PROBABILITIES OF SEQUENCES OF WET AND DRY DAYS FOR FIVE LOCALITIES OF VENEZUELA

Agricultural Engineering 685

by

FELIX CANDELARIO REYES

Submitted in partial fulfillment of the
requirement for the degree of

MASTER OF ENGINEERING

May 1975

Major Subject: Agricultural Engineering

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May 1975

ABSTRACT

Probabilities of Sequences of Wet and Dry Days
for Five Localities of Venezuela. (May 1975)

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From the early days of hydrology, we find numerous statements about the importance of water. Thales of Miletos (624-548 B.C.) said, "Water is the original substance and hence the material cause of all things." This statement by Thales means that life cannot exist without water. Thus, the importance of water was recognized during the early stages of human history.

Today, precipitation plays an important role in many areas of man's life. Estimates of rainfall probability are essential for solving many of man's problems. Knowledge of rainfall amount and time distribution will assist in planning many outdoor activities such as crop planting, crop harvesting, irrigation scheduling, and time requirements for completing construction projects.

The objective of this study was to estimate the probabilities of sequences of dry and wet days for five localities of Venezuela based on a 20-year record (1951-1970). Assuming these probabilities to be the same in the future as they were during the 20-year period

of record, they can be used in models to predict future precipitation events.

A stochastic process known as Markov chain modeling was used to evaluate the probabilities of sequenences of dry and wet days. A Markov chain model is one in which the outcome of any trial depends only on the outcome of directly preceding trials. A first order Markov chain model was applied in this study. The model was assumed to be a good fit for probabilities of sequences of dry and wet days and to be independent of location and climatic conditions. This study was formulated in terms of either the occurrence or non-occurrence of precipitation. The amount of precipitation was not considered quantitatively, except in the definition of a dry or wet day. Daily precipitation of less than 1, 3, or 5 mm was used as the basic definition of a dry day. The first order Markov chain model was found to be a good fit for sequences of dry and wet days at stations in Venezuela.

The results showed the different precipitation patterns for each station. They indicated the annual precipitation distribution and clearly defined the dry and wet seasons. The probability patterns defined the beginning of the wet season to be about April 15 and the end of the wet season, or beginning of the dry season, to be about December 10.

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CHAPTER I

INTRODUCTION

Venezuela is located in the northern region of South America. It is bounded by the Caribbean Sea and the Atlantic Ocean to the north, Guyana to the east, Brazil to the south, and Colombia to the southwest and west. Venezuela is the sixth largest country in South America with a population of about 12 million. The total area of the republic is 912,069 square km. Its maximum measurements are 1496 kilometers from east to west and 1271 kilometers from north to south. Venezuela is entirely within the Torrid Zone and is considered a tropical country. Its southernmost extremity is less than 10° from the equator and its northernmost point is at 12° 11' N.

The climate throughout Venezuela is tropical, and altitude influences the climate more than latitude. There are only slight seasonal changes in temperature. However, the year may be divided into two seasons, the rainy and the dry (summer and winter). The rains occur mostly from May until November, and the dry season from December to April. The wet and dry seasons regulate agricultural activities, establish time requirements for completing construction projects, affect travel and transportation, determine the time for athletic events, and determine vacation periods.

This report follows the style of the Transactions of the ASAE (American Society of Agricultural Engineers).

Most weather forecasts are made from several hours to five days in advance. For longer time periods, accurate predictions of daily rainfall become very difficult to obtain. When the forecast period is from two to five days in advance, energy and water vapor exchange between the atmosphere and the surface of the earth over an entire hemisphere must be known. With high speed computers, mathematical models have been developed for weather prediction. These mathematical models cannot provide accurate, long term precipitation forecasts. The usual prediction period is from one to two weeks in advance.

From the above considerations, we see a need for long period (seasonal or annual) precipitation forecasts. Therefore, the purpose of this study was to use historical weather records and probability theory to make precipitation forecasts and provide some insight into future precipitation conditions. A first order Markov chain model was used to evaluate sequences of dry and wet days for five localities in Venezuela. Historical precipitation records for a 20-year period (1951-1970) were used to evaluate the Markov chain models. Because many activities of man's life are influenced by precipitation, a knowledge of the probability of sequences of dry and wet days can be used in planning and developing many areas of our daily activities.

CHAPTER II

LITERATURE REVIEW

General Considerations and Methods of Estimating the Probability of Sequences of Dry and Wet Days

Several investigators have studied frequencies and probability distributions for various lengths of sequences. Various methods, procedures, and considerations have been used in numerous locations with varied climatic conditions. Jorgensen (1949) studied the persistency of rain and no-rain periods during the winter in San Francisco. Using a 20-year record, he determined the frequencies of rain and no-rain periods of various lengths. From these data, the frequencies of a rain (no-rain) day followed by one, two, or more consecutive days of rain (no-rain) were determined. A rainy day was defined as one receiving a measurable amount of rain. In this way, Jorgensen (1949) obtained frequencies for the recurrence of a specific kind of weather (periods of various lengths of rain or no-rain days). He found the San Francisco weather to contain some short sequences of wet and dry days. He concluded that weather persistency is a real meteorological phenomenon and can be used to develop weather forecasts. He also concluded that persistency is a meteorological variable, and the knowledge of persistency is a tremendous aid in evaluating the accuracy of a forecasting method.

Williams (1952) studied the sequences of wet and dry days at Harpenden, England, during a 10-year period using a logarithmic series. He found that sequences of wet days did not conform to a logarithmic series; or more specifically, that no secular trends existed in the frequency distribution. Cooke (1953) studied the duration of wet and dry spells at Moncton, New Brunswick, and showed the frequency distribution of dry spell data to fit very closely the geometric progression

$$y = 1332\ (0.7272)^n, \qquad \ldots(1)$$

and the frequency distribution of wet spell data to fit the logarithmic curve

$$y = \frac{4391\ (0.551)^n}{n}, \qquad \ldots(2)$$

where n is the number of days in the spell and y the number of sequences containing n days (50-year period).

Longley (1953) studied the length of dry and wet periods at five Canadian cities and developed the following least square regression equation

$$\log_{10} y = a - bn, \qquad \ldots(3)$$

where y is the frequency of the number of wet or dry days during the periods under studies and n is the number of days in each period. The coefficients, a and b, are constants for each station and depend

on the type of series (wet or dry). Longley concluded from his study that the probability of a wet day following a wet day is constant no matter how long the wet period has persisted. He also concluded that the length of dry and wet periods is described by the same probability distribution no matter what the climatic condition or location

In their study of daily rainfall occurrences during 27 rainy seasons at Tel Aviv, Gabriel and Neumann (1962) used a simple Markov chain model. They found this to satisfactorily fit the Tel Aviv daily rainfall, and various aspects of rainfall occurrence patterns were derived from the model and its probabilities.

Eichmeier and Baten (1962) investigated rainfall probabilities during the crop season in south central Michigan by using a 91-year record of daily rainfall data. They found that the probability of rain tomorrow, given the condition that it is raining today, is considerably greater than if it is not raining today. In the determination of probabilities of rain tomorrow, given that it is raining today or given that it is not raining today, Eichmeier and Baten used a least squares curve to establish seasonal trends:

$$y = a + bx + cx^2 + dx^3 \qquad \ldots(4)$$

where y is the percentage of days with precipitation for a particular date and x is the number of days from July 1 to September 30.

Topil (1963) studied precipitation probability at Denver and its relationship to length of period. He used a 10-year record, and studied periods from one minute to one day in length. The probabilities of one minute precipitation periods (more than 0.01 in) was found by computing the total duration of precipitation, dividing by the total time, and multiplying by 100. A poor fit was obtained which was attributed to the chance nature of summer thundershower activity and the short period of record (10 years). Caskey (1963), Weiss (1964), Feyerherm and Bark (1964), and Cornett (1966) investigated the same probability problem and found the simple Markov chain model to fit the observed data.

Minimum Length of Data Period

The use of statistical procedures in hydrology and meteorology allows maximum information to be extracted from observed weather data. Thus, the following question arises: What is the minimum length of data period for analyzing the probability of precipitation occurrence?

In his study of sequences of wet and dry days, Williams (1952) used two 5-year periods and a 10-year period. He concluded that sequences of wet days did not closely fit his model. He believed this to be due to the method of defining wet sequences. He says nothing about the length of records used.

While studying the lengths of dry and wet periods, Longley (1953) established a 30-year period as an adequate length of record for

obtaining stable probability values. He also concluded that periods of less than 30 years may give an approximately correct probability value because probabilities do not change greatly with the length of record. Cooke (1953), Gabriel and Neumann (1962), Eichmeier and Baten (1962), Caskey (1963), and Cornett (1966) used records of 50, 27, 91, 10, and 40 years, respectively. From their analyses with different methods, a good fit of probabilities for sequences of dry and wet days was obtained. Topil (1963) concluded in his precipitation study at Denver that a poor probability fit was obtained because of the short data record of 10 years.

Weiss (1964) applied a first order Markov chain model for sequences of wet or dry days using records of various lengths from different cities. For example, he divided the 50-year data period at Kansas City and Fort Worth into two 25-year periods and tested the secular variation of probabilities. Good stability was found in all cases. His conclusion was that a first order Markov chain model may be applied equally well to sequences of rainy days from a 10-year or longer precipitation period. In their study of statistical methods for persistent precipitation patterns, Feyerherm and Bark (1964) suggested a 50-year period as an adequate length of record and used it in their study of probabilities at six stations in the north-central region of the United States.

Quality of Data

In the above section of this literature review, the authors considered and analyzed many things in their studies, but say nothing about data quality. Quality of data is important and should be considered in any study involving hydrologic or meteorologic data. This is especially true for studies using first order Markov chain models to calculate probabilities of sequences of wet or dry days because the calculated probability of precipitation today depends on whether the previous day is dry or wet. Yevjevich (1972) stated that any inference concerning the future outcome of a variable based on historical records required the data to be free of inconsistency and non-homogeneity. Only a tolerable random error in the data is acceptable.

An observed measurement is the result of sensing, transmitting, recording, and processing data. Errors may occur in each of these four steps, and may be random, systematic or non-homogeneous. Random errors are always present in data, and are approximately symmetrically distributed about the true value. A typical example of random errors is the measurement of a quantity. In the study of precipitation probability, a random error will result in a wrong value of precipitation. The magnitude of random errors are determined by analyzing the measuring techniques used to obtain rainfall data. Inconsistency is defined as a systematic error produced when an observation technique is changed or when the environment around a

precipitation gauge is changed. Non-homogeneity occurs when a sudden change in several parameters take place. Vast environmental changes such as air pollution may change precipitation patterns and result in non-homogeneous data.

Fit of a First Order Markov Chain Model

Statistical methods to test the goodness of fit for first order Markov chain models have been used by several investigators. Gabriel and Neumann (1962) found that a first order Markov chain model fit daily rainfall occurrences at Tel Aviv. Daily rainfall data for 27 rainy seasons were classified as wet if more than 0.1 mm of precipitation occurred during the 24-hour period from 8 a.m. to 8 a.m. The fit of the model was examined by testing whether the proportion of wet days, given the weather characteristics of the previous day, were independent of the weather two or more days earlier. A Chi-square test was used to test the goodness of fit. No difference was found at the 5 per cent level of significance, and the model was considered to be adequate. Finally, with the large number of days observed, Gabriel and Neumann concluded that only slight deviations from the model could have passed unnoticed and hence the first order Markov chain model was at least a close approximation.

Caskey (1963) used a first order Markov chain model to evaluate the probability of precipitation occurrence during various time lengths. He compared theoretical probabilities derived from the

model with empirical values of probability occurrence during a 10-year period at Denver. He found the theoretical values from the model to agree closely with the empirical values.

Weiss (1964) compared precipitation sequences computed using a Markov model with observed sequences of precipitation. The Markov chain model closely represented the sequences of wet or dry days. He compared sequences of dry days for four categories (dry day: <0.01, <0.1, <0.5, and <1.0 in.) at Kansas City over a 50-year period. The same comparison was made using 50 years of data from Fort Worth, Texas. These data were closely approximated by a Markov model. The conclusion from these comparisons was that the Markov chain model fits observed precipitation data very well and may be used at any location.

