Mean	27.2	31.0	33.0	38.7	50.8	61.8	72.1	70.1	60.9	48.8	36.0	29.3	46.6
Generated Mean	27.2	30.8	32.9	38.8	50.8	61.9	71.5	69.5	61.1	48.9	35.8	30.2	46.7
Daily Minimum (°F)													
Observed Mean	17.8	21.4	21.2	24.7	34.7	44.0	53.4	52.1	44.0	34.7	25.3	19.5	32.7
Generated Mean	17.1	21.6	21.0	24.2	34.8	44.3	53.1	52.4	44.6	34.5	25.0	20.2	32.8

* -- GENERATED VALUES SIGNIFICANTLY DIFFERENT FROM OBSERVED VALUES AT 5% LEVEL BY t-test.

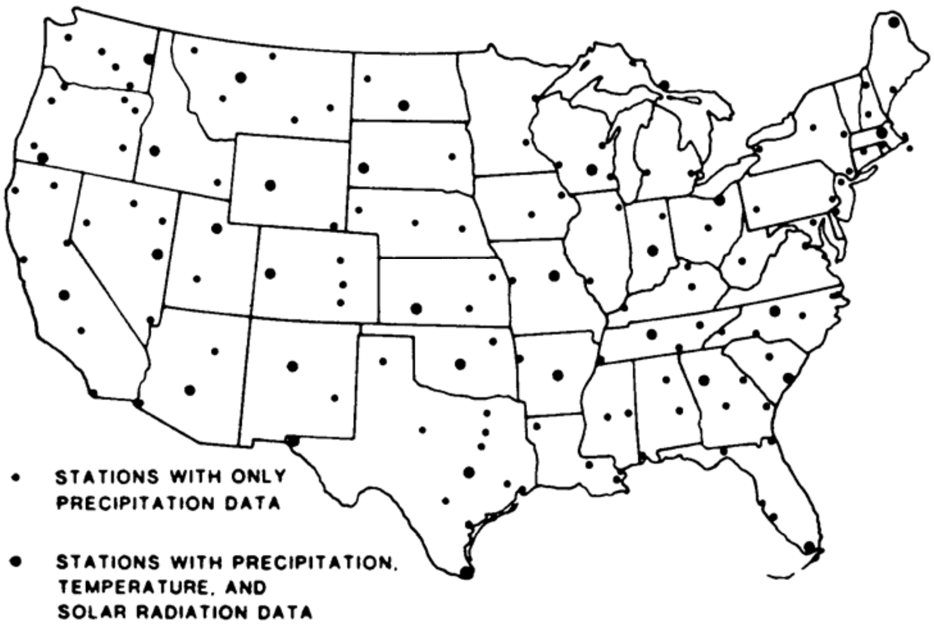


Figure 1. Location of stations used to define weather generation parameters.

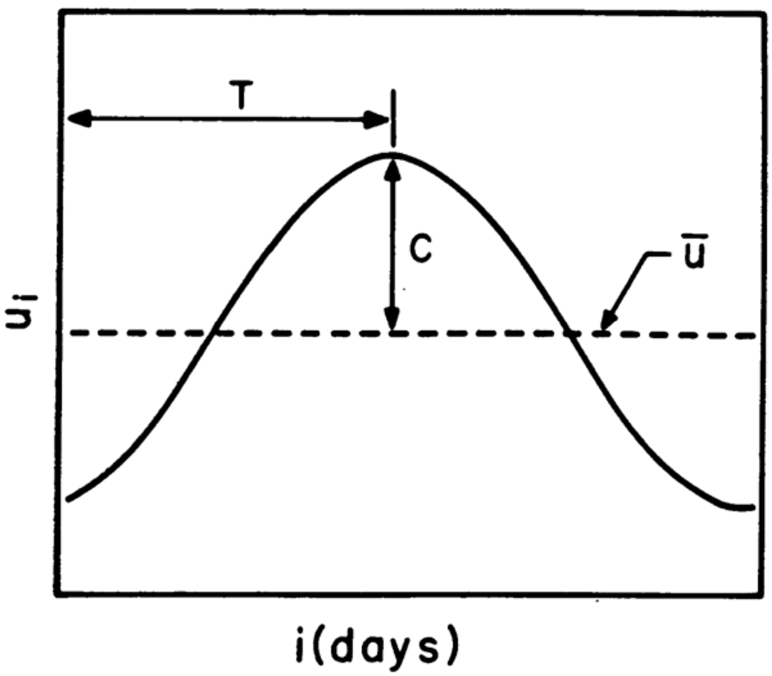
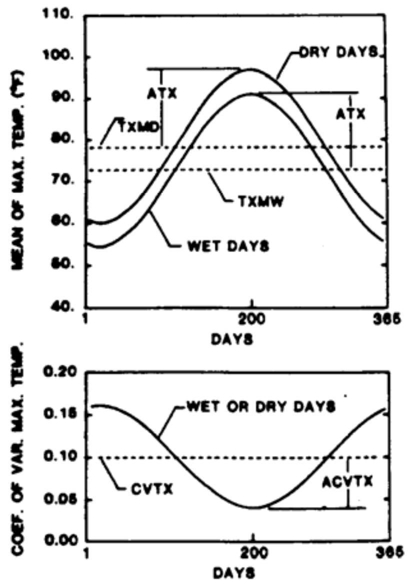
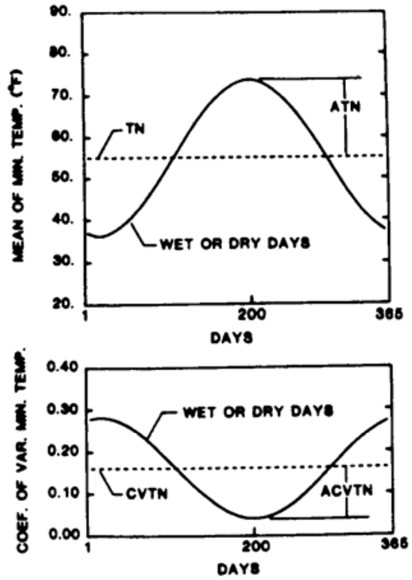


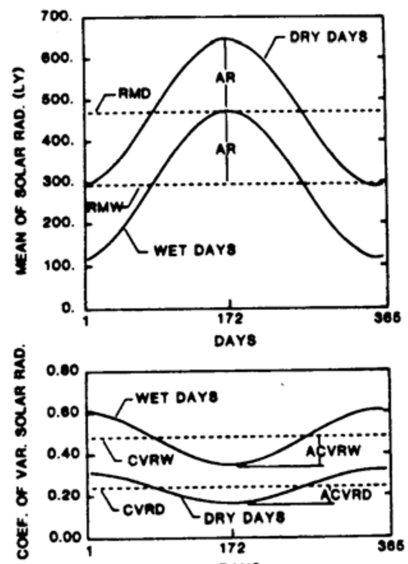
Figure 2. Definition of variables in seasonal description of temperature and solar radiation.



A, maximum temperature



B, minimum temperature



C, solar radiation

Figure 3. Definition of generation parameters for (A) maximum temperature, (B) minimum temperature, and (C) solar radiation.

APPENDIX A

Generation Parameters

TABLE A1. RAINFALL GENERATION PARAMETERS FOR LOCATIONS IN THE UNITED STATES.

STATION		RAINFALL GENERATION PARAMETERS											
		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
BIRMINGHAM, AL	P(W/W)	0.491	0.505	0.475	0.444	0.530	0.481	0.548	0.426	0.480	0.395	0.457	0.495
	P(W/D)	0.264	0.299	0.285	0.245	0.183	0.220	0.307	0.265	0.175	0.144	0.213	0.267
	ALPHA	0.643	0.640	0.648	0.712	0.675	0.626	0.802	0.660	0.676	0.630	0.715	0.647
	BETA	0.710	0.765	0.845	0.724	0.662	0.699	0.499	0.629	0.744	0.716	0.593	0.769
MOBILE, AL	P(W/W)	0.419	0.483	0.514	0.340	0.419	0.547	0.593	0.515	0.538	0.444	0.375	0.493
	P(W/D)	0.294	0.286	0.257	0.197	0.202	0.280	0.446	0.351	0.232	0.135	0.193	0.271
	ALPHA	0.577	0.629	0.556	0.512	0.644	0.623	0.713	0.686	0.548	0.645	0.613	0.624
	BETA	0.766	0.816	0.969	1.434	0.902	0.799	0.697	0.774	1.109	0.659	0.628	0.894
MONTGOMERY, AL	P(W/W)	0.447	0.456	0.435	0.380	0.475	0.457	0.436	0.408	0.514	0.444	0.348	0.471
	P(W/D)	0.269	0.289	0.262	0.219	0.185	0.220	0.317	0.264	0.166	0.117	0.175	0.279
	ALPHA	0.713	0.691	0.699	0.634	0.634	0.706	0.620	0.762	0.546	0.601	0.684	0.691
	BETA	0.525	0.680	0.786	0.852	0.681	0.589	0.648	0.408	1.179	0.767	0.619	0.687
FLAGSTAFF, AZ	P(W/W)	0.558	0.470	0.483	0.464	0.362	0.490	0.545	0.515	0.438	0.470	0.495	0.536
	P(W/D)	0.114	0.138	0.151	0.127	0.073	0.051	0.254	0.279	0.132	0.082	0.114	0.115
	ALPHA	0.895	0.889	0.854	0.945	0.983	0.592	0.826	0.782	0.659	0.811	0.689	0.729
	BETA	0.327	0.292	0.318	0.257	0.187	0.423	0.283	0.324	0.452	0.347	0.436	0.510
PHOENIX, AZ	P(W/W)	0.407	0.478	0.364	0.303	0.294	0.313	0.366	0.318	0.429	0.354	0.327	0.400
	P(W/D)	0.085	0.077	0.070	0.042	0.018	0.022	0.099	0.147	0.057	0.054	0.060	0.078
	ALPHA	0.825	0.822	0.998	0.883	0.899	0.629	0.752	0.650	0.532	0.680	0.917	0.746
	BETA	0.225	0.182	0.242	0.199	0.140	0.271	0.233	0.335	0.462	0.310	0.220	0.323
YUMA, AZ	P(W/W)	0.273	0.077	0.250	0.176	0.000	0.000	0.238	0.211	0.313	0.318	0.222	0.349
	P(W/D)	0.056	0.048	0.041	0.024	0.008	0.000	0.030	0.052	0.017	0.025	0.038	0.047
	ALPHA	0.841	0.763	0.998	0.517	0.802	0.000	0.637	0.670	0.394	0.686	0.624	0.882
	BETA	0.180	0.205	0.102	0.332	0.127	0.000	0.248	0.253	0.875	0.327	0.276	0.197
FORT SMITH, AR	P(W/W)	0.426	0.444	0.394	0.479	0.445	0.407	0.421	0.341	0.432	0.366	0.423	0.444
	P(W/D)	0.157	0.216	0.238	0.280	0.245	0.210	0.195	0.171	0.171	0.134	0.147	0.165
	ALPHA	0.655	0.701	0.719	0.709	0.658	0.632	0.590	0.650	0.752	0.625	0.638	0.719
	BETA	0.447	0.501	0.574	0.624	0.796	0.674	0.762	0.730	0.604	0.956	0.803	0.534
LITTLE ROCK, AR	P(W/W)	0.489	0.437	0.500	0.498	0.500	0.480	0.401	0.383	0.396	0.367	0.392	0.462
	P(W/D)	0.217	0.267	0.242	0.270	0.190	0.179	0.233	0.177	0.174	0.154	0.186	0.225
	ALPHA	0.619	0.681	0.790	0.686	0.554	0.651	0.703	0.581	0.624	0.659	0.633	0.665
	BETA	0.699	0.708	0.564	0.730	1.090	0.664	0.600	0.710	0.909	0.628	0.823	0.694
BAKERSFIELD, CA	P(W/W)	0.425	0.482	0.346	0.474	0.297	0.444	0.300	0.250	0.214	0.391	0.364	0.303
	P(W/D)	0.132	0.132	0.130	0.095	0.039	0.008	0.010	0.006	0.019	0.022	0.082	0.117
	ALPHA	0.966	0.827	0.845	0.822	0.841	0.805	0.800	0.796	0.893	0.967	0.999	0.913
	BETA	0.175	0.215	0.162	0.214	0.115	0.112	0.090	0.063	0.135	0.255	0.232	0.155

TABLE A1. CONTINUED.

RAINFALL GENERATION PARAMETERS

STATION		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
BLUE CANYON, CA	P(W/W)	0.731	0.678	0.663	0.631	0.556	0.488	0.067	0.296	0.370	0.437	0.628	0.710
	P(W/D)	0.208	0.213	0.231	0.184	0.155	0.073	0.025	0.032	0.054	0.090	0.200	0.174
	ALPHA	0.716	0.808	0.880	0.721	0.798	0.742	0.996	0.439	0.600	0.567	0.710	0.791
	BETA	1.597	1.053	0.798	0.777	0.463	0.350	0.070	0.615	0.456	1.694	1.188	1.432
EUREKA, CA	P(W/W)	0.754	0.693	0.724	0.615	0.518	0.398	0.122	0.306	0.397	0.529	0.691	0.718
	P(W/D)	0.331	0.265	0.261	0.209	0.167	0.128	0.064	0.058	0.095	0.177	0.272	0.266
	ALPHA	0.837	0.758	0.968	0.777	0.743	0.777	0.998	0.499	0.651	0.851	0.719	0.877
	BETA	0.556	0.506	0.331	0.359	0.295	0.150	0.050	0.289	0.275	0.379	0.622	0.510
FRESNO, CA	P(W/W)	0.509	0.519	0.393	0.477	0.340	0.158	0.050	0.050	0.154	0.286	0.484	0.475
	P(W/D)	0.172	0.156	0.140	0.105	0.056	0.024	0.010	0.010	0.017	0.034	0.098	0.154
	ALPHA	0.724	0.759	0.852	0.752	0.998	0.998	0.998	0.698	0.848	0.862	0.827	0.755
	BETA	0.384	0.333	0.313	0.357	0.134	0.076	0.080	0.095	0.187	0.287	0.351	0.336
MT. SHASTA, CA	P(W/W)	0.718	0.675	0.646	0.591	0.563	0.466	0.258	0.378	0.386	0.490	0.628	0.689
	P(W/D)	0.233	0.211	0.206	0.154	0.137	0.101	0.042	0.049	0.049	0.097	0.200	0.185
	ALPHA	0.776	0.650	0.729	0.706	0.834	0.998	0.998	0.944	0.558	0.635	0.660	0.623
	BETA	0.724	0.782	0.461	0.471	0.284	0.182	0.150	0.188	0.607	0.593	0.842	0.962
SAN DIEGO, CA	P(W/W)	0.580	0.388	0.427	0.465	0.396	0.190	0.050	0.333	0.368	0.250	0.479	0.458
	P(W/D)	0.124	0.131	0.139	0.106	0.047	0.026	0.006	0.010	0.019	0.046	0.103	0.111
	ALPHA	0.683	0.659	0.737	0.734	0.867	0.998	0.998	0.617	0.847	0.578	0.785	0.708
	BETA	0.398	0.392	0.301	0.235	0.084	0.064	0.040	0.233	0.223	0.230	0.318	0.373
SAN FRANCISCO, CA	P(W/W)	0.662	0.602	0.566	0.515	0.429	0.250	0.091	0.238	0.280	0.385	0.587	0.680
	P(W/D)	0.225	0.193	0.203	0.121	0.063	0.042	0.016	0.030	0.028	0.090	0.168	0.166
	ALPHA	0.725	0.762	0.762	0.803	0.744	0.512	0.900	0.769	0.486	0.535	0.702	0.761
	BETA	0.550	0.385	0.338	0.329	0.199	0.254	0.150	0.083	0.420	0.478	0.423	0.487
COLORADO SPRINGS, CO	P(W/W)	0.333	0.400	0.467	0.456	0.530	0.487	0.521	0.559	0.423	0.424	0.366	0.329
	P(W/D)	0.098	0.123	0.173	0.159	0.232	0.235	0.400	0.253	0.140	0.111	0.098	0.087
	ALPHA	0.905	0.998	0.850	0.656	0.601	0.607	0.708	0.755	0.716	0.774	0.885	0.988
	BETA	0.077	0.068	0.114	0.264	0.361	0.380	0.300	0.278	0.302	0.224	0.141	0.070
DENVER, CO	P(W/W)	0.423	0.384	0.503	0.483	0.540	0.443	0.435	0.373	0.419	0.408	0.427	0.394
	P(W/D)	0.130	0.177	0.201	0.202	0.208	0.246	0.237	0.228	0.149	0.113	0.122	0.126
	ALPHA	0.781	0.853	0.790	0.655	0.611	0.637	0.634	0.600	0.693	0.690	0.948	0.988
	BETA	0.118	0.152	0.179	0.292	0.453	0.295	0.333	0.278	0.292	0.312	3.149	0.093
GRAND JUNCTION, CO	P(W/W)	0.407	0.410	0.388	0.404	0.476	0.427	0.318	0.384	0.391	0.475	0.385	0.344
	P(W/D)	0.173	0.183	0.179	0.168	0.107	0.086	0.114	0.184	0.136	0.107	0.127	0.169
	ALPHA	0.947	0.994	0.998	0.849	0.821	0.835	0.764	0.794	0.840	0.983	0.918	0.973
	BETA	0.096	0.089	0.093	0.128	0.150	0.155	0.121	0.189	0.176	0.172	0.131	0.099

TABLE A1. CONTINUED.

RAINFALL GENERATION PARAMETERS

STATION		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
PUEBLO, CO	P(W/W)	0.362	0.411	0.455	0.404	0.455	0.417	0.370	0.417	0.301	0.372	0.292	0.435
	P(W/D)	0.104	0.113	0.136	0.116	0.172	0.180	0.246	0.230	0.143	0.092	0.093	0.071
	ALPHA	0.935	0.998	0.966	0.634	0.650	0.693	0.720	0.615	0.661	0.719	0.939	0.928
	BETA	0.066	0.065	0.100	0.327	0.322	0.227	0.294	0.346	0.246	0.322	0.141	0.091
WINDSOR LOCKS, CT	P(W/W)	0.406	0.454	0.445	0.475	0.412	0.469	0.356	0.387	0.444	0.421	0.513	0.493
	P(W/D)	0.311	0.311	0.301	0.310	0.309	0.295	0.275	0.274	0.236	0.182	0.297	0.297
	ALPHA	0.780	0.650	0.755	0.689	0.725	0.667	0.702	0.594	0.556	0.641	0.687	0.694
	BETA	3.555	0.485	0.487	0.504	0.369	0.454	0.467	0.718	0.750	0.694	0.530	0.506
WILMINGTON, DE	P(W/W)	0.450	0.410	0.451	0.482	0.462	0.393	0.401	0.420	0.437	0.428	0.460	0.476
	P(W/D)	0.263	0.282	0.312	0.318	0.291	0.244	0.251	0.244	0.172	0.162	0.245	0.226
	ALPHA	0.783	0.727	0.732	0.771	0.692	0.674	0.578	0.684	0.592	0.667	0.699	0.746
	BETA	0.335	0.435	0.468	0.377	0.364	0.537	0.774	0.655	0.852	0.550	0.514	0.494
DISTRICT OF COLUMBIA	P(W/W)	0.424	0.415	0.452	0.478	0.455	0.377	0.400	0.441	0.406	0.394	0.361	0.410
	P(W/D)	0.265	0.254	0.303	0.276	0.260	0.269	0.243	0.231	0.179	0.162	0.242	0.244
	ALPHA	0.834	0.811	0.828	0.789	0.751	0.622	0.581	0.607	0.635	0.628	0.731	0.679
	BETA	0.299	0.384	0.387	0.383	0.423	0.604	0.793	0.810	0.645	0.610	0.478	0.508
JACKSONVILLE, FL	P(W/W)	0.401	0.398	0.408	0.320	0.477	0.564	0.555	0.584	0.598	0.505	0.330	0.370
	P(W/D)	0.212	0.253	0.190	0.172	0.181	0.294	0.391	0.342	0.320	0.200	0.157	0.191
	ALPHA	0.677	0.731	0.626	0.670	0.586	0.651	0.676	0.613	0.622	0.545	0.665	0.677
	BETA	0.486	0.670	0.693	0.676	0.770	0.800	0.706	0.926	0.795	0.869	0.419	0.500
MIAMI, FL	P(W/W)	0.328	0.364	0.286	0.345	0.597	0.631	0.624	0.599	0.697	0.650	0.359	0.360
	P(W/D)	0.182	0.173	0.174	0.160	0.196	0.413	0.382	0.422	0.401	0.319	0.196	0.142
	ALPHA	0.622	0.634	0.662	0.611	0.601	0.679	0.707	0.635	0.631	0.549	0.549	0.562
	BETA	0.553	0.577	0.513	0.735	1.091	0.914	0.559	0.657	0.799	1.027	0.680	0.533
TALLAHASSEE, FL	P(W/W)	0.387	0.433	0.404	0.379	0.483	0.573	0.633	0.577	0.500	0.437	0.344	0.387
	P(W/D)	0.241	0.286	0.225	0.187	0.206	0.304	0.496	0.329	0.254	0.110	0.163	0.219
	ALPHA	0.744	0.696	0.628	0.591	0.722	0.652	0.670	0.745	0.555	0.656	0.625	0.696
	BETA	0.583	0.830	0.973	0.901	0.628	0.836	0.727	0.665	1.288	0.903	0.768	0.780
TAMPA, FL	P(W/W)	0.309	0.409	0.397	0.370	0.359	0.568	0.602	0.583	0.553	0.438	0.327	0.267
	P(W/D)	0.180	0.201	0.169	0.118	0.169	0.270	0.436	0.474	0.350	0.178	0.132	0.181
	ALPHA	0.669	0.719	0.631	0.687	0.578	0.655	0.624	0.701	0.632	0.672	0.641	0.687
	BETA	0.526	0.634	0.951	0.621	0.758	0.713	0.811	0.668	0.719	0.490	0.646	0.497
ATLANTA, GA	P(W/W)	0.502	0.490	0.433	0.426	0.462	0.473	0.548	0.437	0.490	0.561	0.385	0.468
	P(W/D)	0.261	0.291	0.286	0.247	0.188	0.258	0.318	0.208	0.163	0.119	0.207	0.258
	ALPHA	0.718	0.727	0.689	0.723	0.728	0.765	0.681	0.711	0.661	0.622	0.668	0.743
	BETA	0.566	0.618	0.734	0.717	0.613	0.453	0.571	0.561	0.671	0.627	0.621	0.589

TABLE A1. CONTINUED.

RAINFALL GENERATION PARAMETERS

STATION		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
AUGUSTA, GA	P(W/W)	0.477	0.434	0.473	0.436	0.503	0.492	0.532	0.437	0.458	0.482	0.414	0.456
	P(W/D)	0.232	0.290	0.253	0.220	0.183	0.227	0.271	0.233	0.180	0.113	0.165	0.220
	ALPHA	0.733	0.797	0.689	0.637	0.754	0.813	0.614	0.641	0.694	0.643	0.618	0.738
	BETA	0.528	0.537	0.654	0.657	0.556	0.511	0.696	0.695	0.632	0.558	0.463	0.489
MACON, GA	P(W/W)	0.468	0.519	0.478	0.398	0.524	0.472	0.559	0.502	0.503	0.492	0.370	0.442
	P(W/D)	0.250	0.283	0.263	0.214	0.182	0.257	0.340	0.239	0.184	0.118	0.176	0.248
	ALPHA	0.701	0.799	0.666	0.632	0.597	0.637	0.692	0.751	0.623	0.594	0.734	0.756
	BETA	0.527	0.559	0.710	0.693	0.730	0.630	0.511	0.472	0.631	0.653	0.437	0.580
SAVANNAH, GA	P(W/W)	0.439	0.417	0.418	0.321	0.452	0.551	0.577	0.551	0.502	0.463	0.375	0.331
	P(W/D)	0.229	0.283	0.251	0.194	0.203	0.264	0.394	0.292	0.244	0.131	0.158	0.215
	ALPHA	0.737	0.718	0.710	0.712	0.626	0.689	0.671	0.653	0.622	0.582	0.600	0.795
	BETA	0.456	0.499	0.602	0.623	0.861	0.775	0.798	0.823	0.825	0.692	0.474	0.434
BOISE, ID	P(W/W)	0.595	0.559	0.459	0.406	0.476	0.464	0.250	0.353	0.370	0.389	0.534	0.543
	P(W/D)	0.317	0.235	0.223	0.211	0.196	0.150	0.053	0.063	0.083	0.152	0.213	0.271
	ALPHA	0.846	0.920	0.998	0.841	0.740	0.854	0.826	0.676	0.801	0.998	0.998	0.883
	BETA	0.148	0.115	0.101	0.180	0.211	0.176	0.113	0.202	0.159	0.115	0.139	0.128
POCATELLO, ID	P(W/W)	0.511	0.524	0.479	0.380	0.508	0.509	0.286	0.360	0.353	0.370	0.450	0.548
	P(W/D)	0.289	0.253	0.230	0.213	0.194	0.169	0.095	0.107	0.099	0.110	0.194	0.259
	ALPHA	0.949	0.998	0.998	0.998	0.794	0.824	0.850	0.706	0.836	0.884	0.987	0.992
	BETA	0.097	0.080	0.082	0.145	0.167	0.185	0.111	0.199	0.146	0.165	0.111	0.090
CHICAGO, IL	P(W/W)	0.430	0.430	0.485	0.559	0.441	0.458	0.437	0.357	0.455	0.456	0.460	0.483
	P(W/D)	0.291	0.285	0.330	0.332	0.293	0.288	0.270	0.202	0.214	0.193	0.236	0.274
	ALPHA	0.681	0.782	0.705	0.733	0.783	0.692	0.602	0.689	0.718	0.640	0.735	0.666
	BETA	0.251	0.206	0.297	0.424	0.357	0.548	0.735	0.652	0.500	0.537	0.325	0.280
EVANSVILLE, IN	P(W/W)	0.467	0.457	0.485	0.483	0.493	0.459	0.455	0.393	0.418	0.446	0.440	0.490
	P(W/D)	0.242	0.276	0.288	0.336	0.252	0.243	0.263	0.181	0.170	0.166	0.214	0.260
	ALPHA	0.673	0.725	0.622	0.669	0.697	0.676	0.743	0.654	0.629	0.659	0.707	0.648
	BETA	0.479	0.472	0.635	0.509	0.608	0.508	0.517	0.593	0.604	0.504	0.507	0.528
FORT WAYNE, IN	P(W/W)	0.496	0.463	0.552	0.535	0.502	0.493	0.439	0.393	0.424	0.434	0.461	0.498
	P(W/D)	0.326	0.309	0.359	0.389	0.305	0.253	0.297	0.217	0.238	0.202	0.277	0.313
	ALPHA	0.667	0.676	0.743	0.781	0.830	0.838	0.713	0.762	0.758	0.653	0.830	0.668
	BETA	0.280	0.294	0.275	0.346	0.385	0.435	0.489	0.467	0.359	0.525	0.313	0.279
INDIANAPOLIS, IN	P(W/W)	0.466	0.462	0.496	0.543	0.513	0.421	0.406	0.358	0.415	0.428	0.412	0.518
	P(W/D)	0.291	0.277	0.344	0.332	0.304	0.266	0.273	0.218	0.192	0.175	0.259	0.291
	ALPHA	0.630	0.692	0.688	0.749	0.845	0.671	0.746	0.753	0.646	0.689	0.733	0.669
	BETA	0.387	0.362	0.423	0.430	0.390	0.578	0.582	0.437	0.580	0.507	0.461	0.375

TABLE A1. CONTINUED.

RAINFALL GENERATION PARAMETERS

STATION		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
DES MOINES, IA	P(W/W)	0.391	0.397	0.490	0.466	0.455	0.489	0.367	0.393	0.444	0.389	0.403	0.384
	P(W/D)	0.205	0.212	0.255	0.317	0.286	0.295	0.257	0.252	0.238	0.183	0.141	0.200
	ALPHA	0.762	0.821	0.698	0.713	0.681	0.664	0.697	0.693	0.691	0.661	0.536	0.831
	BETA	0.157	0.172	0.302	0.370	0.572	0.567	0.530	0.552	0.499	0.409	0.469	0.149
DUBUQUE, IA	P(W/W)	0.411	0.396	0.483	0.472	0.478	0.475	0.405	0.395	0.422	0.475	0.391	0.444
	P(W/D)	0.234	0.212	0.269	0.326	0.301	0.286	0.298	0.219	0.237	0.184	0.173	0.248
	ALPHA	0.722	0.804	0.814	0.802	0.733	0.752	0.673	0.752	0.644	0.746	0.595	0.744
	BETA	0.227	0.201	0.344	0.484	0.558	0.564	0.674	0.680	0.795	0.528	0.633	0.266
DODGE CITY, KS	P(W/W)	0.287	0.305	0.397	0.402	0.484	0.492	0.421	0.441	0.442	0.425	0.411	0.384
	P(W/D)	0.109	0.138	0.150	0.157	0.233	0.213	0.247	0.209	0.144	0.096	0.074	0.103
	ALPHA	0.927	0.795	0.660	0.733	0.670	0.750	0.709	0.616	0.591	0.592	0.783	0.819
	BETA	0.096	0.138	0.296	0.294	0.500	0.453	0.485	0.454	0.521	0.500	0.191	0.129
TOPEKA, KS	P(W/W)	0.336	0.301	0.480	0.471	0.460	0.471	0.442	0.381	0.419	0.419	0.388	0.342
	P(W/D)	0.151	0.186	0.172	0.243	0.293	0.294	0.228	0.215	0.202	0.147	0.123	0.154
	ALPHA	0.773	0.708	0.748	0.626	0.780	0.720	0.698	0.652	0.755	0.695	0.592	0.894
	BETA	0.169	0.234	0.343	0.543	0.441	0.740	0.685	0.698	0.551	0.560	0.469	0.232
WICHITA, KS	P(W/W)	0.500	0.316	0.462	0.419	0.393	0.577	0.433	0.357	0.412	0.231	0.400	0.250
	P(W/D)	0.060	0.212	0.194	0.322	0.246	0.188	0.254	0.292	0.123	0.137	0.157	0.111
	ALPHA	0.621	0.734	0.524	0.551	0.690	0.786	0.640	0.989	0.724	0.998	0.609	0.858
	BETA	0.256	0.256	0.666	0.503	0.640	0.628	0.634	0.304	0.639	0.416	0.461	0.232
COVINGTON, KY	P(W/W)	0.492	0.477	0.487	0.561	0.561	0.467	0.393	0.418	0.397	0.416	0.480	0.515
	P(W/D)	0.326	0.332	0.380	0.343	0.265	0.259	0.283	0.211	0.198	0.197	0.289	0.309
	ALPHA	0.655	0.708	0.603	0.696	0.794	0.672	0.763	0.648	0.797	0.719	0.680	0.684
	BETA	0.405	0.378	0.501	0.388	0.411	0.527	0.589	0.459	0.420	0.400	0.403	0.356
LEXINGTON, KY	P(W/W)	0.496	0.489	0.502	0.520	0.500	0.526	0.430	0.394	0.441	0.400	0.459	0.478
	P(W/D)	0.317	0.345	0.356	0.353	0.292	0.273	0.312	0.245	0.176	0.194	0.267	0.321
	ALPHA	0.630	0.751	0.652	0.647	0.680	0.778	0.734	0.631	0.666	0.725	0.708	0.678
	BETA	0.464	0.396	0.577	0.478	0.535	0.507	0.560	0.603	0.587	0.363	0.462	0.447
LOUISVILLE, KY	P(W/W)	0.472	0.466	0.484	0.512	0.547	0.513	0.449	0.379	0.420	0.383	0.439	0.486
	P(W/D)	0.301	0.323	0.355	0.331	0.256	0.222	0.297	0.201	0.182	0.188	0.257	0.291
	ALPHA	0.662	0.709	0.645	0.664	0.723	0.680	0.743	0.692	0.648	0.752	0.628	0.653
	BETA	0.447	0.453	0.586	0.497	0.489	0.549	0.463	0.576	0.664	0.435	0.517	0.469
BATON ROUGE, LA	P(W/W)	0.381	0.466	0.398	0.376	0.506	0.531	0.560	0.452	0.416	0.376	0.305	0.464
	P(W/D)	0.251	0.267	0.220	0.182	0.180	0.194	0.363	0.279	0.219	0.121	0.180	0.255
	ALPHA	0.654	0.664	0.645	0.582	0.652	0.811	0.700	0.767	0.721	0.617	0.712	0.725
	BETA	0.684	0.832	0.739	1.311	0.804	0.452	0.712	0.568	0.580	0.836	0.742	0.706

TABLE A1. CONTINUED.

RAINFALL GENERATION PARAMETERS

STATION		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
NEW ORLEANS, LA	P(W/W)	0.409	0.458	0.404	0.343	0.439	0.483	0.576	0.536	0.495	0.433	0.369	0.449
	P(W/D)	0.253	0.279	0.227	0.197	0.191	0.258	0.368	0.329	0.237	0.130	0.168	0.274
	ALPHA	0.575	0.615	0.570	0.604	0.660	0.691	0.705	0.642	0.646	0.694	0.593	0.633
	BETA	0.865	0.903	0.871	0.935	0.870	0.641	0.684	0.670	0.846	0.571	0.825	0.803
SHREVEPORT, LA	P(W/W)	0.497	0.434	0.436	0.430	0.488	0.497	0.375	0.375	0.444	0.376	0.429	0.480
	P(W/D)	0.221	0.237	0.248	0.245	0.186	0.154	0.187	0.163	0.163	0.131	0.205	0.222
	ALPHA	0.625	0.699	0.729	0.665	0.668	0.578	0.607	0.527	0.663	0.713	0.652	0.645
	BETA	0.599	0.621	0.514	0.875	0.834	0.868	0.637	0.759	0.740	0.583	0.692	0.704
CARIBOU, ME	P(W/W)	0.516	0.518	0.539	0.508	0.531	0.472	0.500	0.508	0.473	0.498	0.573	0.527
	P(W/D)	0.409	0.368	0.315	0.318	0.332	0.376	0.424	0.367	0.361	0.316	0.389	0.379
	ALPHA	0.779	0.826	0.756	0.808	0.858	0.782	0.719	0.682	0.609	0.676	0.788	0.720
	BETA	0.192	0.217	0.227	0.264	0.248	0.318	0.385	0.438	0.487	0.400	0.304	0.280
PORTLAND, ME	P(W/W)	0.442	0.422	0.475	0.536	0.473	0.451	0.361	0.364	0.416	0.484	0.515	0.493
	P(W/D)	0.295	0.341	0.281	0.310	0.321	0.310	0.261	0.299	0.234	0.229	0.308	0.299
	ALPHA	0.765	0.672	0.716	0.717	0.714	0.651	0.724	0.708	0.631	0.603	0.691	0.670
	BETA	0.413	0.540	0.490	0.421	0.370	0.423	0.402	0.384	0.597	0.614	0.605	0.566
BALTIMORE, MD	P(W/W)	0.446	0.411	0.504	0.502	0.447	0.392	0.333	0.458	0.421	0.365	0.414	0.407
	P(W/D)	0.263	0.264	0.293	0.319	0.277	0.260	0.243	0.247	0.180	0.164	0.251	0.244
	ALPHA	0.791	0.791	0.713	0.698	0.707	0.631	0.592	0.617	0.530	0.698	0.653	0.737
	BETA	0.334	0.430	0.462	0.419	0.418	0.639	0.771	0.746	0.817	0.599	0.548	0.491
BOSTON, MA	P(W/W)	0.460	0.476	0.500	0.511	0.461	0.443	0.402	0.401	0.375	0.454	0.523	0.456
	P(W/D)	0.333	0.359	0.315	0.302	0.313	0.305	0.248	0.286	0.252	0.229	0.307	0.294
	ALPHA	0.689	0.618	0.662	0.720	0.670	0.680	0.663	0.582	0.562	0.607	0.601	0.679
	BETA	0.456	0.564	0.558	0.474	0.469	0.427	0.448	0.637	0.709	0.596	0.653	0.640
NANTUCKET, MA	P(W/W)	0.498	0.443	0.445	0.483	0.412	0.355	0.316	0.397	0.461	0.448	0.527	0.500
	P(W/D)	0.353	0.369	0.352	0.316	0.281	0.223	0.218	0.255	0.212	0.214	0.319	0.344
	ALPHA	0.763	0.697	0.723	0.699	0.652	0.660	0.636	0.644	0.571	0.665	0.660	0.718
	BETA	0.415	0.538	0.488	0.465	0.507	0.402	0.603	0.656	0.727	0.591	0.545	0.493
DETROIT, MI	P(W/W)	0.496	0.465	0.500	0.527	0.463	0.455	0.357	0.352	0.450	0.468	0.493	0.510
	P(W/D)	0.351	0.329	0.335	0.332	0.313	0.289	0.241	0.225	0.221	0.180	0.262	0.351
	ALPHA	0.695	0.775	0.772	0.741	0.684	0.776	0.713	0.704	0.778	0.672	0.743	0.651
	BETA	0.211	0.203	0.231	0.339	0.345	0.388	0.475	0.528	0.335	0.440	0.289	0.261
GRAND RAPIDS, MI	P(W/W)	0.661	0.510	0.554	0.534	0.469	0.408	0.391	0.382	0.438	0.476	0.578	0.624
	P(W/D)	0.362	0.392	0.352	0.333	0.278	0.288	0.252	0.218	0.276	0.230	0.295	0.373
	ALPHA	0.802	0.788	0.762	0.772	0.706	0.699	0.756	0.757	0.646	0.673	0.727	0.805
	BETA	0.153	0.157	0.228	0.373	0.379	0.514	0.438	0.462	0.508	0.451	0.322	0.173

TABLE A1. CONTINUED.