Feyerherm and Bark (1964) used a Chi-square test in their study of persistent precipitation patterns to test the adequacy of a Markov chain model to describe precipitation data. The test was conducted at six stations in the United States over a 40-day period. Two Chi-square tests were conducted; one for sequences (X_{t-2}, X_{t-1}, X_t) in which the middle day (t-1) was dry and another in which the middle day was wet.

A hypothesis of independence was formulated to determine if the weather (dry or wet) on the third day was independent of the weather (dry or wet) on the first day. A second hypothesis was formulated to test whether the Markov chain model was first order. Rejection

of the hypothesis indicated that the order of the model was at least two. Finally, a third hypothesis was formulated to test whether the model was second order. Rejection of the hypothesis indicated that the order of the model was at least three. The conclusion from these tests was that the order of Markov chain models used in precipitation analyses is not clearly defined. The first order Markov chain model is inadequate for many weather stations, but it appears to provide a good approximation to sequences of wet and dry days.

Cornett (1966) used a first order Markov chain model to study sequences of daily precipitation at San Salvador, El Salvador, during a 40-year period. He tested the independence of rainfall events with the hypothesis, $P(X_t) = P(X_t/X_{t-1})$. Simply stated, the hypothesis says that the probability of a wet (dry) day is independent of the condition (dry or wet) of the previous day. He used a Chi-square test for a 77-day period in the dry season and a 30-day period during the wet season. The conclusion was that persistence in daily rainfall patterns is an important factor in the tropics (San Salvador, El Salvador). In their study, a stochastic model of n-day precipitation, Todorovic and Woolhisier (1975) found that the Markov chain-exponential model to be slightly superior to the binomial-exponential model.

From the literature review, it is possible to conclude that a first order Markov chain model may be used to study sequences of dry

and wet days at any location. Good approximations for this type of precipitation problem have been obtained. Also, a first order Markov chain model may be applied to sequences of rainy days where 10 or more years of data are available. Probabilities do not change greatly when the length of record is greater than 10 years.

CHAPTER III

THE MARKOV CHAIN MODEL

Markov Theory

Markov (1856-1922) introduced the concept that the outcome of any trial depends only on the outcome of the immediately preceding trial. More specifically, the probability of a phenomena at any time depends exclusively on the knowledge of the phenomena condition at the preceding time. This concept has been used to formulate the classical stochastic process known as a Markov process, Markov chain, Markov model, Markov chain model, or Markov probability model.

Most hydrologic and meteorologic phenomena are stochastic in nature and are governed by laws of probability or chance. Precipitation is a good example of a stochastic process. The outcome of this phenomenon is governed by laws of chance and the sequence of variables describing these random phenomenon are stochastic processes. Mathematically speaking, a stochastic process is defined to be an indexed set of random variables, X_t, where the sub-index t runs through a given set T. Frequently, T is a set of nonnegative integers, and X_t is a measurable characteristic at time t. The value of t may be any integer from 0 to n (t = 0, 1, 2, ..., n). The random variable, X_t, is a measurable quantity at any one of the (n+1) integer values from 0 to n. These integers characterize the

(n+1) states of the process. A stochastic process is said to have the Markovian property when the conditional probability of a future phenomenon (X_{t+1}), given the past phenomenom (X_{t-1}) and the present state of the random variable (X_t), is independent of the past phenomenon and depends only on the present state of the process (X_t). The conditional probabilities $P(X_{t+1}/X_t)$ are called transition probabilities and are said to be stationary, implying that they do not change in time.

Another important theoretical consideration is the order of Markov chains. The order is determined by the number of previous trials used in establishing the dependency of the period under consideration. Thus, a first order or simple Markov chain model states that the probability of a phenomena at any time depends only on the state of the phenomena on the previous day. Consequently, the probability in a second order Markov chain model depends only on the state of the phenomena during the two previous days.

A first order Markov chain model applied specifically to rainfall can now be defined. The model assumes that the probability of rainfall on any day depends only on whether the previous day was dry or wet. It is therefore independent of the rainfall state on 2, 3, or more preceding days. The model is based on rainfall occurrence or non-occurrence. The word non-occurrence has a relative meaning, because arbitrary values of rainfall are assigned to the term non-occurrence. Therefore, a dry day (non-occurrence) may be defined as

any day receiving less than 1, 3, 5, ..., n mm of precipitation. The model is assumed to be independent of any other meteorological phenomena and climatic conditions at the location under consideration.

Procedure Used to Calculate the Markov Model

The data for this study were from stations of the Instituto Nacional de Obras Sanitarias, Division de Hidrologia, Caracas, Venezuela. The data were provided by the Universidad Central de Venezuela, Facultad de Ingenieria, Departamento de Meteorologia e Hidrologia, Central de Datos Geofisicos.

Daily precipitation from five stations in Venezuela was selected for determining the probabilities of sequences of dry and wet days. The selection of these stations was limited to those containing at least 20 years of daily precipitation data. The period of record was from 1951 to 1970. A list of the stations with their numbers (national numbers), name, state, coordinates, and elevation is given in Table 3.1. A map of Venezuela showing the station locations is given in Figure 3.1.

The first order Markov chain model developed by Fayerherm and Bark (1964) was used to determine probabilities of sequences of dry and wet days in Venezuela. The procedure used in this study considers a sequence of (n+1) consecutive days of the year. The first day in the year is considered the (t)th day and the last day in the year is considered the (t+n)th day. Therefore, t may take on any

Table 3.1. List of rainfall stations from Venezuela used in this study.

Station Number	Station Name	State	N Latitude		W Longitude		Elevation (meter)
			0	'	0	'	
1289	Yaritagua	Yaracuy	10	05	69	03	360
1432	El Portachuelo	Aragua	10	26	67	21	1300
1436	Agua Fria	Miranda	10	24	67	10	1743
2164	Valera	Trujillo	09	17	70	36	520
2584	Valle de la Pascua	Guarico	09	11	66	00	180

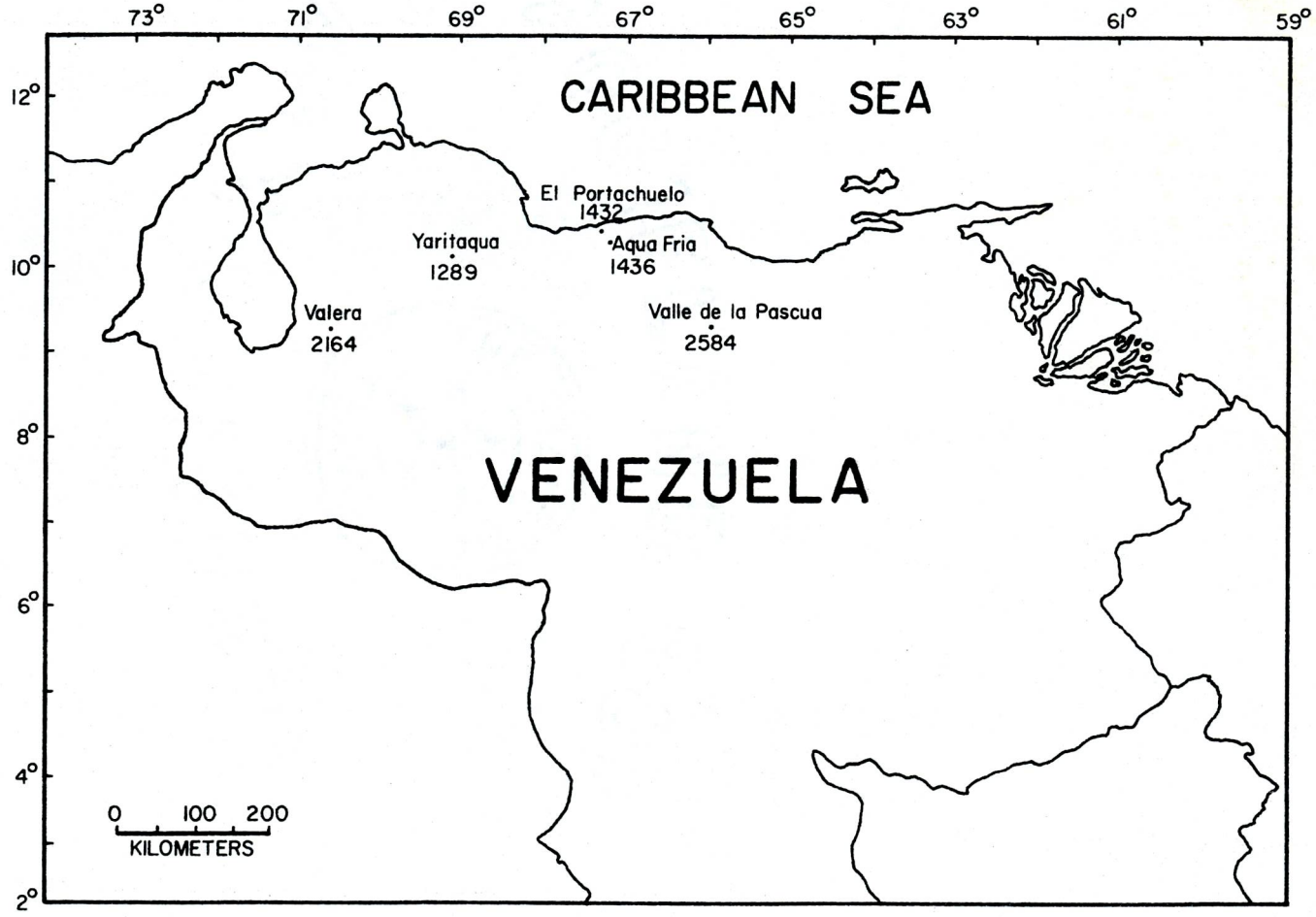

Figure 3.1. Map of Venezuela showing the rainfall station locations used in this study.

value from 1 to 365, but in general t=1 will refer to January 1 and t=365 will refer to December 31. February 29 is ignored when calculating the conditional probabilities.

Let

$$P(X_t, X_{t+1}, \ldots, X_{t+n}), \qquad \ldots(5)$$

be the probability of occurrence of the sequence in parentheses where X, the random variable, is restricted to X = Dry (dry day) or X = wet (wet day).

From the law of multiplication in probability theory, expression (5) can be written in the following form:

$$P(X_t, X_{t+1}, \ldots, X_{t+n}) = P(X_t) \cdot P(X_{t+1}/X_t) \cdot P(X_{t+2}/X_{t+1}, X_t) \cdot$$

$$\cdots P(X_{t+n}/X_{t+n-1}, \ldots, X_t), \qquad \ldots(6)$$

where the right side of this equation is the product of an initial probability $P(X_t)$ and a set of conditional probabilities, and the slant sign (/) of these conditional probabilities is read "given that the previous day is". If the conditional probabilities are assumed to depend only on the weather (dry or wet) of the previous day (i.e., a first order Markov chain), Equation (6) will be:

$$P(X_t, X_{t+1}, \ldots, X_{t+n}) = P(X_t) \cdot P(X_{t+1}/X_t) \cdots P(X_{t+n}/X_{t+n-1}) \cdot$$

$$\ldots(7)$$

The initial probability, $P(X_t)$, is also called the absolute or marginal probability and is computed without reference to previous rainfall data. The conditional or transitional probabilities are computed with the assumption that the probability of rainfall on any day depends on whether the previous day was wet or dry.

There are two initial (Dry or Wet) and four conditional (Dry/Dry, Dry/Wet, Wet/Dry, Wet/Wet) probabilities. However, only one initial and one conditional probability need to be estimated from the daily rainfall data. The remaining four probabilities for sequences of dry and wet days are functionally related and can be calculated from these two.