RAINFALL GENERATION PARAMETERS

STATION		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
DULUTH, MN	P(W/W)	0.528	0.463	0.474	0.498	0.546	0.506	0.439	0.444	0.509	0.524	0.559	0.574
	P(W/D)	0.291	0.272	0.269	0.291	0.342	0.324	0.307	0.324	0.298	0.212	0.239	0.296
	ALPHA	0.819	0.798	0.676	0.713	0.723	0.700	0.701	0.635	0.716	0.688	0.618	0.730
	BETA	0.114	0.113	0.225	0.320	0.349	0.478	0.487	0.511	0.395	0.330	0.266	0.159
MINNEAPOLIS, MN	P(W/W)	0.416	0.414	0.419	0.407	0.502	0.496	0.361	0.383	0.455	0.431	0.407	0.447
	P(W/D)	0.221	0.188	0.275	0.283	0.321	0.331	0.304	0.266	0.252	0.182	0.198	0.247
	ALPHA	0.826	0.730	0.670	0.785	0.751	0.760	0.627	0.732	0.771	0.642	0.675	0.826
	BETA	0.103	0.170	0.263	0.268	0.372	0.419	0.620	0.492	0.359	0.392	0.224	0.117
COLUMBIA, MO	P(W/W)	0.412	0.405	0.456	0.477	0.445	0.473	0.454	0.340	0.415	0.403	0.353	0.424
	P(W/D)	0.181	0.224	0.274	0.309	0.279	0.279	0.243	0.205	0.199	0.182	0.163	0.208
	ALPHA	0.643	0.712	0.695	0.816	0.803	0.677	0.706	0.662	0.612	0.585	0.735	0.750
	BETA	0.315	0.318	0.359	0.374	0.503	0.596	0.605	0.565	0.805	0.745	0.368	0.275
KANSAS CITY, MO	P(W/W)	0.364	0.304	0.438	0.485	0.439	0.450	0.393	0.443	0.448	0.464	0.357	0.381
	P(W/D)	0.157	0.216	0.215	0.260	0.305	0.284	0.235	0.203	0.214	0.156	0.135	0.166
	ALPHA	0.727	0.713	0.682	0.754	0.687	0.786	0.672	0.646	0.662	0.695	0.553	0.859
	BETA	0.259	0.288	0.440	0.454	0.580	0.654	0.783	0.736	0.780	0.633	0.521	0.238
ST. LOUIS, MO	P(W/W)	0.405	0.384	0.477	0.487	0.476	0.487	0.438	0.375	0.426	0.387	0.440	0.453
	P(W/D)	0.195	0.254	0.276	0.328	0.273	0.243	0.224	0.201	0.190	0.184	0.193	0.218
	ALPHA	0.753	0.670	0.725	0.814	0.716	0.664	0.674	0.735	0.796	0.813	0.692	0.753
	BETA	0.281	0.392	0.363	0.392	0.473	0.642	0.623	0.437	0.434	0.417	0.431	0.306
JACKSON, MS	P(W/W)	0.516	0.454	0.458	0.364	0.539	0.450	0.451	0.394	0.429	0.396	0.389	0.488
	P(W/D)	0.262	0.287	0.258	0.267	0.170	0.205	0.289	0.246	0.174	0.126	0.217	0.267
	ALPHA	0.636	0.758	0.670	0.657	0.684	0.673	0.759	0.623	0.540	0.551	0.652	0.679
	BETA	0.605	0.573	0.720	0.840	0.775	0.598	0.516	0.630	0.843	0.749	0.661	0.725
MERIDIAN, MS	P(W/W)	0.411	0.441	0.414	0.399	0.434	0.412	0.456	0.402	0.429	0.436	0.317	0.439
	P(W/D)	0.260	0.281	0.244	0.224	0.174	0.199	0.290	0.243	0.171	0.108	0.195	0.252
	ALPHA	0.812	0.786	0.764	0.835	0.800	0.874	0.783	0.740	0.753	0.590	0.836	0.853
	BETA	0.530	0.622	0.766	0.702	0.599	0.523	0.571	0.569	0.583	0.815	0.543	0.698
BILLINGS, MT	P(W/W)	0.442	0.500	0.439	0.475	0.544	0.491	0.328	0.376	0.414	0.307	0.347	0.489
	P(W/D)	0.198	0.184	0.241	0.233	0.270	0.314	0.177	0.170	0.165	0.160	0.166	0.139
	ALPHA	0.998	0.998	0.845	0.775	0.740	0.728	0.662	0.743	0.753	0.768	0.732	0.911
	BETA	0.094	0.095	0.130	0.267	0.261	0.290	0.189	0.218	0.241	0.191	0.181	0.111
GREAT FALLS, MT	P(W/W)	0.526	0.490	0.478	0.490	0.523	0.564	0.383	0.457	0.428	0.393	0.453	0.481
	P(W/D)	0.210	0.211	0.207	0.245	0.269	0.297	0.177	0.162	0.169	0.129	0.156	0.178
	ALPHA	0.923	0.913	0.998	0.738	0.675	0.692	0.818	0.731	0.787	0.914	0.899	0.988
	BETA	0.113	0.111	0.104	0.193	0.339	0.356	0.201	0.223	0.184	0.151	0.132	0.092

TABLE A1. CONTINUED.

RAINFALL GENERATION PARAMETERS

STATION		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
HAVRE, MT	P(W/W)	0.503	0.481	0.317	0.449	0.457	0.500	0.433	0.424	0.433	0.273	0.394	0.453
	P(W/D)	0.189	0.162	0.169	0.183	0.237	0.308	0.154	0.152	0.163	0.138	0.130	0.144
	ALPHA	0.998	0.998	0.998	0.883	0.747	0.712	0.781	0.669	0.752	0.765	0.940	0.988
	BETA	0.062	0.061	0.065	0.179	0.226	0.292	0.271	0.274	0.206	0.166	0.095	0.065
HELENA, MT	P(W/W)	0.429	0.328	0.421	0.373	0.498	0.573	0.381	0.361	0.446	0.331	0.390	0.481
	P(W/D)	0.215	0.184	0.200	0.249	0.260	0.266	0.180	0.207	0.147	0.159	0.185	0.183
	ALPHA	0.998	0.982	0.843	0.805	0.726	0.891	0.883	0.804	0.844	0.802	0.866	0.988
	BETA	0.070	0.071	0.106	0.143	0.232	0.213	0.152	0.175	0.142	0.134	0.095	0.075
KALISPELL, MT	P(W/W)	0.658	0.567	0.539	0.429	0.518	0.563	0.310	0.510	0.525	0.540	0.525	0.570
	P(W/D)	0.383	0.309	0.249	0.250	0.264	0.310	0.145	0.164	0.197	0.217	0.322	0.431
	ALPHA	0.998	0.998	0.998	0.834	0.862	0.807	0.829	0.798	0.866	0.968	0.857	0.921
	BETA	0.100	0.083	0.073	0.135	0.185	0.248	0.186	0.219	0.163	0.114	0.132	0.110
MILES CITY, MT	P(W/W)	0.444	0.467	0.385	0.488	0.507	0.491	0.344	0.386	0.460	0.324	0.355	0.497
	P(W/D)	0.212	0.193	0.200	0.213	0.262	0.309	0.230	0.166	0.146	0.135	0.159	0.168
	ALPHA	0.998	0.988	0.958	0.869	0.741	0.744	0.666	0.699	0.797	0.848	0.861	0.998
	BETA	0.063	0.077	0.084	0.182	0.265	0.346	0.294	0.242	0.186	0.122	0.114	0.074
GRAND ISLAND, NE	P(W/W)	0.409	0.422	0.413	0.514	0.474	0.500	0.353	0.383	0.441	0.308	0.250	0.287
	P(W/D)	0.108	0.181	0.178	0.204	0.278	0.259	0.271	0.221	0.188	0.113	0.109	0.120
	ALPHA	0.841	0.795	0.745	0.645	0.724	0.745	0.668	0.647	0.650	0.885	0.780	0.676
	BETA	0.120	0.155	0.224	0.441	0.478	0.546	0.476	0.501	0.471	0.263	0.159	0.202
ELKO, NV	P(W/W)	0.467	0.533	0.420	0.476	0.532	0.547	0.310	0.354	0.250	0.338	0.496	0.489
	P(W/D)	0.224	0.216	0.212	0.163	0.176	0.130	0.095	0.091	0.083	0.080	0.146	0.220
	ALPHA	0.797	0.928	0.958	0.905	0.960	0.809	0.828	0.565	0.779	0.738	0.998	0.921
	BETA	0.164	0.091	0.108	0.115	0.117	0.189	0.114	0.310	0.131	0.193	0.124	0.134
LAS VEGAS, NV	P(W/W)	0.271	0.311	0.346	0.250	0.211	0.071	0.275	0.161	0.258	0.300	0.333	0.356
	P(W/D)	0.061	0.065	0.055	0.048	0.025	0.022	0.067	0.082	0.040	0.041	0.056	0.047
	ALPHA	0.808	0.921	0.802	0.749	0.727	0.669	0.672	0.543	0.629	0.799	0.605	0.826
	BETA	0.200	0.125	0.149	0.182	0.157	0.245	0.263	0.340	0.313	0.155	0.380	0.162
RENO, NV	P(W/W)	0.496	0.454	0.380	0.349	0.414	0.386	0.294	0.420	0.297	0.250	0.500	0.484
	P(W/D)	0.138	0.113	0.135	0.101	0.101	0.074	0.067	0.049	0.044	0.046	0.093	0.138
	ALPHA	0.728	0.748	0.838	0.721	0.663	0.942	0.998	0.900	0.960	0.701	0.813	0.718
	BETA	0.275	0.258	0.150	0.182	0.253	0.138	0.095	0.107	0.158	0.233	0.166	0.265
WINNEMULLA, NV	P(W/W)	0.467	0.426	0.443	0.351	0.448	0.554	0.243	0.289	0.340	0.385	0.496	0.473
	P(W/D)	0.198	0.177	0.153	0.146	0.147	0.113	0.053	0.052	0.058	0.087	0.149	0.193
	ALPHA	0.928	0.961	0.998	0.786	0.899	0.718	0.787	0.759	0.783	0.761	0.998	0.930
	BETA	0.123	0.115	0.094	0.172	0.138	0.224	0.106	0.192	0.142	0.179	0.123	0.119

TABLE A1. CONTINUED.

RAINFALL GENERATION PARAMETERS

STATION		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
CONCORD, NH	P(W/W)	0.405	0.396	0.459	0.441	0.463	0.457	0.368	0.403	0.409	0.422	0.494	0.461
	P(W/D)	0.300	0.307	0.295	0.321	0.317	0.296	0.298	0.295	0.241	0.211	0.333	0.293
	ALPHA	0.774	0.800	0.809	0.873	0.763	0.723	0.741	0.654	0.718	0.710	0.701	0.670
	BETA	0.314	0.347	0.320	0.317	0.322	0.385	0.407	0.469	0.507	0.516	0.473	0.475
MT. WASHINGTON, NH	P(W/W)	0.648	0.673	0.724	0.710	0.632	0.628	0.616	0.638	0.634	0.646	0.726	0.714
	P(W/D)	0.524	0.569	0.441	0.436	0.397	0.439	0.473	0.416	0.409	0.313	0.495	0.537
	ALPHA	0.789	0.619	0.735	0.822	0.794	0.972	0.849	0.893	0.787	0.808	0.734	0.695
	BETA	0.390	0.727	0.463	0.391	0.470	0.407	0.494	0.520	0.536	0.551	0.551	0.561
ALBUQUERQUE, NM	P(W/W)	0.263	0.392	0.346	0.264	0.346	0.412	0.395	0.429	0.320	0.378	0.339	0.350
	P(W/D)	0.080	0.090	0.095	0.073	0.094	0.077	0.253	0.240	0.129	0.090	0.070	0.093
	ALPHA	0.840	0.998	0.964	0.712	0.699	0.718	0.744	0.804	0.836	0.739	0.998	0.858
	BETA	0.112	0.101	0.124	0.205	0.139	0.213	0.209	0.191	0.182	0.294	0.111	0.156
ALBANY, NY	P(W/W)	0.456	0.441	0.471	0.519	0.516	0.461	0.391	0.358	0.360	0.425	0.474	0.494
	P(W/D)	0.360	0.365	0.331	0.331	0.336	0.310	0.303	0.322	0.254	0.210	0.340	0.339
	ALPHA	0.755	0.683	0.747	0.708	0.673	0.741	0.695	0.705	0.672	0.709	0.788	0.673
	BETA	0.232	0.294	0.323	0.333	0.372	0.337	0.386	0.399	0.556	0.462	0.312	0.358
BUFFALO, NY	P(W/W)	0.704	0.658	0.613	0.595	0.483	0.397	0.363	0.446	0.480	0.555	0.630	0.699
	P(W/D)	0.578	0.485	0.421	0.409	0.339	0.276	0.283	0.300	0.270	0.239	0.412	0.533
	ALPHA	0.779	0.728	0.752	0.783	0.757	0.785	0.719	0.754	0.728	0.711	0.824	0.751
	BETA	0.188	0.203	0.236	0.270	0.316	0.307	0.419	0.461	0.407	0.374	0.287	0.205
NEW YORK, NY	P(W/W)	0.464	0.446	0.466	0.471	0.443	0.416	0.381	0.358	0.399	0.396	0.479	0.473
	P(W/D)	0.302	0.296	0.325	0.354	0.314	0.271	0.245	0.297	0.217	0.191	0.283	0.299
	ALPHA	0.739	0.671	0.683	0.650	0.664	0.765	0.627	0.583	0.667	0.608	0.683	0.658
	BETA	0.328	0.492	0.509	0.494	0.413	0.380	0.628	0.768	0.579	0.682	0.514	0.481
SYRACUSE, NY	P(W/W)	0.655	0.657	0.631	0.583	0.510	0.413	0.445	0.399	0.467	0.532	0.608	0.674
	P(W/D)	0.494	0.487	0.415	0.388	0.350	0.301	0.284	0.308	0.262	0.266	0.425	0.561
	ALPHA	0.893	0.778	0.736	0.800	0.783	0.735	0.715	0.722	0.805	0.824	0.806	0.840
	BETA	0.161	0.222	0.244	0.267	0.280	0.378	0.417	0.479	0.325	0.324	0.256	0.186
NORTH PLATTE, NE	P(W/W)	0.292	0.377	0.344	0.448	0.498	0.453	0.377	0.314	0.435	0.351	0.309	0.268
	P(W/D)	0.126	0.151	0.167	0.179	0.255	0.273	0.270	0.227	0.154	0.117	0.108	0.112
	ALPHA	0.845	0.750	0.731	0.683	0.700	0.635	0.769	0.676	0.705	0.704	0.813	0.785
	BETA	0.094	0.137	0.190	0.343	0.466	0.640	0.401	0.388	0.408	0.282	0.131	0.126
SCOTTSBLUFF, NE	P(W/W)	0.326	0.396	0.390	0.474	0.555	0.529	0.335	0.323	0.446	0.363	0.286	0.354
	P(W/D)	0.122	0.133	0.192	0.189	0.269	0.312	0.240	0.171	0.147	0.112	0.112	0.129
	ALPHA	0.998	0.998	0.877	0.858	0.715	0.699	0.676	0.789	0.600	0.720	0.868	0.998
	BETA	0.069	0.065	0.114	0.196	0.343	0.398	0.334	0.184	0.279	0.233	0.100	0.084

TABLE A1. CONTINUED.

RAINFALL GENERATION PARAMETERS

STATION		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
ASHEVILLE, NC	P(W/W)	0.448	0.507	0.519	0.520	0.535	0.498	0.551	0.542	0.532	0.582	0.450	0.492
	P(W/D)	0.265	0.302	0.344	0.296	0.265	0.296	0.358	0.279	0.184	0.158	0.221	0.239
	ALPHA	0.690	0.786	0.700	0.670	0.772	0.779	0.818	0.676	0.628	0.672	0.670	0.645
	BETA	0.378	0.382	0.445	0.452	0.319	0.398	0.282	0.491	0.630	0.485	0.425	0.435
CHARLOTTE, NC	P(W/W)	0.463	0.498	0.515	0.465	0.472	0.371	0.495	0.490	0.345	0.523	0.361	0.395
	P(W/D)	0.235	0.287	0.272	0.245	0.205	0.283	0.289	0.223	0.161	0.133	0.189	0.246
	ALPHA	0.752	0.900	0.728	0.751	0.844	0.766	0.679	0.695	0.652	0.688	0.765	0.634
	BETA	0.487	0.438	0.546	0.514	0.392	0.503	0.498	0.614	0.741	0.524	0.480	0.602
GREENSBORO, NC	P(W/W)	0.435	0.500	0.516	0.442	0.502	0.495	0.519	0.539	0.476	0.479	0.436	0.434
	P(W/D)	0.255	0.281	0.264	0.279	0.232	0.266	0.301	0.244	0.167	0.158	0.199	0.202
	ALPHA	0.739	0.819	0.803	0.725	0.721	0.646	0.694	0.643	0.535	0.562	0.697	0.713
	BETA	0.459	0.437	0.426	0.465	0.389	0.628	0.500	0.647	0.768	0.769	0.450	0.581
RALEIGH, NC	P(W/W)	0.416	0.508	0.465	0.433	0.442	0.459	0.521	0.480	0.431	0.400	0.418	0.425
	P(W/D)	0.251	0.258	0.261	0.247	0.247	0.236	0.264	0.243	0.147	0.150	0.201	0.204
	ALPHA	0.722	0.808	0.873	0.844	0.797	0.732	0.770	0.620	0.729	0.722	0.755	0.850
	BETA	0.485	0.454	0.390	0.405	0.428	0.541	0.571	0.813	0.643	0.592	0.473	0.434
BISMARCK, ND	P(W/W)	0.354	0.393	0.372	0.477	0.480	0.519	0.412	0.330	0.344	0.363	0.445	0.437
	P(W/D)	0.227	0.188	0.205	0.187	0.261	0.328	0.249	0.277	0.200	0.112	0.139	0.197
	ALPHA	0.998	0.935	0.803	0.704	0.698	0.673	0.690	0.626	0.755	0.822	0.828	0.998
	BETA	0.066	0.074	0.100	0.250	0.328	0.422	0.336	0.321	0.226	0.158	0.108	0.062
WILLISTON, ND	P(W/W)	0.409	0.374	0.349	0.397	0.469	0.480	0.396	0.297	0.383	0.364	0.393	0.469
	P(W/D)	0.227	0.204	0.206	0.187	0.189	0.322	0.240	0.205	0.176	0.119	0.155	0.169
	ALPHA	0.998	0.998	0.998	0.731	0.728	0.689	0.644	0.644	0.664	0.733	0.998	0.998
	BETA	0.071	0.077	0.065	0.251	0.287	0.360	0.345	0.326	0.274	0.179	0.081	0.067
NEWARK, NJ	P(W/W)	0.437	0.398	0.470	0.463	0.473	0.407	0.448	0.432	0.426	0.378	0.450	0.461
	P(W/D)	0.300	0.313	0.316	0.330	0.297	0.278	0.254	0.260	0.211	0.189	0.299	0.292
	ALPHA	0.781	0.763	0.704	0.738	0.719	0.736	0.630	0.616	0.600	0.691	0.720	0.738
	BETA	0.311	0.419	0.501	0.434	0.397	0.377	0.604	0.681	0.659	0.584	0.449	0.421
CLEVELAND, OH	P(W/W)	0.598	0.606	0.583	0.584	0.506	0.438	0.395	0.384	0.429	0.505	0.613	0.626
	P(W/D)	0.470	0.452	0.432	0.404	0.319	0.290	0.292	0.267	0.252	0.244	0.352	0.419
	ALPHA	0.702	0.781	0.780	0.811	0.794	0.769	0.639	0.691	0.823	0.775	0.748	0.762
	BETA	0.219	0.179	0.235	0.302	0.331	0.379	0.520	0.455	0.348	0.324	0.267	0.197
COLUMBUS, OH	P(W/W)	0.504	0.480	0.516	0.545	0.500	0.463	0.391	0.350	0.418	0.423	0.509	0.502
	P(W/D)	0.339	0.359	0.384	0.360	0.328	0.276	0.323	0.230	0.216	0.205	0.288	0.329
	ALPHA	0.683	0.757	0.664	0.788	0.754	0.733	0.720	0.822	0.766	0.879	0.740	0.739
	BETA	0.325	0.263	0.359	0.358	0.423	0.489	0.543	0.419	0.377	0.252	0.309	0.267

TABLE A1. CONTINUED.

RAINFALL GENERATION PARAMETERS

STATION		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TOLEDO, OH	P(W/W)	0.534	0.450	0.515	0.520	0.519	0.459	0.392	0.364	0.433	0.431	0.505	0.521
	P(W/D)	0.350	0.326	0.364	0.366	0.287	0.252	0.260	0.229	0.251	0.186	0.279	0.363
	ALPHA	0.656	0.752	0.724	0.745	0.802	0.763	0.716	0.737	0.755	0.674	0.759	0.640
	BETA	0.240	0.228	0.251	0.305	0.313	0.434	0.504	0.508	0.321	0.381	0.287	0.283
OKLAHOMA CITY, OK	P(W/W)	0.370	0.415	0.450	0.399	0.492	0.447	0.407	0.328	0.360	0.374	0.424	0.396
	P(W/D)	0.123	0.172	0.179	0.197	0.217	0.205	0.175	0.190	0.190	0.117	0.100	0.125
	ALPHA	0.703	0.744	0.669	0.660	0.632	0.664	0.707	0.696	0.608	0.638	0.616	0.644
	BETA	0.247	0.255	0.387	0.638	0.873	0.696	0.572	0.551	0.880	0.867	0.529	0.351
TULSA, OK	P(W/W)	0.404	0.438	0.414	0.461	0.483	0.413	0.422	0.326	0.399	0.427	0.392	0.422
	P(W/D)	0.146	0.184	0.205	0.231	0.260	0.217	0.186	0.171	0.193	0.133	0.146	0.165
	ALPHA	0.711	0.757	0.672	0.707	0.658	0.647	0.591	0.662	0.638	0.582	0.605	0.625
	BETA	0.301	0.307	0.494	0.630	0.662	0.757	0.909	0.662	0.816	0.912	0.547	0.382
BURNS, OR	P(W/W)	0.566	0.519	0.545	0.438	0.468	0.433	0.255	0.352	0.339	0.508	0.596	0.606
	P(W/D)	0.353	0.223	0.233	0.178	0.180	0.157	0.067	0.082	0.072	0.127	0.201	0.243
	ALPHA	0.910	0.890	0.998	0.927	0.986	0.930	0.868	0.792	0.657	0.738	0.998	0.897
	BETA	0.152	0.142	0.096	0.107	0.126	0.139	0.148	0.164	0.263	0.203	0.146	0.168
MEACHUM, OR	P(W/W)	0.737	0.729	0.713	0.663	0.610	0.556	0.299	0.536	0.521	0.633	0.721	0.716
	P(W/D)	0.484	0.331	0.311	0.291	0.270	0.216	0.080	0.100	0.129	0.194	0.298	0.371
	ALPHA	0.844	0.900	0.998	0.919	0.920	0.838	0.816	0.688	0.792	0.801	0.927	0.906
	BETA	0.279	0.232	0.184	0.210	0.192	0.224	0.172	0.269	0.304	0.307	0.272	0.281
MEDFORD, OR	P(W/W)	0.655	0.557	0.588	0.534	0.538	0.452	0.344	0.367	0.318	0.529	0.627	0.657
	P(W/D)	0.361	0.269	0.236	0.189	0.174	0.111	0.036	0.053	0.086	0.159	0.273	0.281
	ALPHA	0.703	0.608	0.876	0.946	0.791	0.985	0.579	0.998	0.724	0.678	0.692	0.654
	BETA	0.346	0.344	0.174	0.111	0.190	0.138	0.296	0.153	0.248	0.337	0.345	0.422
PENDLETON, OR	P(W/W)	0.571	0.535	0.485	0.434	0.452	0.364	0.232	0.391	0.383	0.462	0.521	0.551
	P(W/D)	0.353	0.247	0.250	0.249	0.179	0.163	0.067	0.078	0.108	0.174	0.275	0.369
	ALPHA	0.966	0.977	0.998	0.938	0.874	0.843	0.957	0.932	0.913	0.813	0.933	0.909
	BETA	0.134	0.111	0.100	0.108	0.163	0.145	0.096	0.111	0.149	0.156	0.139	0.119
SALEM, OR	P(W/W)	0.791	0.728	0.750	0.638	0.611	0.555	0.404	0.494	0.507	0.659	0.776	0.755
	P(W/D)	0.411	0.341	0.293	0.304	0.215	0.151	0.045	0.086	0.148	0.233	0.339	0.427
	ALPHA	0.866	0.763	0.964	0.867	0.998	0.776	0.826	0.829	0.722	0.866	0.833	0.827
	BETA	0.435	0.380	0.270	0.198	0.172	0.221	0.148	0.157	0.296	0.337	0.380	0.434
PORTLAND, OR	P(W/W)	0.802	0.697	0.726	0.634	0.619	0.561	0.386	0.585	0.497	0.684	0.775	0.752
	P(W/D)	0.425	0.357	0.344	0.309	0.236	0.188	0.071	0.082	0.172	0.232	0.324	0.443
	ALPHA	0.830	0.840	0.998	0.945	0.853	0.854	0.788	0.843	0.790	0.962	0.869	0.879
	BETA	0.369	0.303	0.211	0.177	0.196	0.207	0.144	0.224	0.239	0.269	0.343	0.352

TABLE A1. CONTINUED.

RAINFALL GENERATION PARAMETERS

STATION		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
SEXT. SUMMIT, OR	P(W/W)	0.774	0.689	0.712	0.604	0.602	0.476	0.212	0.426	0.489	0.632	0.719	0.745
	P(W/D)	0.373	0.312	0.300	0.230	0.179	0.126	0.044	0.053	0.101	0.174	0.276	0.286
	ALPHA	0.730	0.712	0.887	0.835	0.776	0.890	0.819	0.749	0.745	0.729	0.694	0.731
	BETA	0.533	0.429	0.262	0.223	0.277	0.191	0.173	0.264	0.305	0.445	0.577	0.559
ROSWELL, NM	P(W/W)	0.314	0.352	0.358	0.286	0.329	0.307	0.408	0.421	0.384	0.531	0.360	0.359
	P(W/D)	0.063	0.097	0.072	0.056	0.091	0.117	0.197	0.173	0.125	0.078	0.053	0.070
	ALPHA	0.830	0.858	0.810	0.740	0.641	0.612	0.664	0.683	0.593	0.596	0.768	0.779
	BETA	0.196	0.160	0.170	0.233	0.274	0.330	0.330	0.331	0.367	0.432	0.176	0.183
PHILADELPHIA, PA	P(W/W)	0.464	0.393	0.438	0.459	0.437	0.395	0.372	0.421	0.407	0.381	0.441	0.478
	P(W/D)	0.268	0.295	0.298	0.313	0.275	0.272	0.246	0.256	0.185	0.171	0.257	0.255
	ALPHA	0.749	0.757	0.811	0.759	0.760	0.585	0.664	0.668	0.613	0.577	0.735	0.673
	BETA	0.342	0.388	0.442	0.405	0.365	0.684	0.665	0.615	0.746	0.678	0.467	0.502
PITTSBURGH, PA	P(W/W)	0.596	0.606	0.582	0.526	0.516	0.486	0.400	0.360	0.391	0.443	0.565	0.608
	P(W/D)	0.443	0.414	0.451	0.393	0.311	0.304	0.317	0.267	0.219	0.255	0.328	0.451
	ALPHA	0.751	0.836	0.731	0.847	0.772	0.733	0.728	0.651	0.723	0.695	0.841	0.765
	BETA	0.225	0.197	0.303	0.312	0.369	0.429	0.465	0.530	0.402	0.357	0.215	0.188
PROVIDENCE, RI	P(W/W)	0.422	0.461	0.453	0.484	0.445	0.465	0.354	0.372	0.400	0.405	0.495	0.450
	P(W/D)	0.336	0.323	0.321	0.298	0.301	0.297	0.256	0.304	0.211	0.208	0.292	0.329
	ALPHA	0.650	0.637	0.657	0.658	0.670	0.650	0.655	0.589	0.636	0.590	0.626	0.645
	BETA	0.477	0.568	0.562	0.549	0.451	0.371	0.491	0.640	0.683	0.735	0.633	0.592
CHARLESTON, SC	P(W/W)	0.438	0.448	0.478	0.377	0.443	0.569	0.539	0.520	0.481	0.472	0.383	0.404
	P(W/D)	0.244	0.268	0.265	0.194	0.205	0.259	0.381	0.310	0.231	0.134	0.171	0.222
	ALPHA	0.702	0.760	0.707	0.710	0.628	0.603	0.710	0.677	0.758	0.576	0.657	0.678
	BETA	0.478	0.506	0.604	0.551	0.749	0.941	0.840	0.753	0.684	0.894	0.437	0.501
COLUMBIA, SC	P(W/W)	0.492	0.477	0.481	0.449	0.417	0.446	0.515	0.502	0.462	0.529	0.392	0.416
	P(W/D)	0.227	0.283	0.262	0.227	0.206	0.246	0.290	0.260	0.162	0.112	0.168	0.229
	ALPHA	0.649	0.731	0.758	0.674	0.758	0.812	0.672	0.637	0.559	0.578	0.723	0.737
	BETA	0.612	0.559	0.593	0.634	0.581	0.475	0.676	0.837	1.031	0.824	0.473	0.507
HURON, SD	P(W/W)	0.333	0.445	0.379	0.457	0.485	0.465	0.358	0.360	0.368	0.433	0.368	0.331
	P(W/D)	0.171	0.167	0.189	0.252	0.263	0.324	0.261	0.254	0.176	0.114	0.134	0.169
	ALPHA	0.998	0.707	0.712	0.682	0.616	0.652	0.664	0.615	0.705	0.611	0.699	0.761
	BETA	0.055	0.181	0.185	0.300	0.426	0.514	0.388	0.391	0.322	0.419	0.175	0.127
RAPID CITY, SD	P(W/W)	0.370	0.503	0.444	0.518	0.519	0.557	0.394	0.338	0.362	0.360	0.382	0.411
	P(W/D)	0.156	0.200	0.222	0.233	0.306	0.317	0.239	0.208	0.167	0.103	0.157	0.155
	ALPHA	0.998	0.988	0.815	0.776	0.674	0.713	0.622	0.757	0.709	0.782	0.830	0.998
	BETA	0.064	0.088	0.130	0.263	0.346	0.378	0.390	0.251	0.250	0.201	0.098	0.070

TABLE A1. CONTINUED.

RAINFALL GENERATION PARAMETERS

STATION		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
CHATTANOOGA, TN	P(W/W)	0.513	0.517	0.489	0.493	0.473	0.465	0.541	0.457	0.443	0.489	0.453	0.453
	P(W/D)	0.268	0.295	0.289	0.270	0.228	0.264	0.263	0.240	0.201	0.154	0.217	0.263
	ALPHA	0.727	0.769	0.671	0.719	0.794	0.721	0.801	0.679	0.632	0.738	0.784	0.718
	BETA	0.623	0.612	0.725	0.635	0.457	0.464	0.481	0.502	0.732	0.519	0.572	0.733
KNOXVILLE, TN	P(W/W)	0.506	0.531	0.506	0.528	0.473	0.444	0.494	0.422	0.477	0.503	0.467	0.466
	P(W/D)	0.317	0.329	0.327	0.294	0.253	0.291	0.304	0.257	0.191	0.170	0.271	0.289
	ALPHA	0.747	0.774	0.737	0.759	0.916	0.720	0.778	0.681	0.732	0.729	0.731	0.664
	BETA	0.489	0.517	0.550	0.442	0.336	0.528	0.452	0.493	0.478	0.439	0.490	0.644
MEMPHIS, TN	P(W/W)	0.472	0.455	0.491	0.431	0.482	0.469	0.395	0.397	0.424	0.324	0.374	0.439
	P(W/D)	0.246	0.294	0.270	0.295	0.184	0.200	0.241	0.205	0.154	0.146	0.222	0.259
	ALPHA	0.645	0.753	0.755	0.729	0.717	0.755	0.698	0.620	0.658	0.657	0.715	0.686
	BETA	0.713	0.619	0.605	0.784	0.806	0.535	0.652	0.763	0.777	0.595	0.604	0.684
NASHVILLE, TN	P(W/W)	0.484	0.521	0.500	0.476	0.485	0.516	0.422	0.386	0.462	0.408	0.399	0.493
	P(W/D)	0.274	0.299	0.280	0.323	0.248	0.238	0.272	0.214	0.174	0.161	0.249	0.280
	ALPHA	0.655	0.835	0.705	0.763	0.743	0.718	0.705	0.751	0.647	0.738	0.805	0.721
	BETA	0.616	0.488	0.652	0.512	0.553	0.533	0.524	0.489	0.679	0.456	0.438	0.568
ABILENE, TX	P(W/W)	0.333	0.402	0.318	0.453	0.459	0.491	0.357	0.303	0.415	0.337	0.388	0.392
	P(W/D)	0.102	0.135	0.111	0.149	0.179	0.115	0.097	0.136	0.149	0.136	0.116	0.089
	ALPHA	0.603	0.796	0.864	0.741	0.676	0.633	0.637	0.587	0.609	0.611	0.707	0.700
	BETA	0.425	0.249	0.241	0.565	0.730	0.811	0.858	0.675	0.707	0.663	0.436	0.295
AMARILLO, TX	P(W/W)	0.313	0.353	0.326	0.376	0.443	0.448	0.464	0.373	0.303	0.477	0.419	0.365
	P(W/D)	0.081	0.117	0.121	0.107	0.212	0.207	0.203	0.203	0.147	0.090	0.061	0.092
	ALPHA	0.654	0.748	0.748	0.687	0.575	0.582	0.615	0.639	0.572	0.664	0.834	0.645
	BETA	0.214	0.173	0.240	0.352	0.560	0.753	0.546	0.560	0.564	0.479	0.214	0.237
AUSTIN, TX	P(W/W)	0.444	0.479	0.393	0.397	0.418	0.478	0.312	0.430	0.445	0.390	0.438	0.479
	P(W/D)	0.174	0.205	0.179	0.190	0.197	0.117	0.101	0.115	0.172	0.143	0.146	0.144
	ALPHA	0.601	0.555	0.632	0.613	0.571	0.611	0.547	0.643	0.637	0.550	0.593	0.556
	BETA	0.366	0.644	0.368	0.688	0.841	0.993	0.701	0.653	0.805	1.048	0.534	0.554
BROWNSVILLE, TX	P(W/W)	0.459	0.485	0.413	0.380	0.433	0.527	0.387	0.484	0.540	0.420	0.440	0.492
	P(W/D)	0.148	0.158	0.097	0.087	0.094	0.107	0.093	0.138	0.226	0.160	0.138	0.134
	ALPHA	0.614	0.469	0.646	0.517	0.535	0.586	0.615	0.628	0.579	0.507	0.623	0.559
	BETA	0.324	0.529	0.205	0.636	0.978	0.698	0.382	0.601	0.904	1.074	0.382	0.311
CORPUS CHRISTI, TX	P(W/W)	0.456	0.482	0.327	0.309	0.408	0.422	0.371	0.448	0.529	0.438	0.438	0.431
	P(W/D)	0.171	0.165	0.138	0.130	0.153	0.130	0.104	0.113	0.219	0.142	0.136	0.141
	ALPHA	0.483	0.547	0.635	0.453	0.581	0.560	0.562	0.597	0.565	0.553	0.636	0.544
	BETA	0.435	0.484	0.238	0.882	0.775	0.961	0.585	0.991	1.029	0.862	0.419	0.459

TABLE A1. CONTINUED.

RAINFALL GENERATION PARAMETERS

STATION		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
DALLAS, TX	P(W/W)	0.431	0.456	0.404	0.471	0.447	0.392	0.348	0.298	0.440	0.320	0.447	0.435
	P(W/D)	0.153	0.195	0.203	0.196	0.202	0.146	0.105	0.139	0.143	0.126	0.134	0.131
	ALPHA	0.750	0.653	0.612	0.673	0.632	0.713	0.568	0.581	0.667	0.525	0.652	0.661
	BETA	0.358	0.448	0.586	0.924	0.824	0.659	0.703	0.655	0.882	1.281	0.704	0.589
EL PASO, TX	P(W/W)	0.368	0.352	0.288	0.235	0.257	0.250	0.320	0.441	0.376	0.328	0.320	0.368
	P(W/D)	0.060	0.067	0.075	0.046	0.043	0.087	0.229	0.168	0.093	0.077	0.064	0.080
	ALPHA	0.988	0.911	0.817	0.658	0.709	0.694	0.645	0.716	0.558	0.827	0.890	0.976
	BETA	0.107	0.179	0.165	0.188	0.208	0.279	0.338	0.222	0.510	0.214	0.146	0.117
GALVESTON, TX	P(W/W)	0.383	0.436	0.341	0.311	0.407	0.468	0.453	0.462	0.574	0.424	0.425	0.436
	P(W/D)	0.232	0.251	0.186	0.172	0.141	0.141	0.162	0.206	0.175	0.131	0.156	0.221
	ALPHA	0.640	0.622	0.567	0.551	0.589	0.580	0.609	0.635	0.523	0.727	0.613	0.691
	BETA	0.509	0.566	0.513	0.806	0.838	1.029	0.853	0.805	1.357	0.629	0.718	0.651
HOUSTON, TX	P(W/W)	0.407	0.492	0.369	0.410	0.440	0.478	0.443	0.464	0.541	0.508	0.410	0.473
	P(W/D)	0.253	0.237	0.218	0.212	0.189	0.156	0.214	0.219	0.186	0.135	0.205	0.232
	ALPHA	0.558	0.564	0.507	0.485	0.565	0.585	0.594	0.581	0.645	0.545	0.584	0.626
	BETA	0.615	0.754	0.574	0.899	1.085	1.112	0.710	0.747	0.843	1.034	0.774	0.663
SAN ANTONIO, TX	P(W/W)	0.446	0.494	0.409	0.387	0.403	0.417	0.319	0.378	0.486	0.445	0.448	0.432
	P(W/D)	0.180	0.195	0.166	0.179	0.195	0.123	0.088	0.115	0.167	0.135	0.140	0.158
	ALPHA	0.521	0.604	0.502	0.545	0.592	0.562	0.495	0.566	0.689	0.600	0.577	0.606
	BETA	0.392	0.453	0.420	0.584	0.719	0.947	0.841	0.769	0.650	0.762	0.593	0.343
TEMPLE, TX	P(W/W)	0.507	0.451	0.399	0.477	0.448	0.407	0.333	0.365	0.448	0.421	0.547	0.482
	P(W/D)	0.149	0.213	0.176	0.178	0.193	0.133	0.079	0.118	0.161	0.125	0.127	0.151
	ALPHA	0.659	0.735	0.713	0.680	0.630	0.704	0.705	0.584	0.686	0.488	0.633	0.590
	BETA	0.428	0.454	0.360	0.663	0.816	0.677	0.593	0.831	0.695	1.308	0.616	0.563
WACO, TX	P(W/W)	0.397	0.424	0.417	0.414	0.429	0.416	0.344	0.386	0.455	0.337	0.425	0.414
	P(W/D)	0.148	0.210	0.166	0.203	0.188	0.138	0.072	0.111	0.138	0.123	0.142	0.133
	ALPHA	0.650	0.744	0.676	0.573	0.612	0.651	0.639	0.711	0.706	0.626	0.707	0.677
	BETA	0.415	0.387	0.446	0.838	1.014	0.699	0.493	0.546	0.776	0.858	0.580	0.470
MILFORD, UT	P(W/W)	0.364	0.400	0.497	0.442	0.412	0.403	0.344	0.392	0.313	0.408	0.364	0.441
	P(W/D)	0.151	0.200	0.156	0.153	0.099	0.079	0.119	0.147	0.100	0.078	0.111	0.131
	ALPHA	0.863	0.990	0.981	0.920	0.998	0.770	0.771	0.890	0.721	0.848	0.889	0.956
	BETA	0.122	0.105	0.133	0.159	0.133	0.185	0.154	0.112	0.267	0.175	0.169	0.112
SALT LAKE CITY, UT	P(W/W)	0.479	0.397	0.463	0.525	0.487	0.500	0.315	0.373	0.389	0.461	0.434	0.497
	P(W/D)	0.226	0.263	0.236	0.239	0.165	0.139	0.104	0.139	0.111	0.108	0.170	0.230
	ALPHA	0.854	0.881	0.911	0.799	0.853	0.734	0.635	0.638	0.696	0.702	0.821	0.879
	BETA	0.165	0.169	0.178	0.276	0.206	0.249	0.299	0.264	0.219	0.265	0.212	0.170

TABLE A1. CONTINUED.