From the daily rainfall data for a station the initial probability $P(Dry_t)$ and conditional probability $P(Dry_t/Dry_{t-1})$ are calculated for each day of the year using the following formulas:

$$P(Dry_t) = \frac{\text{number of years that the (t)th day was dry}}{\text{number of years of record}} \qquad \ldots(8)$$

and

$$P(Dry_t/Dry_{t-1}) = \frac{\text{number of years that both the (t)th and (t-1)th days were simultaneously dry}}{\text{number of years that only the (t-1)th day was dry}} . \qquad \ldots(9)$$

The other four probabilities may be calculated from Equations (8) and (9) and have the following form:

$$P(Wet_t) = 1 - P(Dry_t), \qquad \ldots(10)$$

$$P(Wet_t/Dry_{t-1}) = 1-P(Dry_t/Dry_{t-1}), \quad ...(11)$$

$$P(Dry_t/Wet_{t-1}) = \frac{P(Dry_t) - P(Dry_{t-1}) \cdot P(Dry_t/Dry_{t-1})}{P(W_{t-1})}, \quad ...(12)$$

and

$$P(Wet_t/Wet_{t-1}) = 1 - P(Dry_t/Wet_{t-1}) \quad . \quad ...(13)$$

In this study, daily probabilities were calculated for each of the five stations from a 20-year record. The preceding method of analysis was used. A computer program was prepared to make the calculations and it is included in Appendix F. Three probabilities were calculated from the daily rainfall data: $P(Dry_t)$ from Equation (8), $P(Dry_t/Dry_{t-1})$ from Equation (9), and $P(Dry_t/Wet_{t-1})$ from the Equation:

$$P(Dry_t/Wet_{t-1}) = \frac{\text{number of years that the (t)th day was dry and the (t-1)th day was wet}}{\text{number of years that only the (t-1)th day was wet}} \cdot \quad ...(14)$$

The above equation was used instead of Equation (12) in the computer program because it was easier to use.

For flexibility in problem solving, a dry day was defined as one with less than 1, 3, or 5 mm of precipitation. Therefore, a wet day was one which equaled or exceeded 1, 3, or 5 mm of precipitation, respectively. Probabilities for February 29 were calculated

from the five data points recorded during the period 1951-1970. Calculation of the conditional probabilities for March 1/February 29 was ignored.

CHAPTER IV

RESULTS AND USE OF TABLES

The probabilities in percent were calculated for each day of the year and for each station. These data are presented in tabular form in Appendices A, B, and C. Appendices A, B, and C contain the probabilities for dry days defined as <1, <3, or <5 mm of precipitation, respectively. Each Appendix contains tables showing the initial probabilities of dry days, P(Dry), the conditional probability of a dry day given that the previous day is dry, P(Dry/Dry), and the conditional probability of a dry day given that the previous day is wet, P(Dry/Wet). The other three probabilities, P(Wet), P(Wet/Dry), and P(Wet/Wet), can be calculated from the equation written at the top of each table or by Equations (10), (11), and (13). Examples of the data in Appendices A, B, and C are shown in Tables 4.1, 4.2, and 4.3 for station number 1289, Yaritagua. At the top of each table, the definition of the dry day is given along with the station name, the state, and the station number.

The best way to show how the tables presented in this report can be used is by the use of examples. For instance, suppose you are interested in the probability of rainfall on a particular day, for example, May 15. You read from the appropriate tables directly the probability corresponding to the month of May on the 15th day.

However, additional information about the type of probability and the dry day definition will be needed.

For example, suppose you are interested in the initial probability P(Dry), the conditional probability P(Dry/Dry), and the conditional probability P(Dry/Wet) for Yaritagua station on May 15. Also, suppose you are interested in probabilities for all three definitions of a dry day (<1, <3, and <5 mm of precipitation). You read the corresponding probabilities from Tables A-, B-, and C- in Appendices A, B, and C, respectively; Table A- for a dry day <1 mm, Table B- for a dry day <3 mm, and Table C- for a dry day <5 mm of precipitation.

In the illustrative Tables 4.1, 4.2, and 4.3 we can find the answers for our example.

	Table A- (<1 mm)	Table B- (<3 mm)	Table C- (<5 mm)
P(Dry)	65%	65%	65%
P(Dry/Dry)	83%	78%	78%
P(Dry/Wet)	37%	33%	33%

Using these probabilities and the formulas given at the top of each table, it is possible to calculate the remaining probabilities. These kind of problems are the simplest.

The probability of sequences longer than two days can also be obtained. Equation (7) and values obtained from the tables are used

Table 4.1. Probabilities (%) for Yaritagua station for dry days defined as <1 mm of precipitation.

TABLE A-1 PROBABILITY (%) OF DRY DAY P(DRY)

DRY<1 MM P(WET)=1-P(DRY)

YARITAGUA YARACUY STATE NUMBER 1289

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	95	95	95	95	80	75	45	45	70	85	85	75
2	90	100	100	100	75	65	45	65	75	90	85	80
3	95	95	100	100	75	50	45	70	65	75	80	80
4	90	95	100	90	85	55	65	50	80	85	85	90
5	85	100	100	95	75	70	35	30	65	80	80	80
6	95	100	100	95	60	60	55	55	75	70	75	85
7	90	100	95	85	75	40	40	55	80	70	80	85
8	100	100	100	95	75	60	55	75	75	80	85	70
9	100	100	100	100	70	60	60	60	70	95	75	75
10	100	95	100	95	60	50	45	55	70	85	80	95
11	90	100	100	90	65	70	45	65	75	75	85	100
12	95	100	100	90	65	60	45	70	75	60	85	100
13	90	100	100	95	70	60	55	70	70	70	95	100
14	95	100	100	85	60	50	85	60	80	85	85	75
15	95	100	100	90	65	45	50	75	80	75	85	100
16	100	100	100	95	60	55	60	70	80	65	85	90
17	90	80	95	85	70	70	50	55	85	75	80	80
18	90	55	90	70	60	40	55	70	75	80	85	95
19	100	100	95	70	85	45	70	60	75	85	75	95
20	100	100	95	65	80	45	55	80	80	85	80	95
21	95	100	100	85	70	45	65	75	75	70	85	95
22	100	100	100	70	65	45	60	80	75	80	80	95
23	100	100	100	60	65	60	60	90	90	85	75	100
24	100	95	100	75	65	35	50	60	85	70	75	100
25	100	95	100	70	65	45	60	65	90	80	85	100
26	100	100	100	55	65	40	60	75	80	70	80	100
27	95	100	90	85	85	65	55	60	75	85	95	95
28	95	95	100	55	75	30	55	50	70	75	80	95
29	90	100	95	75	75	65	45	50	85	60	85	90
30	95		100	70	55	30	35	80	90	70	80	95
31	100		100		70		45	70		85		95

TABLE A-2 PROBABILITY (%) OF DRY DAY GIVEN THAT THE PREVIOUS DAY IS DRY P(DRY/DRY)

DRY<1 MM P(WET/DRY)=1-P(DRY/DRY)

YARITAGUA YARACUY STATE NUMBER 1289

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	94	95	100	95	92	78	33	66	64	88	88	81
2	94	100	100	100	75	66	44	66	78	88	88	86
3	100	95	100	100	86	61	55	69	66	77	88	87
4	94	100	100	90	86	80	77	50	76	86	87	93
5	88	100	100	94	82	81	46	40	68	82	76	77
6	100	100	100	94	66	78	71	66	84	75	81	87
7	94	100	95	89	91	41	45	54	100	71	73	88
8	100	100	100	100	86	87	87	81	81	85	87	64
9	100	100	100	100	80	58	81	53	80	93	82	92
10	100	95	100	95	78	41	50	58	71	84	73	100
11	90	100	100	89	66	90	77	81	71	82	81	100
12	94	100	100	94	69	85	55	69	80	66	82	100
13	89	100	100	94	84	58	66	64	66	66	94	100
14	100	100	100	89	71	58	72	71	85	85	84	75
15	94	100	100	94	83	50	47	83	81	76	88	100
16	100	100	100	100	76	55	60	73	87	66	88	90
17	90	80	95	89	75	81	41	50	81	84	88	88
18	88	100	94	82	71	42	60	72	76	86	93	93
19	100	100	100	92	91	75	81	64	73	87	88	94
20	100	100	100	100	71	88	55	64	75	80	82	86	100
21	95	100	100	92	68	33	72	81	68	70	81	94
22	100	100	100	76	64	66	69	73	80	78	82	100
23	100	100	100	78	76	55	58	87	100	87	81	100
24	100	95	100	91	69	33	58	66	83	70	73	100
25	100	94	100	73	53	57	50	66	94	92	100	100
26	100	100	100	71	69	55	75	69	83	81	82	100
27	95	100	90	100	84	75	75	66	75	85	100	95
28	100	95	100	52	76	30	54	50	73	70	84	94
29	94	100	95	90	86	66	54	60	92	73	93	89
30	100		100	86	60	30	44	90	88	66	76	94
31	100		100		72		28	68		92		94

TABLE A-3 PROBABILITY (%) OF DRY DAY GIVEN THAT THE PREVIOUS DAY IS WET P(DRY/WET)

DRY<1 MM P(WET/WET)=1-P(DRY/WET)

YARITAGUA YARACUY STATE NUMBER 1289

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	100	0	0	0	50	66	50	63	83	50	66	50
2	0	100	100	100	75	60	45	63	66	100	66	60
3	50	0	0	0	40	28	36	71	60	50	33	50
4	0	0	0	0	80	30	54	50	85	80	75	75
5	50	100	0	100	33	55	14	20	50	66	100	100
6	66	0	0	100	40	16	46	50	57	50	50	75
7	0	0	0	0	50	37	33	55	20	66	100	66
8	100	0	100	66	40	41	33	66	50	66	75	100
9	0	0	0	100	40	62	33	80	40	100	33	33
10	0	0	0	0	16	62	37	50	66	100	100	80
11	0	100	0	100	62	50	18	44	83	33	100	100
12	100	0	0	0	50	57	0	36	71	60	40	100	0
13	100	0	0	100	42	62	45	83	80	75	100	0
14	50	0	0	0	33	37	100	33	66	83	100	0
15	100	0	0	66	37	40	66	62	75	66	66	100
16	100	0	0	50	28	54	60	60	50	60	66	0
17	0	0	0	0	62	55	62	66	100	57	33	0
18	100	75	0	0	32	33	50	66	66	60	50	100
19	100	100	50	16	75	25	55	50	80	75	0	100
20	0	0	0	50	33	36	33	87	80	100	60	0
21	0	0	100	71	75	54	55	50	100	66	100	100
22	100	0	0	33	66	27	42	100	60	83	66	0
23	0	0	0	16	42	63	62	100	60	75	50	100
24	0	0	0	50	57	37	37	0	100	66	80	0
25	0	100	0	60	35	38	70	62	66	50	40	0
26	0	100	0	16	57	27	37	85	50	25	66	0
27	0	0	0	0	66	85	58	25	40	75	83	75	0
28	0	0	100	66	66	28	55	50	60	100	0	100
29	0	100	0	55	40	64	33	40	66	20	50	100
30	50		100	20	40	28	27	70	100	75	100	100
31	100		0		66		53	75		66		100

Table 4.2. Probabilities (%) for Yaritagua station for dry days defined as <3 mm of precipitation.

TABLE 8-1 PROBABILITY (%) OF DRY DAY P(DRY)

DRY<3 MM P(WET)=1-P(DRY)

YARITAGUA YARACUY STATE NUMBER 1289

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	95	100	95	95	85	80	55	60	80	90	90	85
2	90	100	100	100	75	65	50	65	75	90	85	80
3	95	95	100	100	85	70	50	70	75	80	80	80
4	100	95	100	90	85	60	70	65	80	90	90	90
5	95	100	100	100	80	75	65	40	70	85	85	95
6	100	100	100	95	70	70	60	65	85	80	75	85
7	100	100	95	85	75	50	45	55	90	75	85	85
8	100	100	100	100	80	70	70	75	85	80	90	85
9	100	100	100	100	85	65	70	70	80	100	80	75
10	100	100	100	95	65	60	50	70	80	85	80	95
11	95	100	100	90	65	70	55	70	85	85	95	100
12	95	100	100	90	75	65	50	75	80	75	85	100
13	95	100	100	95	70	70	60	75	80	75	95	100
14	100	100	100	85	70	60	90	65	80	90	90	75
15	95	100	100	95	65	50	60	75	80	75	95	100
16	100	100	100	95	60	55	70	80	85	70	90	95
17	100	85	95	85	75	80	60	60	90	85	90	85
18	95	95	100	80	65	45	60	75	85	85	95	95
19	100	100	95	75	85	55	80	70	75	90	85	95
20	100	100	100	65	85	55	60	80	80	85	85	95
21	95	100	100	90	70	50	70	75	75	80	90	95
22	100	100	100	70	65	55	70	85	80	85	85	100
23	100	100	100	60	65	65	75	95	90	85	80	100
24	100	95	100	80	70	45	70	65	85	80	75	100
25	100	100	100	70	75	45	70	70	100	85	95	100
26	100	100	100	70	65	55	65	75	80	80	85	100
27	100	100	95	90	90	65	60	75	75	85	95	95
28	100	100	100	65	90	45	55	60	75	85	85	100
29	95	100	100	75	80	70	60	60	85	65	90	95
30	95		100	75	60	30	45	80	90	90	85	100
31	100		100		70		55	80		85		95

TABLE 8-2 PROBABILITY (%) OF DRY DAY GIVEN THAT THE PREVIOUS DAY IS DRY P(DRY/DRY)

DRY<3 MM P(WET/DRY)=1-P(DRY/DRY)

YARITAGUA YARACUY STATE NUMBER 1289

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	94	100	95	95	93	85	33	63	75	94	94	82
2	94	100	100	100	76	68	45	66	81	88	88	88
3	100	95	100	100	100	84	60	69	73	83	88	87
4	100	100	100	90	88	71	70	64	80	93	93	93
5	95	100	100	100	88	75	71	61	68	83	83	94
6	100	100	100	95	75	80	61	75	92	82	76	89
7	100	100	95	89	78	42	41	53	100	81	80	88
8	100	100	100	100	86	90	88	81	88	86	94	82
9	100	100	100	100	81	64	78	66	88	100	83	82
10	100	100	100	95	70	38	50	71	81	85	75	100
11	95	100	100	89	69	83	70	85	87	94	93	100
12	94	100	100	94	84	85	54	71	82	70	84	100
13	94	100	100	94	80	76	70	73	81	66	94	100
14	100	100	100	89	71	57	83	73	87	93	89	75
15	95	100	100	100	78	66	61	84	81	77	94	100
16	100	100	100	100	76	60	75	80	87	73	89	95
17	100	85	95	89	75	90	64	56	88	85	88	84
18	95	100	100	94	73	56	50	75	83	94	100	94
19	100	100	95	81	92	77	91	73	76	88	84	94
20	100	100	100	73	88	54	62	78	80	83	82	100
21	95	100	100	92	70	45	75	81	68	76	88	94
22	100	100	100	72	64	70	78	80	80	81	88	100
23	100	100	100	78	76	63	71	94	100	82	82	100
24	100	95	100	91	69	30	73	68	83	82	75	100
25	100	100	100	75	71	55	71	69	100	87	100	100
26	100	100	100	78	73	66	78	71	80	82	84	100
27	100	100	95	92	92	81	76	80	75	87	94	95
28	100	100	100	66	88	46	50	66	73	82	84	100
29	95	100	100	84	83	77	72	66	93	70	94	95
30	100		100	86	68	28	50	83	88	84	83	100
31	100		100		75		55	81		88		95

TABLE 8-3 PROBABILITY (%) OF DRY DAY GIVEN THAT THE PREVIOUS DAY IS WET P(DRY/WET)

DRY<3 MM P(WET/WET)=1-P(DRY/WET)

YARITAGUA YARACUY STATE NUMBER 1289

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	100	0	0	0	60	66	66	100	100	50	66	100
2	0	0	100	100	66	50	55	62	50	100	50	33
3	50	0	0	0	40	42	40	71	80	50	33	50
4	100	0	0	0	66	33	70	66	80	75	75	75
5	0	100	0	100	33	75	50	0	75	100	100	100
6	100	0	0	0	50	40	57	58	66	66	66	0
7	0	0	0	0	66	66	50	57	33	50	100	66
8	0	0	100	100	60	50	54	66	50	60	66	100
9	0	0	0	0	0	100	66	50	80	33	100	50	33
10	0	0	0	0	33	100	50	66	75	0	100	80
11	0	0	0	100	57	50	40	33	75	33	100	100
12	100	0	0	50	57	16	44	83	66	100	100	0
13	100	0	0	100	40	57	50	80	75	100	100	0
14	100	0	0	0	66	66	100	40	50	80	100	0
15	0	0	0	66	33	25	50	57	75	50	100	100
16	100	0	0	0	28	50	62	80	75	60	100	0
17	0	0	0	0	75	66	50	75	100	83	100	100
18	0	66	100	0	40	0	75	75	100	33	50	100
19	100	100	0	50	71	36	62	60	66	100	100	100
20	0	0	100	40	66	55	50	83	80	100	100	0
21	0	0	0	0	85	66	55	62	50	100	100	100
22	100	0	0	50	66	40	50	100	80	100	50	100
23	0	0	0	16	42	66	83	100	50	100	66	0
24	0	0	0	62	71	71	60	0	100	66	75	0
25	0	100	0	50	83	36	66	71	100	75	80	0
26	0	0	0	50	40	45	33	83	0	66	100	0
27	0	0	0	83	85	44	28	60	75	75	100	0
28	0	0	100	50	100	42	62	40	80	100	100	100
29	0	0	0	57	50	63	44	50	60	33	66	0
30	0		0	40	25	33	37	75	100	100	100	100
31	100		0		62		54	75		50		0

Table 4.3 Probabilities (%) for Yaritagua station for dry days defined as <5 mm of precipitation.

TABLE C-1 PROBABILITY (%) OF DRY DAY P(DRY)

DRY<5 MM P(WET)=1-P(DRY)

YARITAGUA YARACUY STATE NUMBER 1289

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	95	100	95	95	85	90	70	80	80	95	90	90
2	90	100	100	100	75	70	55	65	75	95	85	85
3	95	95	100	100	35	75	55	80	80	85	80	80
4	100	100	100	90	85	60	80	65	80	90	90	90
5	100	100	100	100	85	80	85	45	80	90	90	95
6	100	100	100	95	70	75	60	70	90	90	75	85
7	100	100	95	85	80	60	50	60	90	85	90	90
8	100	100	100	100	90	75	75	80	90	85	90	85
9	100	100	100	100	85	75	70	80	85	100	80	95
10	100	100	100	95	70	60	75	70	85	95	85	95
11	100	100	100	95	80	75	65	75	85	85	95	100
12	100	100	100	95	80	80	55	90	90	75	85	100
13	95	100	100	95	70	80	65	75	85	85	95	100
14	100	100	100	85	70	65	90	75	85	95	90	90
15	95	100	100	95	65	50	70	75	80	80	95	100
16	100	100	100	95	65	70	75	80	85	80	90	95
17	100	90	95	85	85	90	70	65	90	100	95	95
18	100	95	100	80	80	60	65	75	90	90	95	95
19	100	100	95	80	85	65	85	80	75	95	85	95
20	100	100	100	65	85	65	65	85	80	85	90	95
21	100	100	100	90	75	65	75	75	80	80	90	95
22	100	100	100	75	70	65	70	95	85	85	95	100
23	100	100	100	65	65	80	80	95	90	95	80	100
24	100	95	100	80	70	55	75	65	85	90	80	100
25	100	100	100	70	85	50	75	80	100	90	95	100
26	100	100	100	75	70	75	65	80	90	80	90	100
27	100	100	95	95	90	75	60	80	80	85	95	95
28	100	100	100	65	95	55	60	60	80	90	95	100
29	100	100	100	85	85	70	80	75	85	75	95	100
30	100		100	80	70	45	55	80	95	90	85	100
31	100		100		75		55	85		100		95

TABLE C-2 PROBABILITY (%) OF DRY DAY GIVEN THAT THE PREVIOUS DAY IS DRY P(DRY/DRY)

DRY<5 MM P(WET/DRY)=1-P(DRY/DRY)

YARITAGUA YARACUY STATE NUMBER 1289

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	94	100	95	95	93	100	66	81	76	94	90	88
2	94	100	100	100	76	72	64	68	81	94	88	88
3	100	95	100	100	100	78	54	76	73	84	88	82
4	100	100	100	90	88	66	81	68	81	88	93	93
5	100	100	100	100	94	83	87	69	75	88	88	94
6	100	100	100	95	76	81	58	77	93	94	77	89
7	100	100	95	89	78	60	50	57	100	88	86	88
8	100	100	100	100	87	83	100	83	94	88	94	83
9	100	100	100	100	83	66	80	81	88	100	83	94
10	100	100	100	95	70	46	78	68	82	95	81	94
11	100	100	100	94	85	91	66	85	88	89	94	100
12	100	100	100	94	87	86	53	86	88	70	84	100
13	95	100	100	94	81	75	72	77	83	80	94	100
14	100	100	100	89	71	62	84	73	88	94	89	90
15	95	100	100	100	78	61	66	80	76	84	94	100
16	100	100	100	100	76	60	85	80	87	87	89	95
17	100	90	95	89	76	92	73	62	88	100	94	94
18	100	100	100	94	88	66	64	69	88	90	94	94
19	100	100	95	87	93	91	92	86	77	94	84	94
20	100	100	100	68	88	61	64	81	80	84	88	100
21	100	100	100	92	76	61	76	82	75	76	88	94
22	100	100	100	77	66	76	73	93	81	81	94	100
23	100	100	100	80	71	76	71	94	94	94	84	100
24	100	95	100	92	69	43	81	68	83	94	81	100
25	100	100	100	75	85	54	73	84	100	94	100	100
26	100	100	100	85	70	90	73	75	90	83	89	100
27	100	100	95	93	92	86	76	81	83	87	94	95
28	100	100	100	68	94	60	58	62	75	88	94	100
29	100	100	100	92	89	81	83	75	93	72	94	100
30	100		100	82	76	50	62	80	94	86	84	100
31	100		100		78		54	87		100		95

TABLE C-3 PROBABILITY (%) OF DRY DAY GIVEN THAT THE PREVIOUS DAY IS WET P(DRY/WET)

DRY<5 MM P(WET/WET)=1-P(DRY/WET)

YARITAGUA YARACUY STATE NUMBER 1289

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	100	0	0	0	50	60	72	88	100	100	0	100
2	0	0	100	100	66	50	33	50	50	100	50	50
3	50	0	0	0	40	66	55	85	100	100	33	66
4	100	100	0	0	66	40	77	50	75	100	75	75
5	0	0	0	100	33	75	75	0	100	100	100	100
6	0	0	0	0	33	50	66	63	75	50	50	0
7	0	0	0	0	83	60	50	66	0	50	100	100
8	0	0	100	100	100	62	50	75	50	66	50	100
9	0	0	0	0	100	100	40	75	50	100	50	100
10	0	0	0	0	66	100	66	75	100	0	100	100
11	0	0	0	100	66	50	60	50	66	0	100	100
12	0	0	0	100	50	60	57	100	100	100	100	0
13	0	0	0	100	25	100	55	50	100	100	100	0
14	100	0	0	0	66	75	100	80	66	100	100	0
15	0	0	0	66	33	28	100	60	100	0	100	100
16	100	0	0	0	42	80	50	80	75	50	100	0
17	0	0	0	0	100	83	60	75	100	100	100	100
18	0	50	100	0	33	0	66	85	100	0	100	100
19	0	100	0	50	50	25	71	60	50	100	100	100
20	0	0	100	50	66	71	66	100	80	100	100	0
21	0	0	0	85	66	71	71	33	100	100	100	100
22	0	0	0	50	80	42	60	100	100	100	100	100
23	0	0	0	20	50	85	100	100	66	100	0	0
24	0	0	0	57	71	100	50	0	100	0	75	0
25	0	100	0	50	83	44	80	71	100	50	75	0
26	0	0	0	50	66	60	40	100	0	50	100	0
27	0	0	0	100	83	40	28	75	50	75	100	0
28	0	0	100	0	100	40	62	50	100	100	100	100
29	0	0	0	71	0	55	75	75	50	100	100	0
30	0		0	66	33	33	25	80	100	100	100	0
31	0		0		66		55	75		100		0

to solve this type of problem. Thus, it is possible to calculate the probability of any sequence of dry and/or wet days for any time of the year. For example, if the probability of a sequence of four consecutive dry days beginning on February 5 for Yaritagua station is wanted and if you are interested in dry days with <3 mm of precipitation, it is necessary to take the following steps:

a) select the corresponding tables (Tables B-, dry day <3 mm of precipitation, Yaritagua station),

b) determine from the tables the initial and conditional probabilities corresponding to the period of concern, according to the Equation (7), and

c) use Equation (7) to calculate the corresponding probabilities. This example is worked as follows:

$$P(X_t, X_{t+1}, \ldots, X_{t+n}) = P(X_t) \cdot P(X_{t+1}/X_t) \cdots P(X_{t+n}/X_{t+n-1}) \quad \ldots(7)$$

where, according to our example,

X = D (dry day),

t = 5 (February 5 - first day considered), and

t+n = 8 (February 8 - last day considered).