RAINFALL GENERATION PARAMETERS

STATION		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
NORFOLK, VA	P(W/W)	0.477	0.470	0.429	0.442	0.445	0.435	0.535	0.484	0.478	0.453	0.412	0.405
	P(W/D)	0.246	0.289	0.316	0.301	0.242	0.228	0.266	0.272	0.184	0.174	0.223	0.226
	ALPHA	0.728	0.757	0.744	0.782	0.727	0.645	0.704	0.608	0.519	0.619	0.666	0.823
	BETA	0.493	0.446	0.426	0.331	0.477	0.617	0.647	0.934	1.044	0.713	0.508	0.452
RICHMOND, VA	P(W/W)	0.474	0.446	0.460	0.477	0.490	0.472	0.448	0.472	0.424	0.382	0.396	0.402
	P(W/D)	0.252	0.266	0.284	0.253	0.243	0.226	0.271	0.249	0.187	0.172	0.237	0.215
	ALPHA	0.770	0.843	0.816	0.825	0.734	0.646	0.642	0.607	0.642	0.623	0.620	0.751
	BETA	0.374	0.431	0.393	0.353	0.419	0.641	0.802	0.881	0.661	0.743	0.642	0.553
OLYMPIA, WA	P(W/W)	0.816	0.766	0.758	0.698	0.586	0.542	0.489	0.571	0.601	0.707	0.787	0.788
	P(W/D)	0.452	0.344	0.321	0.276	0.185	0.194	0.079	0.106	0.160	0.267	0.349	0.455
	ALPHA	0.848	0.862	0.998	0.917	0.998	0.796	0.998	0.753	0.848	0.863	0.800	0.851
	BETA	0.482	0.392	0.264	0.236	0.171	0.194	0.149	0.262	0.289	0.419	0.530	0.462
SPOKANE, WA	P(W/W)	0.648	0.600	0.542	0.409	0.469	0.400	0.240	0.388	0.395	0.479	0.584	0.621
	P(W/D)	0.361	0.269	0.239	0.225	0.202	0.200	0.099	0.121	0.154	0.184	0.278	0.386
	ALPHA	0.955	0.998	0.956	0.933	0.889	0.702	0.878	0.746	0.824	0.910	0.903	0.887
	BETA	0.181	0.143	0.139	0.135	0.161	0.242	0.131	0.173	0.135	0.168	0.199	0.178
STAMPEDE PASS, WA	P(W/W)	0.867	0.822	0.807	0.774	0.684	0.714	0.530	0.649	0.638	0.723	0.807	0.858
	P(W/D)	0.457	0.418	0.388	0.379	0.323	0.284	0.161	0.209	0.251	0.330	0.361	0.442
	ALPHA	0.858	0.772	0.889	0.809	0.846	0.785	0.822	0.775	0.701	0.874	0.824	0.797
	BETA	0.698	0.680	0.486	0.458	0.285	0.307	0.217	0.282	0.543	0.596	0.763	0.775
YAKIMA, WA	P(W/W)	0.553	0.574	0.423	0.360	0.337	0.290	0.182	0.296	0.245	0.368	0.470	0.493
	P(W/D)	0.229	0.126	0.126	0.110	0.126	0.124	0.044	0.069	0.073	0.114	0.188	0.229
	ALPHA	0.811	0.873	0.998	0.988	0.977	0.807	0.902	0.998	0.872	0.878	0.974	0.809
	BETA	0.175	0.134	0.118	0.119	0.105	0.177	0.106	0.093	0.127	0.117	0.131	0.161
WALLA WALLA, WA	P(W/W)	0.592	0.560	0.486	0.457	0.451	0.336	0.306	0.328	0.415	0.454	0.539	0.548
	P(W/D)	0.377	0.262	0.259	0.240	0.197	0.181	0.054	0.085	0.119	0.200	0.304	0.370
	ALPHA	0.878	0.880	0.897	0.878	0.766	0.780	0.671	0.778	0.860	0.702	0.855	0.822
	BETA	0.174	0.146	0.148	0.167	0.229	0.197	0.208	0.201	0.196	0.235	0.180	0.174
CHARLESTON, WV	P(W/W)	0.541	0.551	0.577	0.548	0.550	0.500	0.466	0.473	0.473	0.464	0.514	0.521
	P(W/D)	0.383	0.395	0.397	0.395	0.314	0.264	0.369	0.249	0.213	0.222	0.279	0.384
	ALPHA	0.741	0.730	0.761	0.828	0.747	0.827	0.680	0.683	0.780	0.693	0.850	0.746
	BETA	0.315	0.344	0.364	0.304	0.365	0.351	0.598	0.547	0.398	0.380	0.289	0.300
GREEN BAY, WI	P(W/W)	0.400	0.393	0.495	0.493	0.471	0.487	0.398	0.405	0.426	0.467	0.425	0.420
	P(W/D)	0.282	0.217	0.262	0.271	0.339	0.298	0.273	0.267	0.293	0.196	0.223	0.286
	ALPHA	0.821	0.822	0.808	0.781	0.718	0.734	0.688	0.787	0.728	0.724	0.754	0.825
	BETA	0.130	0.159	0.180	0.346	0.362	0.407	0.509	0.342	0.454	0.365	0.252	0.150

TABLE A1. CONTINUED.

RAINFALL GENERATION PARAMETERS

STATION		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
LACROSSE, WI	P(W/W)	0.320	0.410	0.425	0.406	0.515	0.448	0.359	0.412	0.465	0.403	0.414	0.413
	P(W/D)	0.233	0.161	0.272	0.274	0.296	0.308	0.287	0.245	0.242	0.204	0.178	0.221
	ALPHA	0.838	0.778	0.723	0.791	0.862	0.728	0.732	0.816	0.722	0.793	0.662	0.874
	BETA	0.127	0.158	0.264	0.362	0.356	0.554	0.555	0.437	0.516	0.345	0.310	0.131
MADISON, WI	P(W/W)	0.392	0.409	0.468	0.487	0.522	0.452	0.380	0.369	0.432	0.471	0.419	0.455
	P(W/D)	0.284	0.204	0.292	0.322	0.287	0.297	0.282	0.256	0.245	0.204	0.219	0.218
	ALPHA	0.794	0.751	0.783	0.709	0.713	0.695	0.655	0.689	0.631	0.688	0.654	0.767
	BETA	0.137	0.170	0.220	0.350	0.408	0.568	0.616	0.544	0.549	0.413	0.329	0.214
MILWAUKEE, WI	P(W/W)	0.481	0.449	0.466	0.506	0.463	0.509	0.398	0.410	0.464	0.475	0.414	0.466
	P(W/D)	0.288	0.260	0.299	0.349	0.313	0.285	0.288	0.226	0.240	0.206	0.243	0.269
	ALPHA	0.661	0.756	0.711	0.759	0.800	0.670	0.635	0.650	0.638	0.670	0.692	0.695
	BETA	0.208	0.167	0.281	0.323	0.297	0.486	0.584	0.525	0.472	0.390	0.323	0.239
CHEYENNE, WY	P(W/W)	0.360	0.414	0.489	0.527	0.597	0.488	0.425	0.373	0.444	0.386	0.398	0.343
	P(W/D)	0.125	0.176	0.225	0.206	0.251	0.282	0.293	0.255	0.159	0.123	0.133	0.131
	ALPHA	0.998	0.924	0.833	0.864	0.749	0.689	0.742	0.737	0.735	0.794	0.942	0.967
	BETA	0.064	0.071	0.117	0.159	0.283	0.302	0.219	0.222	0.214	0.191	0.091	0.065

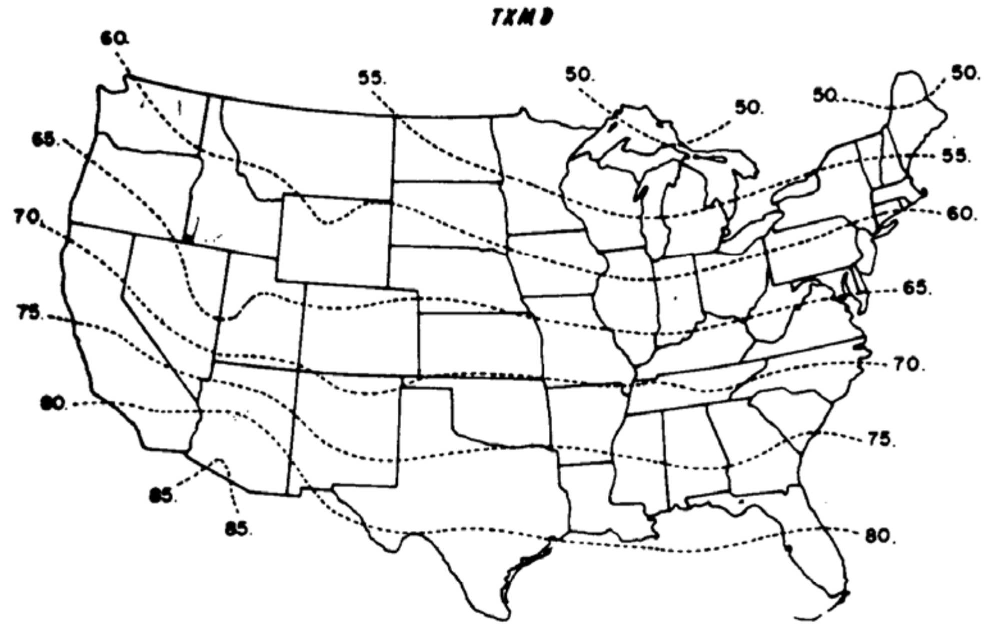


Figure A1. Distribution of the mean of t_{max} for dry days (TXMD), °F.

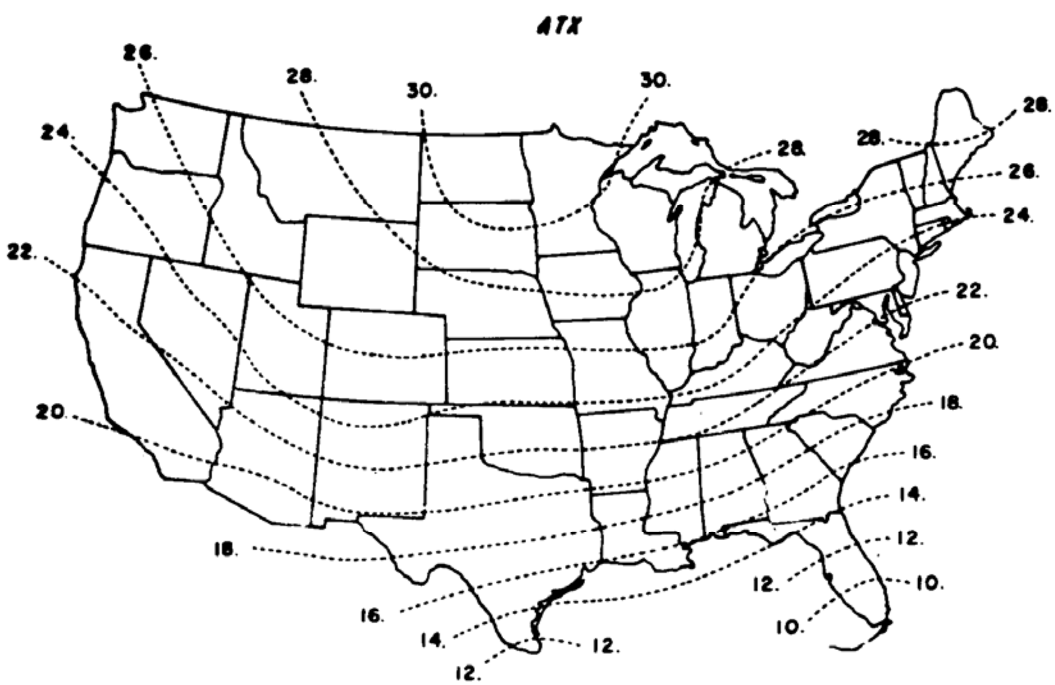


Figure A2. Distribution of the amplitude to t_{max} for wet or dry days (ATX), °F.

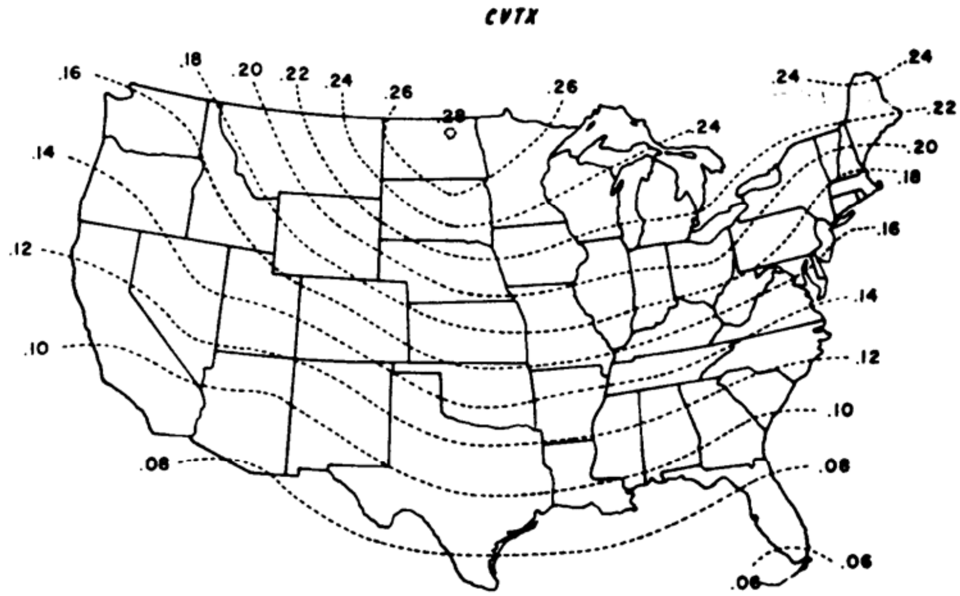


Figure A3. Distribution of the mean of the coefficient of variation of t_{max} for wet or dry days (CVTX).

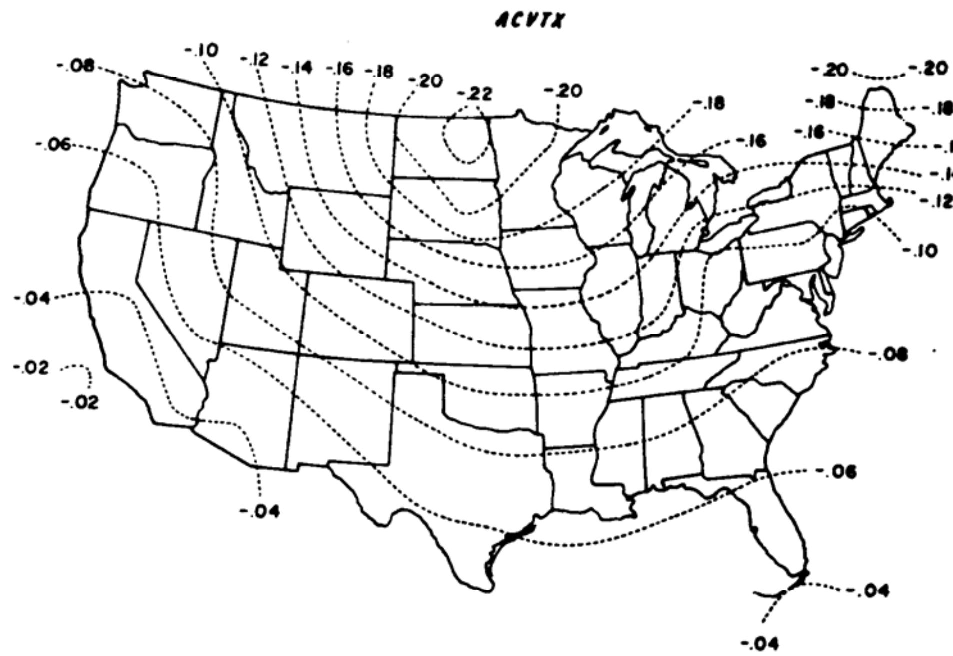


Figure A4. Distribution of the amplitude of the coefficient of variation of t_{max} for wet or dry days (ACVTX).

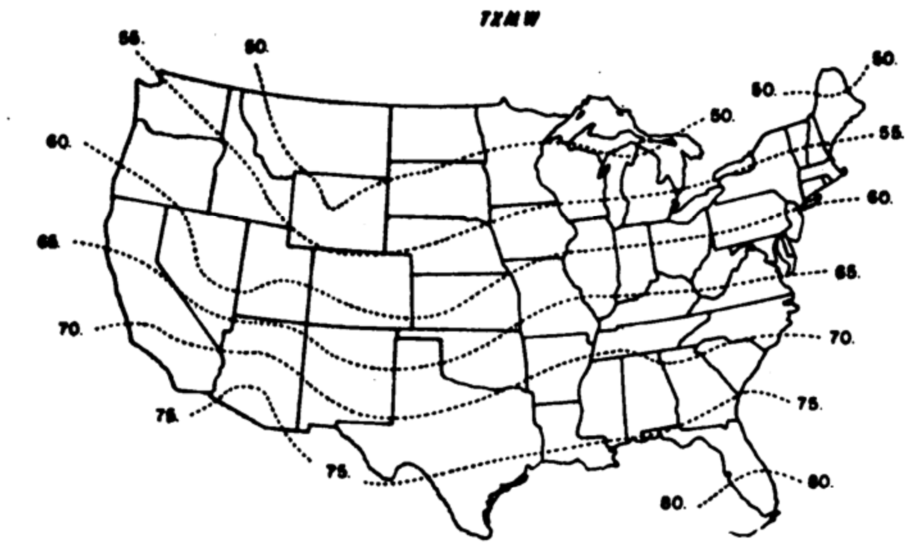


Figure A5. Distribution of the mean of t_{max} for wet days (TXMW), °F.

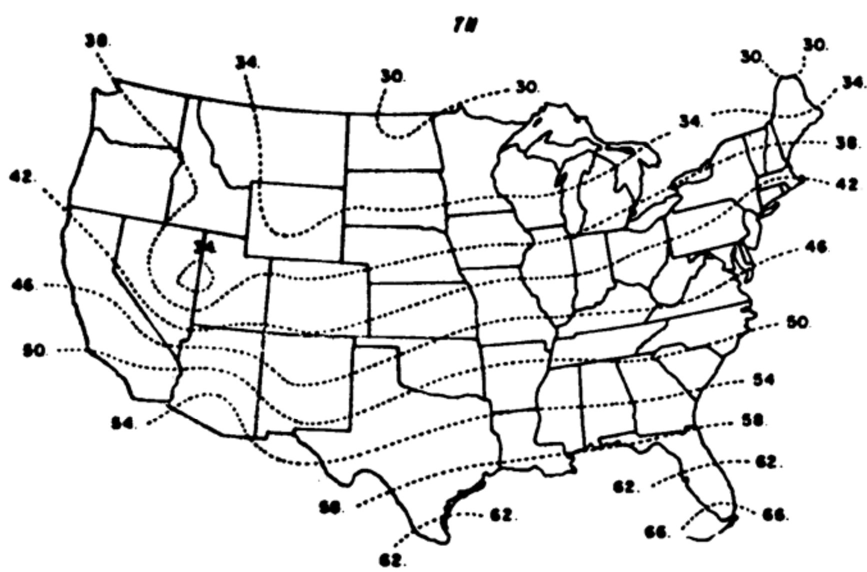


Figure A6. Distribution of the mean of t_{min} for wet or dry days (TN), °F.

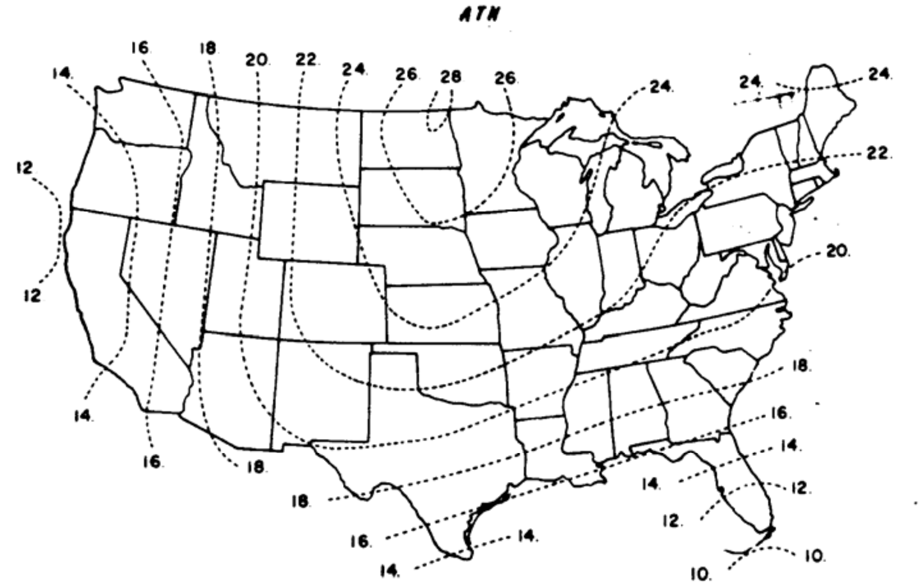


Figure A7. Distribution of the amplitude ot t_{min} for wet or dry days (ATN), °F.