Substituting values of X and t into Equation (7), we have

$$P(D_t, D_{t+1}, D_{t+2}, D_{t+3}) = P(D_t) \cdot P(D_{t+1}/D_t) \cdot P(D_{t+2}/D_{t+1}) \cdot P(D_{t+3}/D_{t+2}),$$

or

$$P(D_5, D_6, D_7, D_8) = P(D_5) \cdot P(D_6/D_5) \cdot P(D_7/D_6) \cdot P(D_8/D_7).$$

From Tables B-1 and B-2 for Yaritagua station, we have

$$P(D_5, D_6, D_7, D_8) = \left(\frac{100}{100}\right)\left(\frac{100}{100}\right)\left(\frac{100}{100}\right)\left(\frac{100}{100}\right) = 1 \times 100 = 100 \text{ percent.}$$

The probability of a sequence of four consecutive dry days (February 5, 6, 7, and 8) for Yaritagua station is equal to 100 percent.

In general, when calculating the probability for any sequence of dry and/or wet days, an initial probability is connected with the first day of the period and conditional probabilities are connected with the remaining days of the corresponding period. Table 4.4 shows all possible sequences of dry and/or wet days for different length periods.

The Markov probabilities are also presented in the form of curves in Appendices D and E. Appendix D presents curves of initial probabilities P(Dry) vs. the day of the year for dry days defined as <1 and <5 mm of precipitation. Appendix E shows curves of conditional probabilities P(Dry/Dry) vs. the day of the year for dry days defined as <1 and <5 mm of precipitation for each station.

Table 4.4. All possible sequences of dry and/or wet days for different length periods.

Two days	Three days	Four days	Five days
D, D	D, D, D	D, D, D, D	D, D, D, D, D
W, D	W, D, D	W, D, D, D	W, D, D, D, D
D, W	D, W, D	D, W, D, D	D, W, D, D, D
W, W	D, D, W	D, D, W, D	D, D, W, D, D
	W, W, D	D, D, D, W	D, D, D, W, D
	W, D, W	W, W, D, D	D, D, D, D, W
	D, W, W	W, D, W, D	W, W, D, D, D
	W, W, W	W, D, D, W	W, D, W, D, D
		D, W, W, D	W, D, D, W, D
		D, W, D, W	W, D, D, D, W
		D, D, W, W	D, W, W, D, D
		W, W, W, D	D, W, D, W, D
		W, W, D, W	D, W, D, D, W
		W, D, W, W	D, D, W, W, D
		D, W, W, W	D, D, W, D, W
		W, W, W, W	D, D, D, W, W
			W, W, W, W, D
			W, W, W, D, W
			W, W, D, W, W
			W, D, W, W, W
			D, W, W, W, W
			W, W, W, W, W

CHAPTER V

DISCUSSION

Fit of First Order Markov Chain Model for Data in Venezuela, Chi-Square Test

Different statistical methods have been used to test hypotheses concerning the order of Markov chains. Specifically, Anderson and Goodman (1957) used a Chi-square (X^2) test in their study to test the goodness of fit for Markov models.

In this study, the question of whether or not a first order Markov chain model fits sequences of dry and wet days for stations in Venezuela (tropical zone) was evaluated. From this evaluation, the reliability of the results obtained from this study were determined.

To test the goodness of fit for a first order Markov model, a Chi-square test was used. The procedure involved computing a test statistic which is asymtotically distributed as a Chi-square. The test was computed from contingency tables showing the observed occurrence for four sequences of dry and wet days (cells). Two Chi-square statistics were computed from the contingency tables using data from Yaritagua station for a 50-day sample during the dry season (January 2 thru February 20) and a 50-day sample during the wet season (June 2 thru July 21). A test of independence among daily

precipitation observations was performed. With the 50-day sample and the 20-year record for each station, a total of 1000 daily observations were used for each of the two seasons.

The hypothesis tested was Ho: $P(X_t) = P(X_t/X_{t-1})$. The two X^2 values (one for each season) were computed for four sequences (cells), (D_{t-1}, D_t), (D_{t-1}, W_t), (W_{t-1}, D_t), and (W_{t-1}, W_t). The hypothesis was to test whether day W_t or D_t were independent of days W_{t-1} or D_{t-1}. More specifically, the hypothesis tested whether the occurrence of precipitation on any day (t) is independent of conditions on the previous day (t-1). If the hypothesis is accepted, X_t is independent of the previous day X_{t-1}.

The contingency table with its four sequences has the following form:

	X_{t-1}	X_{t-1}
X_t	(a)	(b)
X_t	(c)	(d)

The Chi-square was computed from the observed values presented in the corresponding contingency tables with the use of the following formula (Massey, 1969):

$$X^2 = \frac{(|abd-bc|-\frac{N}{2})^2 N}{(a+b)(a+c)(b+d)(c+d)} \qquad \ldots(15)$$

where

$N = a+b+c+d.$

The observed values for the two selected seasons had the following distribution in the contingency tables:

	Dry season		Wet season	
	X_{t-1} = D	X_{t-1} = W	X_{t-1} = D	X_{t-1} = W
X_t = D	943	23	319	207
X_t = W	22	12	210	264

The corresponding values of the two Chi-squares calculated from these two tables give $X^2_D = 95.8$ and $X^2_W = 26.1$ for the dry and wet seasons, respectively.

To test the hypothesis, a 10 percent level of significance with 1 degree of freedom was used. From X^2 tables (Massey, 1969) the critical value of $X^2_{.90}(1) = 2.71$. Since $95.8 > 2.71$ and $26.1 > 2.71$ ($X^2_D = 95.8$, $X^2_W = 26.1$), the hypothesis that daily precipitation is independent of the previous day's conditions is rejected.

Therefore, presistence in daily precipitation patterns for Yaritagua station, Venezuela, was found. Given that the sequence used in the contingency tables for Chi-square test was for two days, a first order Markov chain model appears to fit daily precipitation data for Yaritagua, Venezuela (tropical zone).

Application of Probabilities

A study of persistency of precipitation at a station provides an important tool for evaluating the weather. A knowledge of

persistency of precipitation is of great importance when evaluating a forecasting method. Climatological probabilities are often the best forecasts available for long periods (seasonal or annual).

The importance of the probabilities obtained from this study are its applications. Climatological predictions given by these probabilities can play an important role in the daily activities of man. Advanced planning for our daily activities and jobs is possible. The results from this study will be of great benefit in the development of industry, commerce, recreation and agriculture in Venezuela.

In their study of probabilities of sequences of wet and dry days, Heermann et al. (1971) stated the applications as follows: 1) field drying of hay, 2) germination of seed, 3) disease susceptibility in periods of plant growth, 4) applying fertilizer, 5) applying insecticides, 6) applying herbicides, and 7) time requirements to complete construction projects and recreation activities.

An example of the uses of the probabilities in the field of agriculture may be the planning of harvest dates. Suppose that a farmer in Yaritagua area needs to know the probability of precipitation for three consecutive days following the cutting of his hay. After cutting the hay, it must lie in the field and dry approximately three days prior to baling. Hence, the chance of rain during the three days following harvest need to be very low. If the farmer planned to cut his hay during the week of April 7-13, what will be

the best day for cutting? A dry day is assumed to be one with less than 1 mm of precipitation.

The initial probability of dry days at Yaritagua station for the week April 7-13 is (from Table A-1):

days	7	8	9	10	11	12	13
probability (percent)	85	95	100	95	90	90	90

Because the probability of its being dry is 100 percent, the best day for cutting hay appears to be April 9. The probability of the sequence of three consecutive days, April 9, 10, and 11, being dry is given by:

$$P(D_9, D_{10}, D_{11}) = P(D_9) \cdot P(D_{10}/D_9) \cdot P(D_{11}/D_{10}).$$

Using the conditional probabilities, P(Dry/Dry), from Table A-2, we have

$$P(D_9, D_{10}, D_{11}) = \left(\frac{100}{100}\right) \left(\frac{95}{100}\right) \left(\frac{89}{100}\right) = 85 \text{ percent}$$

The probability of the sequence of three consecutive days (April 9, 10, and 11) being dry is equal to 85 percent.

April 9 may not be the best day for cutting hay, and another sequence can be analyzed. Thus, if April 8 is assumed to be the best day for cutting hay, the problem is worked as follows:

$$P(D_8, D_9, D_{10}) = P(D_8) \cdot P(D_9/D_8) \cdot P(D_{10}/D_9) \quad \text{or}$$

$$P(D_8, D_9, D_{10}) = \left(\frac{95}{100}\right)\left(\frac{100}{100}\right)\left(\frac{95}{100}\right) = 90 \text{ percent}$$

The probability of the sequence of three consecutive days (April 8, 9, and 10) being dry is equal to 90 percent. Hence, April 8 is a better day than April 9 for cutting hay. The last sequence indicates a probability of three consecutive days without any measurable precipitation. The farmer should cut his hay on April 8.

Another use of the results obtained in this study is the probability curves presented in Appendices D and E. A decline of the probability curves determines the end of the dry season and a rise in probability curves determines the end of the wet season (i.e., beginning of the dry season). It is possible also by comparison of stations (curves) to see different distributions and precipitation patterns between stations.

CHAPTER VI

CONCLUSIONS

From the results obtained and the Chi-square test, it is concluded that a first order Markov chain model can be used to predict sequences of dry and wet days in Venezuela.

Five specific conclusions were made from this study:

1. A first order Markov chain model was found to fit daily precipitation data in Venezuela.
2. Persistence in daily rainfall for a station in Venezuela (tropical zone) was found.
3. The model was independent of location and other meteorological conditions.
4. The 20-year record used in this study appeared to be a satisfactory length of record.
5. The results obtained by using the model appeared to properly evaluate future sequences of dry and wet days (climatological predictions).

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APPENDICES

APPENDIX A

TABLE A-1 PROBABILITY (%) OF DRY DAY P(DRY)

DRY<1 MM P(WET)=1-P(DRY)

YARITAGUA YARACUY STATE NUMBER 1289

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	95	95	95	95	80	75	45	45	70	85	85	75
2	90	100	100	100	75	65	45	65	75	90	85	80
3	95	95	100	100	75	50	45	70	65	75	80	80
4	90	95	100	90	85	55	65	50	80	85	85	90
5	85	100	100	95	75	70	35	30	65	80	80	80
6	95	100	100	95	60	60	55	55	75	70	75	85
7	90	100	95	85	75	40	40	55	80	70	80	85
8	100	100	100	95	75	60	55	75	75	80	85	70
9	100	100	100	100	70	60	60	60	70	95	75	75
10	100	95	100	95	60	50	45	55	70	85	80	95
11	90	100	100	90	65	70	45	65	75	75	85	100
12	95	100	100	90	65	60	45	70	75	60	85	100
13	90	100	100	95	70	60	55	70	70	70	95	100
14	95	100	100	85	60	50	85	60	80	85	85	75
15	95	100	100	90	65	45	50	75	80	75	85	100
16	100	100	100	95	60	55	60	70	80	65	85	90
17	90	80	95	85	70	70	50	55	85	75	80	80
18	90	95	90	70	60	40	55	70	75	80	85	95
19	100	100	95	70	85	45	70	60	75	85	75	95
20	100	100	95	65	80	45	55	80	80	85	80	95
21	95	100	100	85	70	45	65	75	75	70	85	95
22	100	100	100	70	65	45	60	80	75	80	80	95
23	100	100	100	60	65	60	60	90	90	85	75	100
24	100	95	100	75	65	35	50	60	85	70	75	100
25	100	95	100	70	65	45	60	65	90	80	85	100
26	100	100	100	55	65	40	60	75	80	70	80	100
27	95	100	90	85	85	65	55	60	75	85	95	95
28	95	95	100	55	75	30	55	50	70	75	80	95
29	90	100	95	75	75	65	45	50	85	60	85	90
30	95		100	70	55	30	35	80	90	70	80	95
31	100		100		70		45	70		85		95

TABLE A-2 PROBABILITY (%) OF DRY DAY GIVEN THAT THE PREVIOUS DAY IS DRY P(DRY/DRY)

DRY<1 MM P(WET/DRY)=1-P(DRY/DRY)

YARITAGUA YARACUY STATE NUMBER 1289

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	94	95	100	95	92	78	33	66	64	88	88	81
2	94	100	100	100	75	66	44	66	78	88	88	86
3	100	95	100	100	86	61	55	69	66	77	88	87
4	94	100	100	90	86	80	77	50	76	86	87	93
5	88	100	100	94	82	81	46	40	68	82	76	77
6	100	100	100	94	66	78	71	66	84	75	81	87
7	94	100	95	89	91	41	45	54	100	71	73	88
8	100	100	100	100	86	87	87	81	81	85	87	64
9	100	100	100	100	80	58	81	53	80	93	82	92
10	100	95	100	95	78	41	50	58	71	84	73	100
11	90	100	100	89	66	90	77	81	71	82	81	100
12	94	100	100	94	69	85	55	69	80	66	82	100
13	89	100	100	94	84	58	66	64	66	66	94	100
14	100	100	100	89	71	58	72	71	85	85	84	75
15	94	100	100	94	83	50	47	83	81	76	88	100
16	100	100	100	100	76	55	60	73	87	66	88	90
17	90	80	95	89	75	81	41	50	81	84	88	88
18	88	100	94	82	71	42	60	72	76	86	93	93
19	100	100	100	92	91	75	81	64	73	87	88	94
20	100	100	100	71	88	55	64	75	80	82	86	100
21	95	100	100	92	68	33	72	81	68	70	81	94
22	100	100	100	76	64	66	69	73	80	78	82	100
23	100	100	100	78	76	55	58	87	100	87	81	100
24	100	95	100	91	69	33	58	66	83	70	73	100
25	100	94	100	73	53	57	50	66	94	92	100	100
26	100	100	100	71	69	55	75	69	83	81	82	100
27	95	100	90	100	84	75	75	66	75	85	100	95
28	100	95	100	52	76	30	54	50	73	70	84	94
29	94	100	95	90	86	66	54	60	92	73	93	89
30	100		100	86	60	30	44	90	88	66	76	94
31	100		100		72		28	68		92		94

TABLE A-3 PROBABILITY (%) OF DRY DAY GIVEN THAT THE PREVIOUS DAY IS WET P(DRY/WET)

DRY<1 MM P(WET/WET)=1-P(DRY/WET)

YARITAGUA YARACUY STATE NUMBER 1289

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	100	0	0	0	50	66	50	63	83	50	66	50
2	0	100	100	100	75	60	45	63	66	100	66	60
3	50	0	0	0	40	28	36	71	60	50	33	50
4	0	0	0	0	80	30	54	50	85	80	75	75
5	50	100	0	100	33	55	14	20	50	66	100	100
6	66	0	0	100	40	16	46	50	57	50	50	75
7	0	0	0	0	50	37	33	55	20	66	100	66
8	100	0	100	66	40	41	33	66	50	66	75	100
9	0	0	0	100	40	62	33	80	40	100	33	33
10	0	0	0	0	16	62	37	50	66	100	100	80
11	0	100	0	100	62	50	18	44	83	33	100	100
12	100	0	0	50	57	0	36	71	60	40	100	0
13	100	0	0	100	42	62	45	83	80	75	100	0
14	50	0	0	0	33	37	100	33	66	83	100	0
15	100	0	0	66	37	40	66	62	75	66	66	100
16	100	0	0	50	28	54	60	60	50	60	66	0
17	0	0	0	0	62	55	62	66	100	57	33	0
18	100	75	0	0	33	33	50	66	66	60	50	100
19	100	100	50	16	75	25	55	50	80	75	0	100
20	0	0	0	50	33	36	33	87	80	100	60	0
21	0	0	100	71	75	54	55	50	100	66	100	100
22	100	0	0	33	66	27	42	100	60	83	66	0
23	0	0	0	16	42	63	62	100	60	75	50	100
24	0	0	0	50	57	37	37	0	100	66	80	0
25	0	100	0	60	85	38	70	62	66	50	40	0
26	0	100	0	16	57	27	37	85	50	25	66	0
27	0	0	0	66	85	58	25	40	75	83	75	0
28	0	0	100	66	66	28	55	50	60	100	0	100
29	0	100	0	55	40	64	33	40	66	20	50	100
30	50		100	20	40	28	27	70	100	75	100	100
31	100		0		66		53	75		66		100

TABLE A-4 PROBABILITY (%) OF DRY DAY P(DRY)

DRY<1 MM P(WET)=1-P(DRY)

EL PORTACHUELO ARAGUA STATE NUMBER 1432

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	80	65	65	85	65	55	40	50	40	50	45	50
2	80	70	80	70	55	60	75	45	45	60	50	65
3	80	55	65	75	70	50	55	55	25	55	50	70
4	70	65	80	75	65	40	60	50	25	55	50	65
5	70	60	75	65	65	45	50	40	60	85	50	65
6	55	65	75	80	45	60	55	60	60	45	60	55
7	75	80	75	85	50	40	60	45	45	35	55	45
8	55	70	80	70	70	50	40	55	40	65	50	60
9	75	60	70	80	80	50	40	45	45	40	55	60
10	90	65	70	75	75	70	50	50	30	60	45	60
11	80	70	70	85	75	65	55	45	40	55	45	70
12	70	70	75	75	65	65	45	55	30	50	35	45
13	60	75	75	65	60	50	50	45	35	55	40	45
14	65	75	85	65	70	50	35	45	45	60	40	65
15	65	65	75	65	60	50	40	35	70	55	55	70
16	75	80	70	55	70	50	25	60	45	45	35	40
17	75	65	80	50	45	35	35	75	40	35	45	55
18	75	80	70	70	55	50	40	40	20	35	45	50
19	75	80	70	45	80	70	35	40	60	60	30	60
20	60	70	75	55	55	40	50	65	45	55	50	70
21	80	70	75	60	50	45	60	60	45	60	40	75
22	65	65	85	75	50	65	45	55	50	50	40	55
23	70	60	85	60	60	65	40	50	65	45	40	50
24	75	70	60	60	65	55	35	35	50	60	55	70
25	60	60	65	50	60	45	45	60	50	40	60	55
26	60	80	85	60	50	40	40	30	55	45	60	65
27	55	85	90	65	50	55	45	45	50	10	40	80
28	80	80	70	65	65	60	40	35	50	50	30	75
29	55	100	85	35	55	55	40	55	50	55	55	70
30	55		85	50	70	65	40	50	55	50	60	65
31	50		75		60		60	45		55		65

TABLE A-5 PROBABILITY (%) OF DRY DAY GIVEN THAT THE PREVIOUS DAY IS DRY P(DRY/DRY)

DRY<1 MM P(WET/DRY)=1-P(DRY/DRY)

EL PORTACHUELO ARAGUA STATE NUMBER 1432

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	69	80	68	100	90	58	46	58	33	54	54	66
2	100	84	92	76	69	72	87	60	37	50	66	90
3	87	64	68	85	81	75	66	66	44	50	70	76
4	68	90	92	86	78	70	54	45	40	45	50	71
5	78	76	81	73	84	50	33	50	60	100	60	69
6	57	66	86	92	53	66	60	75	58	35	70	69
7	100	84	86	87	55	50	90	58	58	66	66	54
8	60	81	86	76	90	87	50	77	55	57	72	66
9	90	64	75	92	85	60	62	63	75	46	60	66
10	100	75	85	81	81	80	75	55	22	87	54	66
11	83	92	92	93	80	64	80	70	50	58	44	100
12	75	78	78	82	73	61	54	77	50	63	44	50
13	71	78	80	80	76	61	33	63	50	70	42	55
14	100	86	86	76	75	60	40	55	42	45	75	88
15	69	73	82	76	57	70	42	55	55	75	50	84
16	76	84	86	69	83	50	37	57	42	45	63	42
17	73	75	100	63	64	30	40	83	33	33	14	87
18	80	92	87	70	88	85	85	46	25	28	66	63
19	73	87	78	57	81	80	37	50	75	71	55	60
20	73	81	85	77	62	35	42	62	41	58	83	83
21	75	92	93	81	72	50	60	46	55	90	40	100
22	68	71	93	83	60	66	41	50	55	50	50	73
23	76	84	94	66	70	61	55	54	60	60	62	54
24	85	91	70	75	66	69	50	30	53	88	62	80
25	53	71	75	75	84	63	57	71	60	41	81	71
26	58	91	92	70	75	55	44	25	60	50	83	72
27	66	87	88	75	70	100	50	83	63	22	50	84
28	90	94	77	61	80	54	44	44	20	50	25	81
29	62	100	100	46	76	50	50	57	40	50	50	80
30	81		94	71	81	81	62	54	70	45	54	71
31	54		82		78		87	30		60		76

TABLE A-6 PROBABILITY (%) OF DRY DAY GIVEN THAT THE PREVIOUS DAY IS WET P(DRY/WET)

DRY<1 MM P(WET/WET)=1-P(DRY/WET)

EL PORTACHUELO ARAGUA STATE NUMBER 1432

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	100	50	50	40	40	50	28	25	45	44	33	25
2	0	42	57	33	28	44	66	30	50	70	36	40
3	50	33	50	50	55	12	20	45	9	62	30	57
4	75	33	57	40	33	10	66	55	20	66	50	50
5	50	28	50	40	28	41	75	30	60	66	40	57
6	50	62	40	57	28	54	50	50	62	100	50	28
7	44	71	40	75	45	25	22	25	25	9	37	33
8	40	25	60	33	50	25	25	36	27	69	22	54
9	55	50	50	50	66	40	25	22	25	28	50	50
10	60	50	33	50	50	60	33	45	36	41	33	50
11	50	28	16	60	60	66	30	20	35	50	45	25
12	50	50	66	33	40	71	33	36	16	33	27	33
13	33	66	60	20	28	28	63	22	28	40	38	36
14	12	40	80	42	62	40	30	36	46	77	16	45
15	57	40	33	42	66	30	38	18	81	25	58	42
16	71	71	20	28	50	50	16	61	50	44	0	33
17	80	25	33	33	0	40	33	62	45	36	61	33
18	60	57	0	70	27	30	15	20	16	38	27	33
19	80	50	50	16	77	60	33	33	56	53	9	60
20	20	25	50	36	25	50	53	66	50	50	35	50
21	87	16	20	33	22	41	60	85	36	22	40	16
22	50	50	60	62	40	63	50	62	45	50	33	0
23	57	14	33	40	50	71	27	44	70	30	25	44
24	50	37	0	37	62	28	25	40	42	36	50	60
25	80	33	50	12	14	22	38	53	40	37	33	16
26	62	62	71	50	12	27	36	37	50	41	25	55
27	37	75	100	50	30	25	41	28	33	0	25	71
28	66	0	0	71	50	66	36	27	80	50	33	50
29	25	100	50	14	14	62	33	53	60	60	57	40
30	22		33	38	55	44	25	44	40	55	66	50
31	44		33		16		41	60		50		42

TABLE A-7 PROBABILITY (%) OF DRY DAY P(DRY)

DRY<1 MM P(WET)=1-P(DRY)