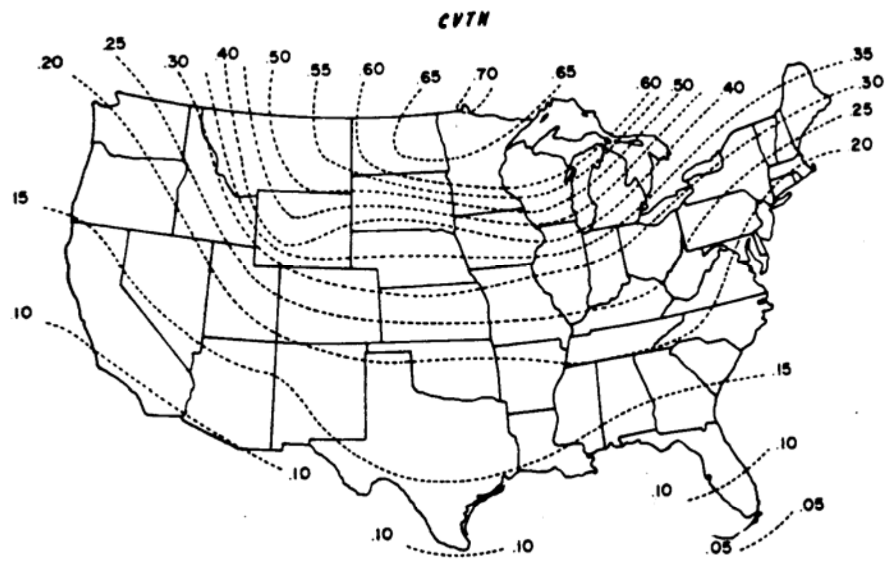


Figure A8. Distribution of the mean of the coefficient of variation of t_{min} for wet or dry days (CVTN).

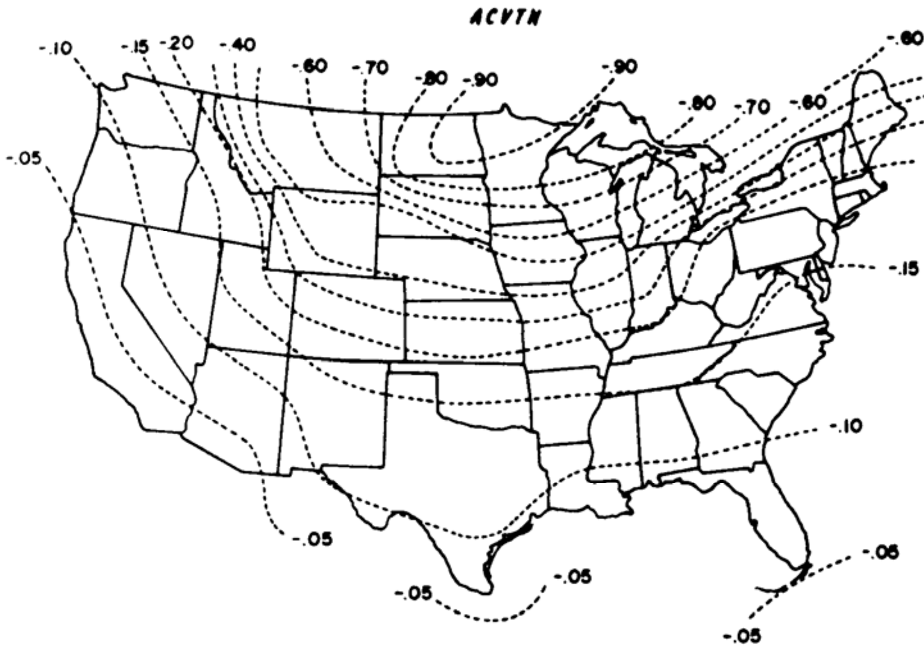


Figure A9. Distribution of the amplitude of the coefficient of variation of t_{min} for wet or dry days (ACVTN).

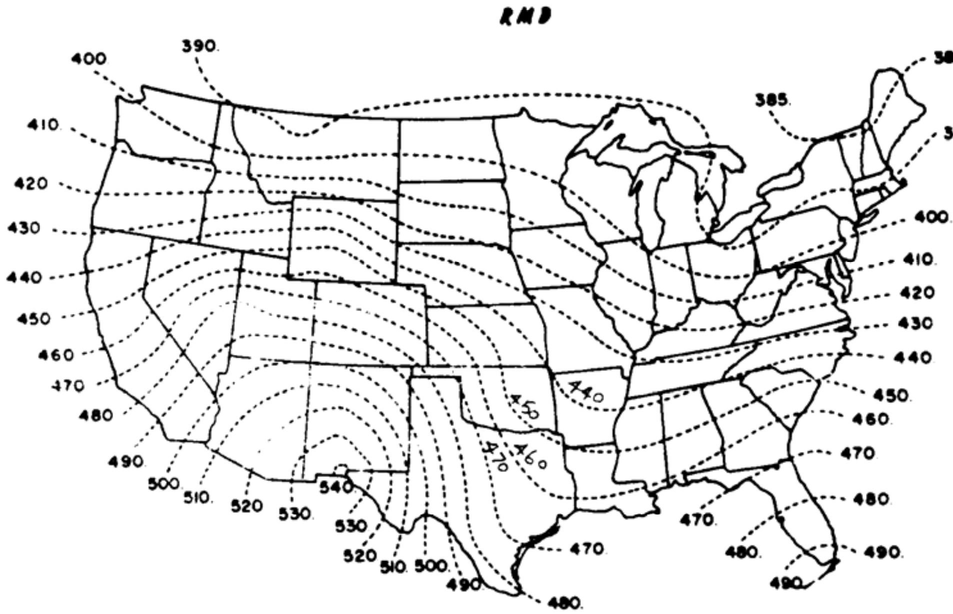


Figure A10. Distribution of the mean of r for dry days (RMD), ly.

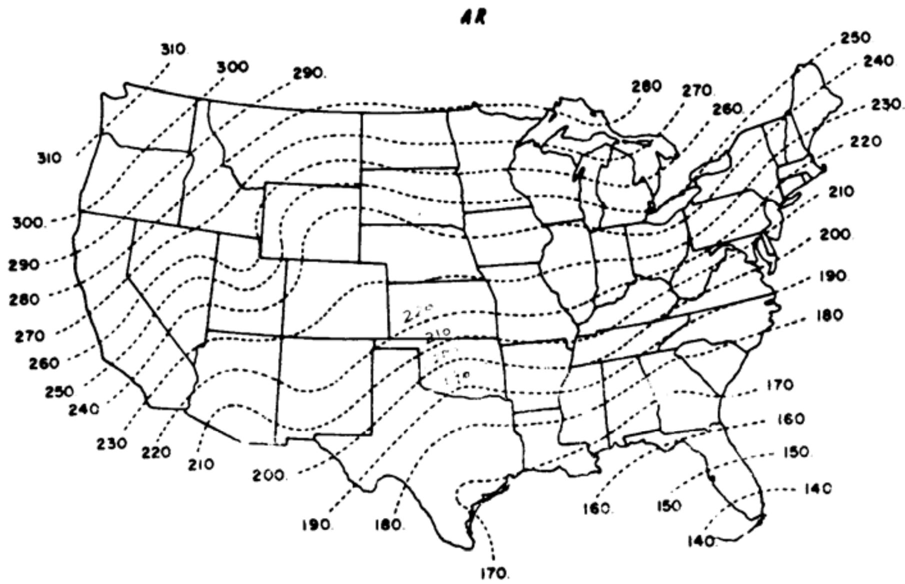


Figure A11. Distribution of the amplitude of r for dry days (AR), ly.

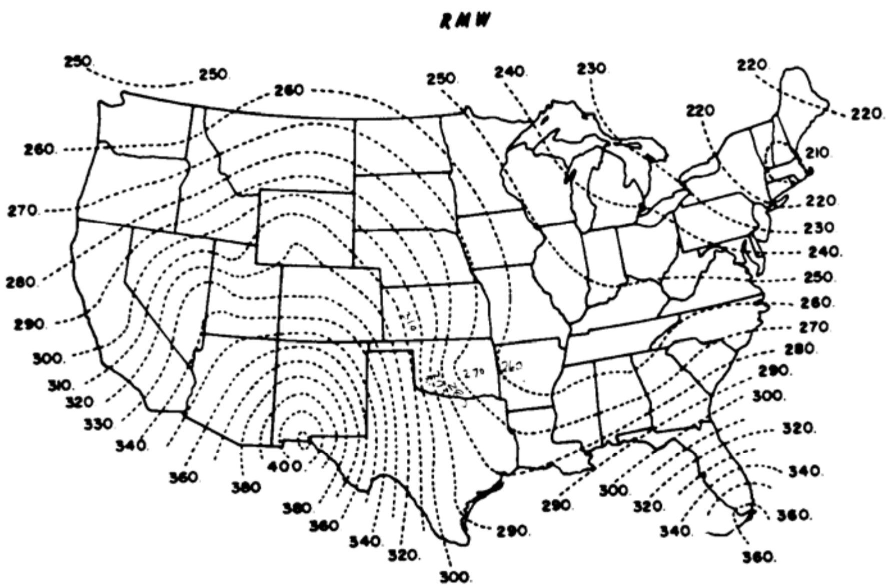


Figure A12. Distribution of the mean of r for wet days (RMW), ly.

APPENDIX B

Input Data for WGEN

Table B1. Description of order, format, and source of input for WGEN

Input no.	Variable name	Description	Format	Source
1	ACOM(I)	Up to 80 characters of user comments	20A4	User supplied
2	NYRS	Number of years of data to be generated	I5	User supplied
	KGEN	Generation option code 1 if p, t_{max}, t_{min} and r to be generated 2 if actual p to be used	I5	User supplied
	ALAT	Station latitude, deg	F5.0	User supplied
	KTCF	Temperature correction factor code 0 if no temperature correction 1 if some correction factor for maximum and minimum temperatures 2 if independent correction factors for maxiimum and miminum temperatures	I5	User supplied
	KRFC	Precipitation correction factor code 0 if no precipitation correction 1 if precipitation to be corrected	I5	User supplied
----------------------If KGEN = 2, skip to Input No. 7------------------------------				
3	PWW(I)	Monthly probability of wet day given wet on previous day	12F6.0	Table A1
4	PWD(I)	Monthly probability of wet day given dry on previous day	12F6.0	Table A1
5	ALPHA(I)	Monthly values of gamma distribution shape parameter	12F6.0	Table A1
6	BETA(I)	Monthly values of gamma distribution scale parameter	12F6.0	Table A1

Table B1. Continued.

Input no.	Variable name	Description	Format	Source
7	TXMD	Mean of t_{max} (dry)	F8.0	Figure A1
	ATX	Amplitude of t_{max} (wet or dry)	F8.0	Figure A2
	CVTX	Mean of coef. of var. of t_{max} (wet or dry)	F8.0	Figure A3
	ACVTX	Amplitude of coef. of var. of t_{max} (wet or dry)	F8.0	Figure A4
8	TXMW	Mean of t_{max} (wet)	F8.0	Figure A5
9	TN	Mean of t_{min} (wet or dry)	F8.0	Figure A6
	ATN	Amplitude of t_{min} (wet or dry)	F8.0	Figure A7
	CVTN	Mean of coef. of var. of t_{min} (wet or dry)	F8.0	Figure A8
	ACTVN	Amplitude of coef.of var. of t_{min} (wet or dry)	F8.0	Figure A9
10	RMD	Mean of r (dry)	F8.0	Figure A10
	AR	Amplitude of r (wet or dry)	F8.0	Figure A11
11	RMW	Mean of r (wet)	F8.0	Figure A12
----------------------If KTCF = 0, skip to Input No. 15-------------------------				
----------------------If KTCF = 2, skip to Input No. 13-------------------------				
12	TM(I)	Monthly values of actual mean temperature (°F)	12F6.0	User supplied
13	TTMAX(I)	Monthly values of actual mean maximum temperature (°F)	12F6.0	User supplied
14	TTMIN(I)	Monthly values of actual mean minimum temperature (°F)	12F6.0	User supplied
----------------------If KRCF = 0, omit Input No. 15-------------------------------				
15	RM(I)	Monthly values of actual mean precipitation amount (in.)	12F6.0	User supplied
----------------------If KGEN = 1, omit Input No. 16-------------------------------				
16	RAIN(I)	Actual precipitation data	User specified	User supplied

APPENDIX C

The WGEN Program

TABLE C1. LISTING OF FORTRAN PROGRAM FOR WGEN.

```
      DIMENSION TXM(366),TXS(366),TXM1(366),TXS1(366),TNM(366),TNS(366),
     1RM0(366),RS0(366),RM1(366),RS1(366),RC(366),RAIN(366),TMAX(366),
     2TMIN(366),RAD(366),ACOM(20),NI(12),SR(12),SSTX(12),SSTN(12),SSRAD(
     32),SRAIN(12),STMAX(12),STMIN(12),SRAD(12),NII(12),PWW(12),PWD(12),
     4ALPHA(12),BETA(12),TM(12),PW(12),TG(12),RM(12),RG(12),RCF(12),
     5NWET(12),XNW(12)
      DIMENSION TAMAX(12),TAMIN(12)
      DIMENSION TTMAX(12),TTMIN(12),TCFMAX(12),TCFMIN(12)
      DATA NI/31,59,90,120,151,181,212,243,273,304,334,365/
      DATA NII/31,60,91,121,152,182,213,244,274,305,335,366/
C*****************************************************************
C*  INPUT # 01 - TITLE                                            *
C*     ACOM(I) - LOCATION IDENTIFICATION OR OTHER USER            *
C*               COMMENTS.  80 CHARACTER MAXIMUM                  *
C*****************************************************************
      READ(2,98) (ACOM(I),I=1,20)
98    FORMAT(20A4)
      WRITE(6,99) (ACOM(I),I=1,20)
99    FORMAT('1',20A4)
C*****************************************************************
C*  INPUT # 02 - NUMBER OF YEARS, GENERATION CODES, AND LATITUDE *
C*                                                                *
C*        NYRS - YEARS OF DATA TO BE GENERATED                    *
C*        KGEN - GENERATION OPTION CODE                           *
C*               IF KGEN = 1,RAIN, MAX TEMP, MIN TEMP, AND        *
C*               SOLAR RADIATION WILL BE GENERATED                *
C*               IF KGEN = 2 OBSERVED RAIN WILL BE USED AND       *
C*               MAX TEMP, MIN TEMP, SOLAR RADIATION WILL         *
C*               BE GENERATED                                     *
C*        ALAT - STATION LATITUDE IN DEGREES                      *
C*        KTCF - TEMP. CORRECTION FACTOR OPTION CODE              *
C*               IF KTCF = 0  NO TEMP CORRECTION WILL BE MADE     *
C*               IF KTCF = 2 GENERATED MAX TEMP AND               *
C*               MIN TEMP WILL BE CORRECTED BASED ON              *
C*               OBSERVED MEAN MONTHLY MAX AND MIN TEMP           *
C*               IF KTCF = 1 GENERATED MAX TEMP AND MIN TEMP      *
C*               WILL BE CORRECTED BASED ON OBSERVED MEAN         *
C*               MONTHLY TEMP                                     *
C*        KRCF - RAIN CORRECTION FACTOR OPTION CODE               *
C*               IF KRCF = 1 GENERATED RAIN WILL BE CORRECTED     *
C*               BASED ON OBSERVED MEAN MONTHLY RAIN              *
C*               IF KRCF = 0 NO RAIN CORRECTION WILL BE MADE      *
C*****************************************************************
      READ(2,100) NYRS,KGEN,ALAT,KTCF,KRCF
100   FORMAT(2I5,F5.2,2I5)
C***** CALCULATE MAXIMUM SOLAR RADIATION FOR EACH DAY
      XLAT = ALAT*6.2832/360.
      DO 6 I = 1,366
      XI = I
      SD = 0.4102*SIN(0.0172*(XI-80.25))
      CH = -TAN(XLAT)*TAN(SD)
```

TABLE C1. CONTINUED.

```
      IF(CH .GT. 1.0) H = 0.
      IF(CH .GT. 1.0) GO TO 5
      IF(CH .LT. -1.0)H=3.1416
      IF(CH .LT. -1.0) GO TO 5
      H = ACOS(CH)
5     DD = 1.0+0.0335*SIN(0.0172*(XI+88.2))
      RC(I)=889.2305*DD*((H*SIN(XLAT)*SIN(SD))+(COS(XLAT)*COS(SD)*SIN(H)
     1))
      RC(I) = RC(I) * 0.8
6     CONTINUE
      DO 7 I = 1,12
      TTMAX(I)=0.
      TTMIN(I)=0.
      RM(I) = 0.
7     CONTINUE
      IF(KGEN .EQ. 2) GO TO 10
C*****************************************************************
C*  NOTE--INPUTS #03,04,05,06  ARE RAINFALL PARAMETERS           *
C*        OMIT IF KGEN=2                                          *
C*****************************************************************
C*  INPUT # 03 - PROBABILITY OF WET GIVEN WET                    *
C*     PWW(I) - 12 MONTHLY VALUES OF P(W/W)                       *
C*****************************************************************
      READ(2,103) (PWW(I),I=1,12)
103   FORMAT(12F6.0)
C*****************************************************************
C*  INPUT # 04 - PROBABILITY OF WET GIVEN DRY                    *
C*     PWD(I) - 12 MONTHLY VALUES OF P(W/D)                       *
C*****************************************************************
      READ(2,103)(PWD(I),I=1,12)
C*****************************************************************
C*  INPUT # 05 - GAMMA DISTRIBUTION SHAPE PARAMETER              *
C*     ALPHA(I) - 12 MONTHLY VALUES OF SHAPE PARAMETER            *
C*****************************************************************
      READ(2,103)(ALPHA(I),I=1,12)
C*****************************************************************
C*  INPUT # 06 - GAMMA DISTRIBUTION SCALE PARAMETER              *
C*     BETA(I) - 12 MONTH VALUES OF SCALE PARAMETER               *
C*****************************************************************
      READ(2,103)(BETA(I),I=1,12)
101   FORMAT(9F8.0)
C*****************************************************************
C*  INPUT # 07 - FOURIER COEFFICIENTS OF MAX TEMP ON DRY DAYS   *
C*     TXMD - MEAN OF TMAX - DRY                                  *
C*     ATX  - AMPLITUDE OF TMAX - WET OR DRY                      *
C*     CVTX - MEAN OF COEF. OF VAR. OF TMAX - WET OR DRY          *
C*     ACVTX - AMPLITUDE OF COEF.OF VAR. OF TMAX - WET OR DRY    *
C*****************************************************************
10    READ(2,101) TXMD,ATX,CVTX,ACVTX
```

TABLE C1. CONTINUED.

```
C***************************************************************
C*  INPUT # 08 - FOURIER COEFFICIENTS OF MAX TEMP ON WET DAYS   *
C*     TXMW - MEAN OF TMAX - WET                                *
C***************************************************************
      READ(2,101) TXMW
C***************************************************************
C*  INPUT # 09 - FOURIER COEFFICIENTS OF MIN TEMP               *
C*     TN - MEAN OF TMIN - WET OR DRY                           *
C*     ATN - AMPLITUDE OF TMIN - WET OR DRY                     *
C*     CVTN - MEAN OF COEF. OF VAR. OF TMIN - WET OR DRY        *
C*     ACVTN - AMPLITUDE OF COEF. OF VAR. OF TMIN - WET OR DRY  *
C***************************************************************
      READ(2,101) TN,ATN,CVTN,ACVTN
C***************************************************************
C*  INPUT # 10 - FOURIER COEFFICIENTS OF RAD ON DRY DAYS        *
C*     RMD - MEAN OF RAD - DRY                                  *
C*     AR  - AMPLITUDE OF RAD - WET OR DRY                      *
C***************************************************************
      READ(2,101) RMD,AR
      CVRD = 0.24
      ACVRD = -0.08
C***************************************************************
C*  INPUT # 11 - FOURIER COEFFICIENTS OF RAD ON WET DAYS        *
C*     RMW - MEAN OF RAD - WET                                  *
C***************************************************************
      READ(2,101) RMW
      CVRW = 0.48
      ACVRW = -0.13
      D1 = TXMD - TXMW
      D2 = RMD - RMW
      IF(KTCF .EQ. 0) GO TO 12
       IF(KTCF .EQ. 2) GO TO 8
C***************************************************************
C*  INPUT # 12 - MONTHLY VALUES OF ACTUAL MEAN TEMP             *
C*               OMIT IF KTCF = 0 OR 2                          *
C*     TM(I) - 12 MONTHLY VALUES OF ACTUAL MEAN TEMP            *
C***************************************************************
       READ(2,103)(TM(I),I=1,12)
       GO TO  12
C***************************************************************
C*  INPUT # 13 - MONTHLY VALUES OF ACTUAL MEAN MAX TEMP         *
C*               OMIT IF KTCF = 0 OR 1                          *
C*     TTMAX(I) - 12 MONTHLY VALUES OF ACTUAL MEAN MAX TEMP     *
C***************************************************************
8     READ(2,103) (TTMAX(I),I=1,12)
C***************************************************************
C*  INPUT # 14 - MONTHLY VALUES OF ACTUAL MEAN MIN TEMP         *
C*               OMIT IF KTCF = 0 OR 1                          *
C*     TTMIN(I) - 12 MONTHLY VALUES OF ACTUAL MEAN MIN TEMP     *
C***************************************************************
```

TABLE C1. CONTINUED.

```
      READ(2,103) (TTMIN(I),I=1,12)
12    IF(KRCF .EQ. 0) GO TO 13
C*****************************************************************
C*  INPUT # 15 - MONTHLY VALUES OF ACTUAL MEAN RAINFALL          *
C*               OMIT IF KRCF = 0                                *
C*     RM(I) = 12 MONTHLY VALUES OF ACTUAL MEAN RAINFALL         *
C*****************************************************************
      READ(2,103)(RM(I),I=1,12)
13    WRITE(6,700)
700   FORMAT(////,10X,'GENERATION PARAMETERS',//,15X,'PRECIPITATION')
      WRITE(6,701)(PWW(I),I=1,12)
701   FORMAT(20X,'P(W/W)  ',12F7.3)
      WRITE(6,702) (PWD(I),I=1,12)
702   FORMAT(20X,'P(W/D)  ',12F7.3)
      WRITE(6,703) (ALPHA(I),I=1,12)
703   FORMAT(20X,'ALPHA   ',12F7.3)
      WRITE(6,704) (BETA(I),I=1,12)
704   FORMAT(20X,'BETA    ',12F7.3)
      WRITE(6,705)TXMD,ATX,CVTX,ACVTX,TXMW
705   FORMAT(15X,'MAXIMUM TEMPERATURE',/,20X,'TXMD = ',F8.3,/,20X,
     * 'ATX = ',F8.3,/,20X,'CVTX = ',F8.3,/,20X,'ACVTX = ',F8.3,/,20X,
     * 'TXMW = ',F8.3,//)
      WRITE(6,706)TN,ATN,CVTN,ACVTN
706   FORMAT(15X,'MINIMUM TEMPERATURE',/,20X,'TN = ',F8.3,/,20X,
     *'ATW = ',F8.3,/,20X,'CVTN = ',F8.3,/,20X,'ACVTN = ',F8.3,//)
      WRITE(6,707)RMD,AR,RMW
707   FORMAT(15X,'SOLAR RADIATION',/,20X,'RMD = ',F8.3,/,20X,
     * 'AR = ',F8.3,/,20X,'RMW = ',F8.3,///)
      DO 11 J = 1,366
      XJ = J
      DT = COS(.0172*(XJ-200.))
      DR = COS(.0172*(XJ-172.))
      TXM(J) = TXMD+ATX*DT
      XCR1=CVTX+ACVTX*DT
      IF(XCR1 .LT. 0.0) XCR1=0.06
      TXS(J)=TXM(J)*XCR1
      TXM1(J) = TXM(J) - D1
      TXS1(J)=TXM1(J)*XCR1
      TNM(J) = TN + ATN*DT
      XCR2=CVTN+ACVTN*DT
      IF(XCR2 .LT. 0.0) XCR2=0.06
      TNS(J)=TNM(J)*XCR2
      RM0(J) = RMD+AR * DR
      XCR3=CVRD+ACVRD*DR
      IF(XCR3 .LT. 0.0) XCR3=0.06
      RS0(J)=RM0(J)*XCR3
      RM1(J) = RM0(J) - D2
      XCR4=CVRW+ACVRW*DR
      IF(XCR4 .LT. 0.0) XCR4=0.06
      RS1(J)=RM1(J)*XCR4
```

TABLE C1. CONTINUED.

```
11    CONTINUE
      DO 22 IM=1,12
      XNW(IM) = 0.
      SR(IM) = 0.
      SSTX(IM) = 0.
      SSTN(IM) = 0.
      SSRAD(IM) = 0.
      TCFMAX(IM) = 0.0
      TCFMIN(IM) = 0.0
      RCF(IM) = 1.0
      PW(IM) = PWD(IM)/(1.-PWW(IM)+PWD(IM))
      S1 = 0.
      S2 = 0.
      S3 = 0.
      NL = NI(IM)
      IF(IM .EQ. 1) GO TO 14
      NF = NI(IM-1) + 1
      GO TO 15
14    NF = 1
15    CONTINUE
      ZN = NL - NF + 1
      DO 16 J = NF,NL
      S1 = S1 + TXM(J)/ZN
      S2 = S2 + TXM1(J)/ZN
      S3 = S3 + TNM(J)/ZN
16    CONTINUE
C*****CALCULATE MONTHLY RAINFALL CORRECTION FACTOR
      RG(IM) = ALPHA(IM)*BETA(IM)*ZN*PW(IM)
      IF(KRCF .EQ. 0 ) GO TO 17
      RCF(IM) = RM(IM)/RG(IM)
17    IF(KTCF .EQ. 0) GO TO  22
C*****CALCULATE MONTHLY TEMP CORRECTION FACTOR
      IF(KTCF.EQ.2)  GO TO 18
      TMD = (S1 + S3) / 2.
      TMW = (S2 + S3) / 2.
      TG(IM) = TMW*PW(IM)+TMD*(1-PW(IM))
      TCFMAX(IM) = TM(IM) -  TG(IM)
      TCFMIN(IM) = TCFMAX(IM)
      GO TO 22
18    TAMAX(IM)=S2*PW(IM) + S1*(1.-PW(IM))
      TAMIN(IM)=S3
      IF(KTCF .EQ. 0.) GO TO 22
      TCFMAX(IM)=TTMAX(IM)-TAMAX(IM)
      TCFMIN(IM)=TTMIN(IM)-TAMIN(IM)
22    CONTINUE
      IF(KRCF .EQ. 0) GO TO 52
      WRITE(6,712)(RM(I),I=1,12)
712   FORMAT(10X,'ACT MEAN RAIN',12F7.2)
      WRITE(6,713) (RG(I),I=1,12)
713   FORMAT(10X,'EST MEAN RAIN',12F7.2)
```

```
      WRITE(6,714)(RCF(I),I=1,12)
714   FORMAT(10X,'RAIN CF      ',12F7.3)
52    IF (KTCF .EQ. 0) GO TO 19
      IF(KTCF .EQ. 2) GO TO 51
      WRITE(6,708) (TM(I),I=1,12)
708   FORMAT(10X,'ACT MEAN TEMP',12F7.1)
      WRITE(6,711)(TG(I),I=1,12)
711   FORMAT(10X,'EST MEAN TEMP',12F7.1)
      GO TO 50
51    WRITE(6,722) (TTMAX(I),I=1,12)
722   FORMAT(10X,'ACT MEAN TMAX',12F7.1)
      WRITE(6,723) (TTMIN(I),I=1,12)
723   FORMAT(10X,'ACT MEAN TMIN',12F7.1)
      WRITE(6,720) (TAMAX(I),I=1,12)
720   FORMAT(10X,'EST MEAN TMAX',12F7.1)
      WRITE(6,721) (TAMIN(I),I=1,12)
721   FORMAT(10X,'EST MEAN TMIN',12F7.1)
50    WRITE(6,709) (TCFMAX(I),I=1,12)
709   FORMAT(10X,'CF. MEAN TMAX',12F7.1)
      WRITE(6,724) (TCFMIN(I),I=1,12)
724   FORMAT(10X,'CF. MEAN TMIN',12F7.1)
19    XYR = NYRS
      SYTX = 0.
      SYTN = 0.
      SYRAD = 0.
      SYR = 0.
      SYNW = 0.
      DO 40 I = 1,NYRS
      IYR = I
      IF(KGEN .EQ. 1) GO TO 20
      KK = 0
      IJ = 1
C*****************************************************************
C*  INPUT # 16 - MEASURED RAINFALL FOR NYRS                       *
C*             OMIT IF KGEN = 1                                   *
C*     RAIN(I) - ACTUAL RAINFALL DATA - ONE VALUE PER DAY         *
C*             FOR NYRS                                           *
C*****************************************************************
21    READ(2,102) IYR,MO,IDAY,RAIN(IJ)
102   FORMAT(4X,3I2,20X,F10.0)
      IF(KK .EQ. 1) GO TO 24
20    IDAYS = 365
      IFLG= MOD(IYR,4)
      IF(IFLG .EQ. 0) IDAYS = 366
      KK = 1
      IF(KGEN .EQ. 1) GO TO 28
24    IJ = IJ + 1
      IF(IJ .LE. IDAYS) GO TO 21
28    CONTINUE
```

TABLE C1. CONTINUED.

```
      CALL WGEN(PWW,PWD,ALPHA,BETA,TXM,TXS,TXM1,TXS1,TNM,TNS,RM0,RS0,
     *RM1,RS1,RAIN,TMAX,TMIN,RAD,KGEN,RC,IDAYS,NI,NII,
     *TCFMAX,TCFMIN,RCF)
      DO 23 IM = 1,12
      SRAIN(IM) = 0.
      STMAX(IM) = 0.
      STMIN(IM) = 0.
      SRAD(IM) = 0.
      NWET(IM) = 0
23    CONTINUE
      IM = 1
      YTMAX = 0.
      YTMIN = 0.
      YRAD = 0.
      RYR = 0.
      NYWET = 0
      IDA = 0
      DO 30 J=1,IDAYS
      IDA = IDA + 1
      IF(IDAYS .EQ. 366) GO TO 27
      IF(J .GT. NI(IM)) GO TO 251
      GO TO 29
251   IM = IM + 1
      IDA = 1
      GO TO 29
27    IF(J .GT. NII(IM)) GO TO 251
29    CONTINUE
C*****THE FOLLOWING STATEMENT WRITES DAILY GENERATED WEATHER ON AN
C*****EXTERNAL FILE (UNIT 8).
      WRITE(8,200)IM,IDA,IYR,J,RAIN(J),TMAX(J),TMIN(J),RAD(J)
800   CONTINUE
C*****THE FOLLOWING STATEMENT PRINTS DAILY GENERATED WEATHER
      WRITE(6,200)IM,IDA,IYR,J,RAIN(J),TMAX(J),TMIN(J),RAD(J)
200   FORMAT(2X,4I5,F7.2,3F7.0)
25    CONTINUE
      IF(RAIN(J) .LT. 0.005) GO TO 26
      NWET(IM) = NWET(IM) + 1
      NYWET = NYWET + 1
26    CONTINUE
      SRAIN(IM) = SRAIN(IM) + RAIN(J)
      STMAX(IM) = STMAX(IM) + TMAX(J)
      STMIN(IM) = STMIN(IM) + TMIN(J)
      SRAD(IM) = SRAD(IM) + RAD(J)
      RYR = RYR + RAIN(J)
30    CONTINUE
      XNM1 = 0.
      DO 35 IM = 1,12
      XXN = NI(IM)
      XNI = XXN - XNM1
      XNM1 = XXN
```

TABLE C1. CONTINUED.

```
      ANW = NWET(IM)
      XNW(IM) = XNW(IM) + ANW/XYR
      SR(IM) = SR(IM) + SRAIN(IM) / XYR
      STMAX(IM) = STMAX(IM)/ XNI
      SSTX(IM) = SSTX(IM) + STMAX(IM) / XYR
      STMIN(IM) = STMIN(IM) / XNI
      SSTN(IM) = SSTN(IM) + STMIN(IM) / XYR
      SRAD(IM) = SRAD(IM) / XNI
      SSRAD(IM) = SSRAD(IM) + SRAD(IM) / XYR
      YTMAX = YTMAX + STMAX(IM) / 12.
      YTMIN = YTMIN + STMIN(IM) / 12.
      YRAD = YRAD + SRAD(IM) / 12.
35    CONTINUE
      SYTX = SYTX + YTMAX/XYR
      SYTN = SYTN + YTMIN/XYR
      SYRAD = SYRAD + YRAD / XYR
      SYR = SYR + RYR / XYR
      XYNW = NYWET
      SYNW = SYNW + XYNW / XYR
      WRITE(6,201) IYR
201   FORMAT(//,5X,'SUMMARY FOR YEAR',I5,/,2X,'MONTH             1
     * 2       3       4       5       6       7       8       9      10
     *      11      12      YR',/)
      WRITE(6,207)(NWET(IM),IM=1,12),NYWET
207   FORMAT(2X,'WET DAYS    ',13I8)
       WRITE(6,202)(SRAIN(IM),IM=1,12),RYR
202   FORMAT(2X,'RAINFALL    ',13F8.2)
      WRITE(6,203)(STMAX(IM),IM=1,12),YTMAX
203   FORMAT(2X,'AVE MAX TEMP',13F8.2)
      WRITE(6,204)(STMIN(IM),IM=1,12),YTMIN
204   FORMAT(2X,'AVE MIN TEMP',13F8.2)
      WRITE(6,205)(SRAD(IM),IM=1,12),YRAD
205   FORMAT(2X,'AVE RAD     ',13F8.2)
40    CONTINUE
      WRITE(6,206)NYRS
206   FORMAT(///,5X,'SUMMARY FOR',I5,'YEARS')
      WRITE(6,208)(XNW(IM),IM=1,12),SYNW
208   FORMAT(2X,'WET DAYS    ',13F8.2)
      WRITE(6,202)(SR(IM),IM=1,12),SYR
      WRITE(6,203)(SSTX(IM),IM=1,12),SYTX
      WRITE(6,204)(SSTN(IM),IM=1,12),SYTN
      WRITE(6,205)(SSRAD(IM),IM=1,12),SYRAD
999   STOP
      END
C*****THE FOLLOWING SUBROUTINE GENERATED DAILY WEATHER DATA FOR
C*****ONE YEAR.
      SUBROUTINE WGEN(PWW,PWD,ALPHA,BETA,TXM,TXS,TXM1,TXS1,TNM,TNS,RM0,
     1RS0,RM1,RS1,RAIN,TMAX,TMIN,RAD,KGEN,RC,IDAYS,NI,NII,
     2TCFMAX,TCFMIN,RCF)
```

TABLE C1. CONTINUED.

```
      DIMENSION TXM(366),TXS(366),TXM1(366),
     1 TXS1(366),TNM(366),TNS(366),RM0(366),RS0(366),RM1(366),RS1(366),
     2 RAIN(366),TMAX(366),TMIN(366),RAD(366),RC(366),A(3,3),B(3,3),
     3XIM1(3),E(3),R(3),X(3),RR(3),PWW(12),PWD(12),ALPHA(12),BETA(12),
     4NI(12),NII(12),TCF(12),RCF(12)
      DIMENSION TCFMAX(12),TCFMIN(12)
      DATA A/0.567,0.253,-0.006,0.086,0.504,-0.039,-0.002,-0.050,0.244/
      DATA B/0.781,0.328,0.238,0.0,0.637,-0.341,0.0,0.0,0.873/
      DATA XIM1/0.,0.,0./
      DATA IX/9398039/
      DATA IP/0/
      IM = 1
      DO 50 IDAY=1,IDAYS
      IF(IDAYS .EQ. 366) GO TO 2
      IF(IDAY .GT. NI(IM)) IM = IM + 1
      GO TO 4
2     IF(IDAY .GT. NII(IM)) IM = IM + 1
4     CONTINUE
      IF(IM.GT.12) PAUSE ' IM >12 '
      IF(KGEN .EQ. 2) GO TO 15
C*****DETERMINE WET OR DRY DAY USING MARKOV CHAIN MODEL
      CALL RANDN(RN)
      IF(IP-0) 7,7,10
7     IF(RN - PWD(IM  ))11,11,8
8     IP = 0
      RAIN(IDAY) = 0.
      GO TO 18
10    IF(RN-PWW(IM  ))11,11,8
11    IP = 1
C*****DETERMINE RAINFALL AMOUNT FOR WET DAYS USING GAMMA DISTRIBUTION
      AA = 1./ALPHA(IM)
      AB = 1./(1.-ALPHA(IM))
      TR1 = EXP(-18.42/AA)
      TR2 = EXP(-18.42/AB)
      SUM = 0.
      SUM2 = 0.
12    CALL RANDN(RN1)
      CALL RANDN(RN2)
      IF(RN1-TR1) 61,61,62
61    S1 = 0.
      GO TO 63
62    S1 = RN1**AA
63    IF(RN2-TR2) 64,64,65
64    S2 = 0.
      GO TO 66
65    S2 = RN2**AB
66    S12 = S1 + S2
      IF(S12-1.) 13,13,12
13    Z = S1/S12
      CALL RANDN(RN3)
      RAIN(IDAY) = -Z*ALOG(RN3)*BETA(IM)*RCF(IM)
```

TABLE C1. CONTINUED

```
C*****RAIN(IDAY) IS GENERATED RAINFALL FOR IDAY
15    IF(RAIN(IDAY)) 16,16,17
16    IP = 0
      GO TO 18
17    IP = 1
18    IF(IP-1) 25,26,26
C*****GENERATE TMAX, TMIN, AND RAD FOR IDAY
25    RM=RM0(IDAY)
      RS = RS0(IDAY)
      TXXM = TXM(IDAY)
      TXXS = TXS(IDAY)
      GO TO 27
26    RM = RM1(IDAY)
      RS = RS1(IDAY)
      TXXM = TXM1(IDAY)
      TXXS = TXS1(IDAY)
27    CONTINUE
      DO 30 K = 1,3
131   AA = 0.
      CALL RANDN(RN1)
      CALL RANDN(RN2)
      V = SQRT(-2.*ALOG(RN1))*COS(6.283185*RN2)
      IF(ABS(V) .GT. 2.5) GO TO 131
      E(K) = V
30    CONTINUE
      DO 31 I = 1,3
      R(I) = 0.
      RR(I) = 0.
31    CONTINUE
      DO 32 I = 1,3
      DO 32 J = 1,3
      R(I) = R(I)+B(I,J)*E(J)
      RR(I) = RR(I) + A(I,J)*XIM1(J)
32    CONTINUE
      DO 37 K = 1,3
      X(K) = R(K) + RR(K)
      XIM1(K) = X(K)
37    CONTINUE
      TMAX(IDAY) = X(1) * TXXS + TXXM
      TMIN(IDAY) = X(2)*TNS(IDAY)+TNM(IDAY)
      IF(TMIN(IDAY) .GT. TMAX(IDAY)) GO TO 38
      GO TO 39
38    TMM = TMAX(IDAY)
      TMAX(IDAY) = TMIN(IDAY)
      TMIN(IDAY) = TMM
39    CONTINUE
      TMAX(IDAY)=TMAX(IDAY)+TCFMAX(IM)
      TMIN(IDAY)=TMIN(IDAY)+TCFMIN(IM)
C*****TMAX(IDAY) IS GENERATED TMAX FOR IDAY
C*****TMIN(IDAY) IS GENERATED TMIN FOR IDAY
```