AGUA FRIA MIRANDA STATE NUMBER 1436

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	80	90	90	85	70	40	20	60	35	50	60	75
2	85	85	85	90	80	30	50	30	40	50	50	55
3	90	95	90	95	65	30	45	55	40	55	85	65
4	65	95	95	90	65	45	65	40	25	65	70	65
5	80	95	90	90	65	30	45	40	45	70	60	80
6	90	90	95	95	70	30	30	35	50	70	65	65
7	95	80	95	85	60	55	35	55	55	40	65	75
8	70	95	95	85	75	35	45	55	50	60	50	75
9	90	95	100	95	80	55	40	45	50	60	60	70
10	100	90	90	95	90	50	30	40	40	55	70	55
11	80	90	95	95	80	70	40	60	40	60	70	75
12	85	100	100	85	55	65	65	60	40	70	60	70
13	75	90	100	75	70	35	40	50	55	60	60	70
14	90	90	95	90	75	40	50	45	55	70	60	80
15	95	90	90	60	65	50	25	45	65	60	75	95
16	95	85	90	75	55	30	45	40	50	50	75	55
17	80	90	90	75	55	30	45	60	45	50	55	75
18	90	95	85	90	60	45	35	65	45	40	50	80
19	70	90	90	60	70	55	40	40	60	50	50	80
20	95	80	90	75	55	35	50	60	60	40	65	80
21	100	90	100	60	60	35	45	70	60	60	60	75
22	95	75	100	70	45	45	50	60	55	65	85	90
23	95	80	95	75	40	45	35	55	70	50	65	100
24	90	90	95	75	55	35	35	35	50	50	65	85
25	80	100	95	70	60	45	35	55	55	50	70	75
26	90	95	100	75	55	30	35	30	60	65	60	95
27	70	90	85	80	60	45	60	45	40	35	60	80
28	75	90	90	60	70	50	50	35	40	55	70	95
29	80	100	90	60	50	45	35	55	55	55	75	80
30	65		95	70	50	40	50	55	65	70	70	95
31	80		90		60		65	45		55		85

TABLE A-8 PROBABILITY (%) OF DRY DAY GIVEN THAT THE PREVIOUS DAY IS DRY P(DRY/DRY)

DRY<1 MM P(WET/DRY)=1-P(DRY/DRY)

AGUA FRIA MIRANDA STATE NUMBER 1436

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	76	87	100	94	78	50	25	61	55	53	63	92
2	93	83	88	94	85	37	25	33	42	60	58	66
3	100	94	100	100	75	66	60	83	50	50	90	81
4	66	94	94	89	76	83	77	54	25	63	70	69
5	84	94	94	88	76	44	53	25	100	76	64	84
6	93	94	94	94	76	33	33	37	44	78	66	68
7	94	77	94	84	71	83	33	85	40	57	61	76
8	68	93	94	88	91	54	71	54	63	75	69	73
9	92	94	100	100	86	57	55	63	70	66	50	80
10	100	89	90	94	100	45	37	33	40	58	75	50
11	80	88	100	94	88	80	83	87	50	72	71	90
12	81	100	100	89	68	78	87	91	50	75	57	80
13	82	90	100	76	100	30	30	66	75	71	58	85
14	93	88	95	86	85	57	62	30	72	83	66	92
15	94	88	89	66	73	75	30	55	63	64	75	100
16	94	94	100	100	61	30	60	33	46	58	80	57
17	78	100	94	86	72	16	66	75	70	70	66	100
18	87	100	94	100	72	66	44	58	44	50	63	86
19	72	89	94	66	91	55	42	38	55	75	50	87
20	100	83	94	100	64	36	62	75	58	30	80	87
21	100	100	100	80	100	57	50	66	50	87	61	81
22	95	83	100	83	50	71	33	50	66	75	91	86
23	100	93	95	92	44	77	50	58	81	69	64	100
24	94	93	100	80	75	44	42	36	57	80	69	85
25	83	100	94	80	81	85	28	71	60	60	76	76
26	100	95	100	71	83	33	28	27	72	80	64	93
27	72	89	85	80	81	50	85	50	41	38	58	78
28	78	88	88	68	83	66	50	44	37	57	75	100
29	86	100	88	75	57	30	40	57	50	63	78	78
30	81		94	91	80	55	57	63	72	81	66	100
31	100		89		70		70	54		64		84

TABLE A-9 PROBABILITY (%) OF DRY DAY GIVEN THAT THE PREVIOUS DAY IS WET P(DRY/WET)

DRY<1 MM P(WET/WET)=1-P(DRY/WET)

AGUA FRIA MIRANDA STATE NUMBER 1436

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	100	100	0	0	50	25	16	28	18	42	55	33
2	50	100	50	66	66	25	56	25	38	40	37	20
3	33	100	33	50	25	14	30	42	33	60	80	44
4	50	100	100	100	42	28	54	22	25	66	66	57
5	71	100	0	100	42	18	28	50	26	57	50	71
6	75	0	100	100	57	28	27	33	54	50	62	50
7	100	100	100	100	33	42	35	38	70	0	71	71
8	100	100	100	66	50	11	30	55	33	50	14	80
9	83	100	100	66	60	53	27	22	30	50	70	40
10	100	100	0	100	50	55	25	45	40	50	62	66
11	0	100	50	100	0	60	21	41	33	44	66	55
12	100	100	100	0	0	33	50	12	33	62	66	40
13	33	0	0	66	33	42	57	25	41	33	62	33
14	80	100	0	100	50	30	41	60	33	50	50	50
15	100	100	100	0	40	33	20	36	66	50	75	75
16	100	0	0	37	42	30	40	45	57	37	60	0
17	100	33	50	40	33	35	27	50	20	30	20	44
18	100	50	0	60	44	35	27	75	45	30	33	60
19	50	100	66	0	37	54	38	42	63	33	50	50
20	83	50	50	37	33	33	41	50	62	50	50	50
21	100	50	100	0	11	23	40	75	75	41	57	50
22	0	0	0	50	37	30	63	83	37	50	75	100
23	0	40	0	33	36	18	20	50	55	14	66	100
24	0	75	0	60	41	27	30	33	33	20	57	0
25	50	100	100	40	33	23	38	46	50	40	57	66
26	50	0	100	83	12	27	38	33	44	50	50	100
27	50	100	0	80	33	42	46	42	37	28	62	100
28	66	100	100	25	50	36	50	27	41	53	62	75
29	60	100	100	37	33	60	30	53	58	44	66	100
30	0		100	37	20	27	46	44	55	55	80	75
31	42		100		50		60	33		33		100

TABLE A-10 PROBABILITY (%) OF DRY DAY P(DRY)

DRY<1 MM P(WET)=1-P(DRY)

VALERA TRUJILLO STATE NUMBER 2164

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	85	80	80	85	55	70	65	70	50	55	60	75
2	95	80	80	85	85	65	70	75	60	70	65	90
3	90	85	85	60	70	60	75	60	55	65	60	95
4	85	75	90	85	85	60	95	65	65	60	70	75
5	90	80	80	45	60	60	80	70	60	55	50	60
6	95	90	90	75	55	55	75	65	80	85	65	85
7	90	95	90	80	65	60	50	55	85	60	80	75
8	90	90	75	70	90	60	70	85	85	45	75	80
9	90	95	80	80	70	60	70	45	60	50	65	50
10	90	75	60	70	65	80	65	55	55	70	85	65
11	80	85	75	45	55	65	80	75	60	60	65	65
12	85	85	90	60	55	60	90	65	70	65	60	55
13	70	85	90	55	75	70	80	55	65	60	80	80
14	60	85	90	80	70	70	65	75	60	65	55	90
15	90	95	100	55	70	70	75	65	50	85	60	90
16	85	95	85	70	65	65	65	65	45	75	65	70
17	100	95	75	50	60	65	75	40	75	55	85	75
18	80	90	80	75	70	75	70	60	60	65	75	90
19	90	95	80	70	70	65	60	60	70	65	70	80
20	85	90	85	50	70	65	70	70	60	80	65	70
21	95	80	80	60	85	65	80	70	60	60	50	80
22	95	85	55	65	65	80	80	80	75	50	60	90
23	95	70	95	60	70	80	85	45	60	60	70	90
24	95	90	80	40	60	70	50	65	65	65	60	85
25	85	85	60	45	75	55	85	40	70	70	55	85
26	80	85	75	50	70	60	65	65	55	55	50	70
27	85	85	85	75	80	80	80	65	55	45	65	90
28	85	95	85	70	75	75	85	65	55	65	95	85
29	75	80	70	60	75	70	70	60	70	70	70	85
30	55		80	50	70	85	85	60	65	60	80	85
31	55		75		55		65	70		55		85

TABLE A-11 PROBABILITY (%) OF DRY DAY GIVEN THAT THE PREVIOUS DAY IS DRY P(DRY/DRY)

DRY<1 MM P(WET/DRY)=1-P(DRY/DRY)

VALERA TRUJILLO STATE NUMBER 2164

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	82	100	78	86	60	72	64	76	50	61	63	81
2	100	87	87	88	81	64	84	85	60	72	66	86
3	89	87	81	64	76	76	78	66	50	78	61	94
4	88	82	88	91	92	75	93	66	54	69	75	73
5	94	80	83	52	64	75	78	76	53	75	57	60
6	100	93	87	88	50	66	75	71	75	90	60	91
7	94	94	88	73	72	63	66	53	81	58	84	82
8	88	89	72	81	92	66	90	100	82	50	81	80
9	94	94	80	78	77	75	71	41	52	77	60	62
10	94	78	75	75	71	66	78	55	66	70	84	80
11	83	93	75	42	69	81	76	72	63	71	58	76
12	93	82	93	77	72	76	93	73	75	75	84	69
13	76	88	94	75	90	66	77	61	71	61	83	81
14	64	88	88	90	86	78	75	72	69	75	50	100
15	83	100	100	62	78	71	76	73	66	84	63	100
16	83	100	85	81	64	64	60	69	50	76	66	72
17	100	100	76	57	61	69	84	23	55	53	92	85
18	80	94	80	90	83	69	66	75	46	63	76	86
19	93	100	87	73	71	73	78	58	75	61	73	83
20	88	89	81	57	71	53	75	83	57	84	71	68
21	100	83	82	90	100	69	85	85	50	68	53	85
22	94	87	56	83	64	100	87	92	91	50	70	87
23	94	70	100	69	76	93	81	50	53	70	75	94
24	94	92	84	16	71	62	58	77	83	75	64	83
25	89	83	68	62	66	71	80	38	76	76	58	94
26	88	94	83	55	80	63	64	75	64	64	54	76
27	87	88	80	70	92	83	69	69	81	45	70	85
28	88	94	88	80	81	75	87	61	63	66	100	83
29	88	94	76	57	80	66	76	61	72	76	68	88
30	60		78	50	66	85	85	58	71	71	85	88
31	81		75		57		64	83		58		82

TABLE A-12 PROBABILITY (%) OF DRY DAY GIVEN THAT THE PREVIOUS DAY IS WET P(DRY/WET)

DRY<1 MM P(WET/WET)=1-P(DRY/WET)