TABLE C1. CONTINUED.

```
      RAD(IDAY) = X(3)*RS+RM
      RMIN = 0.2*RC(IDAY)
      IF(RAD(IDAY) .LT. RMIN) RAD(IDAY) = RMIN
      IF(RAD(IDAY) .GT. RC(IDAY)) RAD(IDAY) = RC(IDAY)
C*****RAD(IDAY) IS GENERATED RAD FOR IDAY
 50   CONTINUE
      RETURN
      END
C*****THE FOLLOWING SUBROUTINE GENERATES A UNIFORM RANDOM NUMBER ON
C*****THE INTERVAL 0 - 1
      SUBROUTINE RANDN(YFL)
      DIMENSION K(4)
      DATA K/2510,7692,2456,3765/
      K(4) = 3*K(4)+K(2)
      K(3) = 3*K(3)+K(1)
      K(2)=3*K(2)
      K(1) = 3*K(1)
      I=K(1)/1000
      K(1)=K(1)-I*1000
      K(2)=K(2) + I
      I = K(2)/100
      K(2)=K(2)-100*I
      K(3) = K(3)+I
      I = K(3)/1000
      K(3)=K(3)-I*1000
      K(4)=K(4)+I
      I = K(4)/100
      K(4)=K(4)-100*I
      YFL=(((FLOAT(K(1))*.001+FLOAT(K(2)))*.01+FLOAT(K(3)))*.001+FLOAT
     *(K(4)))*.01
      RETURN
      END
```

APPENDIX D

The WGEN PAR Program

TABLE D1. LISTING OF FORTRAN PROGRAM FOR WGEN PAR.

```
C**************************************************************************
C*                                                                        *
C*                      DEE ALLEN WRIGHT                                  *
C*                      COMPUTER PROGRAMMER                               *
C*                      FEBRUARY 25, 1983                                 *
C*                                                                        *
C**************************************************************************

      DIMENSION TMAX(20,365),TMIN(20,365),RAIN(20,365),RAD(20,365)
      DIMENSION AA(20)
      DIMENSION RC(365)
      DIMENSION XDATA(30),YDATA(4,12)
      DO 1 I=1,30
      XDATA(I)=0.0
1     CONTINUE
      DO 2 I=1,4
      DO 2 J=1,12
      YDATA(I,J)=0.0
2     CONTINUE
C*************************************************************************
C*                                                                       *
C*    INPUT #1  TITLE OF DATA SET (20A4)                                 *
C*                                                                       *
C*************************************************************************
      READ(5,100) (AA(I),I=1,20)
100   FORMAT(20A4)
      WRITE(6,101) (AA(I),I=1,20)
101   FORMAT('1',//,30X,'DATA IS ------',20A4,//)
C*************************************************************************
C*                                                                       *
C*    INPUT #2  NUMBER OF YEARS AND LATITUDE                             *
C*                                                                       *
C*************************************************************************
      READ(5,102) NYRS, ALAT
102   FORMAT(I10,F10.0)
C*****CALCULATE MAXIMUM SOLAR RADIATION FOR EACH DAY.
      XYRS=NYRS
      XLAT=ALAT*6.2832/360.
      DO 6 I = 1,365
      XI = I
      SD = 0.4102*SIN(0.0172*(XI-80.25))
      CH = -TAN(XLAT)*TAN(SD)
      IF (CH .GT. 1.0) H = 0.
      IF (CH .GT. 1.0) GO TO 5
      IF(CH .LT. -1.0) H = 3.1416
      IF(CH .LT. -1.0) GO TO 5
      H = ARCOS(CH)
5     DD=1.0+0.0335*SIN(0.0172 *(XI+88.2))
      RC(I)=889.2305*DD*((H*SIN(XLAT)*SIN(SD))+(COS(XLAT)*COS(SD)*SIN(H)
     *))
      RC(I)=RC(I)*0.80
```

```
6     CONTINUE
      DO 7 I = 1, NYRS
      DO 7 J = 1, 365
C************************************************************************
C*                                                                      *
C*   INPUT #3  MO, DAY, YEAR, MAX TEMP, MIN TEMP, RAINFALL, RADIATION    *
C*                                                                      *
C*                                                                      *
C************************************************************************
8      READ(5,103) IMO,IDA,IYR,V1,V2,V3,V4
      IF(IMO.EQ.2.AND.IDA.EQ.29) GOTO 8
      TMAX(I,J) = V1
      TMIN(I,J) = V2
      RAIN(I,J) = V3
      RAD(I,J) = V4
      IF(RAD(I,J).GT.RC(J)) RAD(I,J)=RC(J)
7     CONTINUE
103   FORMAT(3I2,3F6.0,6X,F6.0)
      WRITE(6,104)
104   FORMAT('1',///,5X,'MAXIMUM TEMPERATURE',/)
C*****CALCULATE TMAX PARAMETERS
      CALL MSD(NYRS,TMAX,RAIN,1,XDATA)
      WRITE(6,105)
105   FORMAT('1',///5X,'MINIMUM TEMPERATURE',/)
C*****CALCULATE TMIN PARAMETERS
      CALL MSD(NYRS,TMIN,RAIN,2,XDATA)
      WRITE(6,106)
106   FORMAT('1',///,5X,'SOLAR RADIATION')
C*****CALCULATE RAD PARAMETERS
      CALL MSD(NYRS,RAD,RAIN,3,XDATA)
      WRITE(6,107)
107   FORMAT('1',///,5X,'PRECIPITATION',/)
C*****CALCULATE RAINFALL PARAMETERS
      CALL PPRAIN(RAIN,NYRS,YDATA)
C--PHASE ANGEL SHIFTED BY 180 DEGREES
C--AND SIGNS CHANGED ON AMPLITUDES
      XDATA(02)=XDATA(02)*(-1.0)
      XDATA(04)=XDATA(04)*(-1.0)
      XDATA(10)=XDATA(10)*(-1.0)
      XDATA(12)=XDATA(12)*(-1.0)
      XDATA(14)=XDATA(14)*(-1.0)
C*****WRITE GENERATION PARAMETERS FOR INPUT TO WGEN PROGRAM
      WRITE(6,'(20A4)') (AA(I),I=1,20)
      WRITE(6,707)
707   FORMAT(///,20X,'INPUT CARDS FOR THE WEATHER GENERATOR ARE AS FOLLO
     *WS -----------',////)
      WRITE(6,403)
403   FORMAT(///)
      WRITE(6,513) (YDATA(1,J),J=1,12)
      WRITE(6,514) (YDATA(2,J),J=1,12)
      WRITE(6,515) (YDATA(3,J),J=1,12)
```

TABLE D1. Continued.

```
      WRITE(6,516) (YDATA(4,J),J=1,12)
513   FORMAT(5X,'INPUT #  3 ---- P(W/W)',12F6.3)
514   FORMAT(5X,'INPUT #  4 ---- P(W/D)',12F6.3)
515   FORMAT(5X,'INPUT #  5 ---- ALPHA ',12F6.3)
516   FORMAT(5X,'INPUT #  6 ---- BETA  ',12F6.3)
      WRITE(6,400)
400   FORMAT(////)
      WRITE(6,701)
      WRITE(6,501) XDATA(01)
      WRITE(6,502) XDATA(02)
      WRITE(6,503) XDATA(03)
      WRITE(6,504) XDATA(04)
701   FORMAT(5X,'INPUT #  7 ----',/)
501   FORMAT(15X,' 1    TXMD     ----  ',F10.3)
502   FORMAT(15X,' 2    ATX      ----  ',F10.3)
503   FORMAT(15X,' 3    CVTX     ----  ',F10.3)
504   FORMAT(15X,' 4    ACVTX    ----  ',F10.3)
      WRITE(6,702)
702   FORMAT(//,5X,'INPUT #  8 ----',/)
      WRITE(6,505) XDATA(05)
505   FORMAT(15X,' 5    TXMW     ----  ',F10.3)
      WRITE(6,703)
703   FORMAT(//,5X,'INPUT #  9 ----',/)
      WRITE(6,506) XDATA(09)
      WRITE(6,507) XDATA(10)
      WRITE(6,508) XDATA(11)
      WRITE(6,509) XDATA(12)
506   FORMAT(15X,' 6    TN     ----  ',F10.3)
507   FORMAT(15X,' 7    ATN    ----  ',F10.3)
508   FORMAT(15X,' 8    CVTN   ----  ',F10.3)
509   FORMAT(15X,' 9    ACVTN  ----  ',F10.3)
      WRITE(6,704)
704   FORMAT(//,5X,'INPUT # 10 ----',/)
      WRITE(6,510) XDATA(13)
      WRITE(6,511) XDATA(14)
510   FORMAT(15X,'10    RMD     ---  ',F10.3)
511   FORMAT(15X,'11    AR      ---  ',F10.3)
      WRITE(6,705)
705   FORMAT(//,5X,'INPUT # 11 ----',/)
      WRITE(6,512) XDATA(17)
512   FORMAT(15X,'12    RMW     ----  ',F10.3)
      WRITE(6,600)
600   FORMAT('1')
      STOP
      END
C*****THE FOLLOWING SUBROUTINE CALCULATES A ONE HARMONIC SERIES
      SUBROUTINE FOUR(XM,SD,CV,XDATA)
      DIMENSION XM(13),SD(13)
      DIMENSION CV(13)
      DIMENSION XDATA(30)
```

TABLE D1. CONTINUED.

```
      DATA JCT /0/
      S = 0.
      S1 = 0.
      S2 = 0.
      WRITE(6,200)
200   FORMAT(//,33X,'    PERIOD   MEAN    STD DEV     CV')
      DO 10 I = 1,13
      WRITE(6,201)I,XM(I),SD(I),CV(I)
201   FORMAT(30X,I10,3F10.2)
      S = S + XM(I)
      S1 = S1 + SD(I)
      S2 = S2 + CV(I)
10    CONTINUE
      XBAR=S/13.
      XBAR1=S1/13.
      XBAR2=S2/13.
      SUMA = 0.
      SUMB = 0.
      SUMA1 = 0.
      SUMB1 = 0.
      SUMA2=0.
      SUMB2 = 0.
      DO 15 K = 1,13
      XK = K
      SUMA=SUMA+(XM(K)-XBAR)*COS(6.2832*XK/13.)
      SUMA1=SUMA1+(SD(K)-XBAR1)*COS(6.2832*XK/13.)
      SUMA2=SUMA2+(CV(K)-XBAR2)*COS(6.2832*XK/13.)
      SUMB=SUMB+(XM(K)-XBAR)*SIN(6.2832*XK/13.)
      SUMB1=SUMB1+(SD(K)-XBAR1)*SIN(6.2832*XK/13.)
      SUMB2=SUMB2+(CV(K)-XBAR2)*SIN(6.2832*XK/13.)
15    CONTINUE
      A = SUMA*(2./13.)
      A1= SUMA1*(2./13.)
      A2 = SUMA2*(2./13.)
      B = SUMB*(2./13.)
      B1 = SUMB1*(2./13.)
      B2 = SUMB2*(2./13.)
      T = ATAN(-B/A)
      T1= ATAN(-B1/A1)
      T2=ATAN(-B2/A2)
      C = A/COS(T)
      C1 = A1/COS(T1)
      C2 = A2/COS(T2)
      WRITE(6,100)
100   FORMAT(/,5X,'FOURIER COEFFICIENTS--MEAN')
      WRITE(6,101) XBAR,C,T
101   FORMAT(5X,'MEAN =',F10.4,5X,'AMPLITUDE =',F10.4,5X,'PHASE =',
     *F10.4)
      JCT=JCT+1
      XDATA(JCT)=XBAR
```

TABLE D1. Continued.

```
      JCT=JCT+1
      XDATA(JCT)=C
      WRITE(6,102)
102   FORMAT(/,5X,'FOURIER COEFFICIENTS--STD. DEV.')
      WRITE(6,101)XBAR1,C1,T1
      WRITE(6,103)
103   FORMAT(/,5X,'FOURIER COEEFICIENTS--CV')
      WRITE(6,101) XBAR2,C2,T2
      JCT=JCT+1
      XDATA(JCT)=XBAR2
      JCT=JCT+1
      XDATA(JCT)=C2
      RETURN
      END
C*****THE FOLLOWING SUBTOUTINE CALCULATES THE STATISTICS OF TMAX, TMIN AND RAD
C*****BY 28-DAY PERIOD OF THE YEAR AND FITS A FOURIER SERIES TO THE RESULTS
      SUBROUTINE MSD(NYRS,W,RAIN,ID,XDATA)
      DIMENSION W(20,365),RAIN(20,365),XM(13),XM1(13),SD(13),SD1(13)
      DIMENSION CX(13),CX1(13)
      DIMENSION XDATA(30)
      DO 20 I = 1,13
      NF=I*28
      NI=NF-27
      XN = 0.
      XN1 = 0.
      SUM = 0.
      SUM1 = 0.
      SS = 0.
      SS1 = 0.
      DO 15 JD=NI,NF
      DO 15 JY = 1,NYRS
      IF(ID .EQ. 2) GO TO 11
      IF(RAIN(JY,JD))11,11,12
11    CONTINUE
      XN = XN + 1.
      SUM = SUM+W(JY,JD)
      SS = SS + (W(JY,JD)*W(JY,JD))
      GO TO 15
12    CONTINUE
      XN1 = XN1 + 1.
      SUM1 = SUM1 + W(JY,JD)
      SS1=SS1+(W(JY,JD)*W(JY,JD))
15    CONTINUE
      IF(XN .LE. 2.) XM(I) = 0.
      IF(XN .LE. 2.) SD(I) = 0.
      IF(XN .LE. 2.) CX(I) = 0.
      IF(XN .LE. 2.) GO TO 400
      XM(I) = SUM / XN
      SD(I) = SQRT((SS-SUM*SUM/XN)/(XN-1.))
      IF(XM(I) .LT. 0.001) XM(I) = 0.001
```

TABLE D1. CONTINUED.

```
      CX(I) = SD(I) / XM(I)
400   CONTINUE
      IF(ID .EQ. 2) GO TO 20
      IF(XN1 .LE. 2.) XM1(I)=0.
      IF(XN1 .LE. 2.) SD1(I) = 0.
      IF(XN1 .LE. 2.) CX1(I) = 0.
      IF(XN1 .LE. 2.) GO TO 500
      XM1(I) = SUM1 / XN1
      SD1(I)=SQRT((SS1-SUM1*SUM1/XN1)/(XN1-1.))
      IF(XM1(I) .LT. 0.001) XM1(I) = 0.001
      CX1(I)=SD1(I)/XM1(I)
500   CONTINUE
20    CONTINUE
      IF(ID .EQ. 2) GO TO 25
      WRITE(6,100)
100   FORMAT(10X,'DRY DAYS')
      CALL FOUR(XM,SD,CX,XDATA)
      WRITE(6,101)
101   FORMAT(/,10X,'WET DAYS')
      CALL FOUR(XM1,SD1,CX1,XDATA)
      GO TO 30
25    WRITE(6,102)
102   FORMAT(10X,'WET AND DRY DAYS')
      CALL FOUR(XM,SD,CX,XDATA)
30    CONTINUE
      RETURN
      END
C*****THIS SUBROUTINE CALCULATES THE RAINFALL GENERATION PARAMETERS
C*****USING THE MARKOV CHAIN-GAMMA MODEL
      SUBROUTINE PPRAIN(XRAIN,NYR,YDATA)
      DIMENSION XRAIN(20,365)
      DIMENSION NWD(12),NDD(12),NDW(12),NWW(12)
      DIMENSION SUM(12),SUM2(12),SUM3(12)
      DIMENSION SL(12),PWW(12),PWD(12),RBAR(12)
      DIMENSION ALPHA(12),BETA(12)
      DIMENSION NW(12),IC(12),SUML(12)
      DIMENSION RLBAR(12),AL2(12),BE2(12),DATE(12)
      DIMENSION PPPW(12),ND(12)
      DIMENSION YDATA(4,12)
      CHARACTER *36 A(2)
      DATA DATE /'JAN.','FEB.','MAR.','APR.','MAY ','JUNE',
     *           'JULY','AUG.','SEP.','OCT.','NOV.','DEC.'/
      DATA A(1) /'                                    '/
      DATA A(2) /'NOT ENOUGH DATA TO DEFINE PARAMETERS'/
      DO 10 I =1,12
      ND(I) = 0
      PPPW(I) = 0.
      NWD(I) = 0
      NWW(I) = 0
      NDD(I) = 0
```

TABLE D1. CONTINUED.

```
      NDW(I) =0
      NW(I) = 0
      SL(I) = 0.
      SUML(I) = 0.
      SUM(I) = 0.
      SUM2(I) = 0.
      PWW(I) = 0.
      PWD(I) = 0.
      ALPHA(I) = 0.
      BETA(I) = 0.
      SUM3(I) = 0.
10    CONTINUE
      XYR=NYR
      RIM1 = 0.
      DO 20 J = 1,NYR
      DO 30 K = 1,365
      IF(K .GE. 001 .AND. K .LE. 031) MO = 1
      IF(K .GE. 032 .AND. K .LE. 059) MO = 2
      IF(K .GE. 060 .AND. K .LE. 090) MO = 3
      IF(K .GE. 091 .AND. K .LE. 120) MO = 4
      IF(K .GE. 121 .AND. K .LE. 151) MO = 5
      IF(K .GE. 152 .AND. K .LE. 181) MO = 6
      IF(K .GE. 182 .AND. K .LE. 212) MO = 7
      IF(K .GE. 213 .AND. K .LE. 243) MO = 8
      IF(K .GE. 244 .AND. K .LE. 273) MO = 9
      IF(K .GE. 274 .AND. K .LE. 304) MO = 10
      IF(K .GE. 305 .AND. K .LE. 334) MO = 11
      IF(K .GE. 335 .AND. K .LE. 365) MO = 12
      RAIN=XRAIN(J,K)
      IF(RAIN .GT. 0.00) NW(MO)=NW(MO)+1
      ND(MO)=ND(MO)+1
      IF(RAIN) 5,5,3
  3   IF(RIM1)2,2,4
2     NWD(MO)=NWD(MO)+1
      GO TO 6
4     NWW(MO)=NWW(MO)+1
6     CONTINUE
      SUML(MO)=SUML(MO)+ALOG(RAIN)
      SUM(MO)=SUM(MO)+RAIN
      SUM2(MO)=SUM2(MO)  + RAIN * RAIN
      SUM3(MO)=SUM3(MO)+RAIN*RAIN*RAIN
      SL(MO)  = SL(MO)+ALOG(RAIN)
      GO TO 9
5     IF(RIM1) 7,7,8
 7    NDD(MO)=NDD(MO)+1
      GO TO 9
8     NDW(MO)=NDW(MO)+1
9     RIM1 = RAIN
30    CONTINUE
20    CONTINUE
      DO 120 I = 1,12
```

TABLE D1. CONTINUED.

```
      XXND=ND(I)
      YYNW=NW(I)
      PPPW(I) = YYNW/XXND
      III=1
      IF(NW(I) .LT. 3) III=2
      IC(I) = III
      IF(NW(I) .LT. 3) GO TO 120
      XNWW=NWW(I)
      XNWD=NWD(I)
      XXNW=NWW(I)+NDW(I)
      XND=NDD(I)+NWD(I)
      XNW=NW(I)
      PWW(I)=XNWW/XXNW
      PWD(I)=XNWD/XND
      RBAR(I)=SUM(I)/XNW
      RLBAR(I)=SUML(I)/XNW
      Y=ALOG(RBAR(I))-RLBAR(I)
      ANUM=8.898919+9.05995*Y+0.9775373*Y*Y
      ADOM=Y*(17.79728+11.968477*Y+Y*Y)
      ALPHA2=ANUM/ADOM
      IF(ALPHA2 .GE. 1.0) ALPHA2=0.998
      BETA2=RBAR(I)/ALPHA2
      ALPHA(I)=ALPHA2
      BETA(I)=BETA2
120   CONTINUE
      WRITE(6,201)
201   FORMAT(///,8X,'--MARKOV CHAIN--                 -GAMMA DIST-',/,
     *1X,'MONTH  P(W/W)    P(W/D)                ALPHA   BETA',/)
      DO 130 I = 1,12
      WRITE(6,202)DATE(I),PWW(I),PWD(I),ALPHA(I),BETA(I),A(IC(I))
202   FORMAT(1X,A4,F8.3,F10.3,11X,F11.3,F7.3,5X,A36)
130   CONTINUE
      DO 400 J=1,12
      YDATA(1,J)=PWW(J)
      YDATA(2,J)=PWD(J)
      YDATA(3,J)=ALPHA(J)
      YDATA(4,J)=BETA(J)
400   CONTINUE
      RETURN
      END
```