VALERA TRUJILLO STATE NUMBER 2164

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	100	55	100	80	50	66	66	28	50	42	55	50
2	66	50	50	66	88	66	42	50	60	66	62	100
3	100	75	100	33	33	28	66	40	62	33	57	100
4	50	33	100	75	66	37	100	62	77	42	62	100
5	66	80	50	0	33	37	100	57	71	25	33	60
6	50	75	100	63	62	37	75	50	87	77	70	75
7	0	100	100	100	55	55	0	57	100	66	71	33
8	100	100	100	25	85	50	50	66	100	37	50	80
9	50	100	80	83	0	37	66	66	100	27	80	0
10	50	0	0	50	50	100	33	54	37	70	85	50
11	50	60	75	50	28	0	85	77	55	33	100	42
12	50	100	80	45	33	28	75	40	62	50	14	28
13	33	66	50	25	55	75	100	42	50	57	75	77
14	50	66	100	66	20	50	25	77	42	50	75	50
15	100	66	100	25	50	66	71	40	25	85	55	0
16	100	0	0	55	66	66	80	57	40	66	62	50
17	100	0	66	33	57	57	57	71	90	60	71	50
18	0	0	80	60	50	85	80	50	100	66	66	100
19	75	50	50	60	66	40	16	62	62	71	60	50
20	50	100	100	33	66	85	62	50	66	71	50	75
21	66	50	66	30	50	57	66	33	75	25	42	66
22	100	75	50	37	66	42	50	50	50	50	50	100
23	100	66	88	42	57	25	100	25	80	50	62	50
24	100	83	0	75	33	100	0	54	37	50	50	100
25	0	100	25	33	87	16	90	42	57	57	50	33
26	33	33	62	45	40	55	66	58	33	33	44	33
27	75	66	100	80	50	75	100	57	22	44	60	100
28	66	100	66	40	50	75	75	71	44	63	85	100
29	0	100	33	66	60	80	33	57	66	57	100	66
30	40		83	50	80	83	83	62	50	33	66	66
31	22		75		50		66	50		50		100

TABLE A-13 PROBABILITY (%) OF DRY DAY P(DRY)

DRY<1 MM P(WET)=1-P(DRY)

VALLE DE LA PASCUA GUARICO STATE NUMBER 2584

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	95	100	100	90	70	40	20	50	50	65	70	85
2	100	100	90	95	75	40	55	40	60	85	90	90
3	95	95	100	100	70	65	25	40	55	65	95	80
4	100	100	100	100	80	40	40	65	55	70	90	90
5	100	100	100	100	80	40	60	60	60	85	70	90
6	85	100	100	100	80	40	45	60	55	75	95	95
7	95	95	100	100	95	40	25	55	70	75	85	95
8	90	100	100	100	75	55	40	35	80	85	75	100
9	100	100	100	95	85	50	40	60	70	85	85	80
10	100	100	100	100	95	55	60	35	50	80	95	90
11	95	95	100	100	90	55	50	40	50	65	75	90
12	100	95	100	90	70	60	50	60	75	80	95	90
13	95	100	100	95	70	45	65	60	70	95	80	90
14	90	95	95	95	95	45	70	40	75	70	85	100
15	95	100	100	95	85	60	35	35	65	80	90	85
16	95	100	85	100	75	25	60	40	65	85	90	90
17	100	90	100	100	85	20	60	50	55	55	75	70
18	95	100	95	90	75	45	55	15	55	70	80	95
19	95	100	90	90	75	45	40	50	60	90	75	95
20	95	100	100	85	90	40	55	50	50	65	70	95
21	100	100	100	85	55	40	55	80	75	70	95	100
22	95	100	100	95	60	55	45	70	80	90	80	95
23	100	100	100	80	45	65	30	55	65	75	85	100
24	90	100	95	85	60	50	35	50	75	75	90	100
25	95	100	100	80	60	35	60	50	75	90	85	90
26	95	100	100	80	70	35	45	40	60	70	85	100
27	95	95	100	75	60	50	30	40	95	70	100	100
28	100	100	100	85	70	50	60	40	70	95	85	100
29	95	100	100	95	65	45	50	60	75	75	75	95
30	95		95	85	65	25	50	55	70	90	80	95
31	95		95		55		65	50		80		95

TABLE A-14 PROBABILITY (%) OF DRY DAY GIVEN THAT THE PREVIOUS DAY IS DRY P(DRY/DRY)

DRY<1 MM P(WET/DRY)=1-P(DRY/DRY)

VALLE DE LA PASCUA GUARICO STATE NUMBER 2584

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	94	100	100	94	76	45	0	61	60	71	81	81
2	100	100	90	100	85	50	75	40	60	76	92	88
3	95	95	100	100	66	87	36	50	66	70	100	83
4	100	100	100	100	85	61	60	75	45	84	89	93
5	100	100	100	100	87	50	62	61	63	85	72	88
6	85	100	100	100	87	50	50	75	41	76	100	94
7	94	95	100	100	93	62	11	66	90	93	84	94
8	94	100	100	100	78	62	80	54	71	80	82	100
9	100	100	100	95	100	45	37	85	68	82	86	80
10	100	100	100	100	100	60	75	33	50	82	100	100
11	95	95	100	100	94	72	66	57	50	62	78	88
12	100	94	100	90	77	54	60	62	80	76	100	94
13	95	100	100	100	85	58	60	58	66	100	78	94
14	89	95	95	94	100	55	69	33	71	68	87	100
15	94	100	100	94	84	66	42	50	66	78	88	85
16	94	100	85	100	70	25	57	14	69	81	94	88
17	100	90	100	100	93	20	66	62	69	52	77	72
18	95	100	95	90	82	75	58	30	45	81	86	100
19	100	100	94	94	86	55	54	66	72	92	75	100
20	94	100	100	94	93	44	62	60	50	66	93	94
21	100	100	100	94	61	37	63	60	80	76	92	100
22	95	100	100	100	72	62	45	62	86	92	78	95
23	100	100	100	84	50	72	44	57	68	77	93	100
24	90	100	95	93	66	61	66	63	76	80	88	100
25	94	100	100	82	66	40	85	70	73	86	83	90
26	94	100	100	81	91	28	41	60	73	72	82	100
27	94	95	100	87	71	57	44	37	91	78	100	100
28	100	100	100	100	100	50	50	37	68	100	85	100
29	95	100	100	94	57	40	50	50	71	73	76	95
30	94		95	89	76	33	50	58	60	86	86	94
31	100		100		76		80	45		77		94

TABLE A-15 PROBABILITY (%) OF DRY DAY GIVEN THAT THE PREVIOUS DAY IS WET P(DRY/WET)

DRY<1 MM P(WET/WET)=1-P(DRY/WET)

VALLE DE LA PASCUA GUARICO STATE NUMBER 2584

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	100	100	0	0	33	33	26	57	40	50	25	100
2	100	0	0	50	50	33	50	40	60	100	83	100
3	0	0	100	100	80	50	11	33	37	33	50	50
4	100	100	0	0	66	0	33	58	66	42	100	75
5	0	0	0	0	50	33	58	57	55	83	50	100
6	0	0	0	0	50	33	37	37	75	66	83	100
7	100	0	0	0	100	25	36	37	44	20	100	100
8	0	100	0	0	0	50	26	11	100	100	33	100
9	100	0	0	0	40	55	41	46	75	100	80	0
10	0	0	0	100	66	50	50	37	50	66	66	50
11	0	0	0	0	0	33	25	30	50	75	0	100
12	100	100	0	0	0	66	40	58	70	85	80	50
13	0	100	0	50	33	25	70	62	80	75	100	50
14	100	0	0	100	83	36	71	50	83	100	75	100
15	100	100	100	100	100	54	16	25	60	83	100	0
16	100	0	0	100	100	25	61	53	57	100	50	100
17	100	0	100	0	60	20	50	41	28	66	50	50
18	0	100	0	0	33	37	50	0	66	55	60	83
19	0	0	0	50	40	36	22	47	44	83	75	0
20	100	0	100	0	80	36	50	40	50	50	0	100
21	100	0	0	33	0	41	44	100	70	57	100	100
22	0	0	0	66	44	50	44	100	60	83	100	0
23	100	0	0	0	37	55	18	50	50	50	50	100
24	0	0	0	50	54	28	21	33	71	60	100	0
25	100	0	100	66	50	30	46	30	80	100	100	0
26	100	0	0	75	37	38	50	20	20	50	100	100
27	100	0	0	25	33	46	18	41	100	50	100	0
28	100	100	0	40	25	50	64	41	100	83	0	0
29	0	0	0	100	83	50	50	66	83	100	66	0
30	100		0	0	42	18	50	50	100	100	60	100
31	0		0		14		50	55		100		100

APPENDIX B

TABLE B-1 PROBABILITY (%) OF DRY DAY P(DRY)

DRY<3 MM P(WET)=1-P(DRY)

YARITAGUA YARACUY STATE NUMBER 1289

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	95	100	95	95	85	80	55	60	80	90	90	85
2	90	100	100	100	75	65	50	65	75	90	85	80
3	95	95	100	100	85	70	50	70	75	80	80	80
4	100	95	100	90	85	60	70	65	80	90	90	90
5	95	100	100	100	80	75	65	40	70	85	85	95
6	100	100	100	95	70	70	60	65	85	80	75	85
7	100	100	95	85	75	50	45	55	90	75	85	85
8	100	100	100	100	80	70	70	75	85	80	90	85
9	100	100	100	100	85	65	70	70	80	100	80	75
10	100	100	100	95	65	60	50	70	80	85	80	95
11	95	100	100	90	65	70	55	70	85	85	95	100
12	95	100	100	90	75	65	50	75	80	75	85	100
13	95	100	100	95	70	70	60	75	80	75	95	100
14	100	100	100	85	70	60	90	65	80	90	90	75
15	95	100	100	95	65	50	60	75	80	75	95	100
16	100	100	100	95	60	55	70	80	85	70	90	95
17	100	85	95	85	75	80	60	60	90	85	90	85
18	95	95	100	80	65	45	60	75	85	85	95	95
19	100	100	95	75	85	55	80	70	75	90	85	95
20	100	100	100	65	85	55	60	80	80	85	85	95
21	95	100	100	90	70	50	70	75	75	80	90	95
22	100	100	100	70	65	55	70	85	80	85	85	100
23	100	100	100	60	65	65	75	95	90	85	80	100
24	100	95	100	80	70	45	70	65	85	80	75	100
25	100	100	100	70	75	45	70	70	100	85	95	100
26	100	100	100	70	65	55	65	75	80	80	85	100
27	100	100	95	90	90	65	60	75	75	85	95	95
28	100	100	100	65	90	45	55	60	75	85	85	100
29	95	100	100	75	80	70	60	60	85	65	90	95
30	95		100	75	60	30	45	80	90	90	85	100
31	100		100		70		55	80		85		95

TABLE B-2 PROBABILITY (%) OF DRY DAY GIVEN THAT THE PREVIOUS DAY IS DRY P(DRY/DRY)

DRY<3 MM P(WET/DRY)=1-P(DRY/DRY)

YARITAGUA YARACUY STATE NUMBER 1289

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	94	100	95	95	93	85	33	63	75	94	94	82
2	94	100	100	100	76	68	45	66	81	88	88	88
3	100	95	100	100	100	84	60	69	73	83	88	87
4	100	100	100	90	88	71	70	64	80	93	93	93
5	95	100	100	100	88	75	71	61	68	83	83	94
6	100	100	100	95	75	80	61	75	92	82	76	89
7	100	100	95	89	78	42	41	53	100	81	80	88
8	100	100	100	100	86	90	88	81	88	86	94	82
9	100	100	100	100	81	64	78	66	88	100	83	82
10	100	100	100	95	70	38	50	71	81	85	75	100
11	95	100	100	89	69	83	70	85	87	94	93	100
12	94	100	100	94	84	85	54	71	82	70	84	100
13	94	100	100	94	80	76	70	73	81	66	94	100
14	100	100	100	89	71	57	83	73	87	93	89	75
15	95	100	100	100	78	66	61	84	81	77	94	100
16	100	100	100	100	76	60	75	80	87	73	89	95
17	100	85	95	89	75	90	64	56	88	85	88	84
18	95	100	100	94	73	56	50	75	83	94	100	94
19	100	100	95	81	92	77	91	73	76	88	84	94
20	100	100	100	73	88	54	62	78	80	83	82	100
21	95	100	100	92	70	45	75	81	68	76	88	94
22	100	100	100	72	64	70	78	80	80	81	88	100
23	100	100	100	78	76	63	71	94	100	82	82	100
24	100	95	100	91	69	30	73	68	83	82	75	100
25	100	100	100	75	71	55	71	69	100	87	100	100
26	100	100	100	78	73	66	78	71	80	82	84	100
27	100	100	95	92	92	81	76	80	75	87	94	95
28	100	100	100	66	88	46	50	66	73	82	84	100
29	95	100	100	84	83	77	72	66	93	70	94	95
30	100		100	86	68	28	50	83	88	84	83	100
31	100		100		75		55	81		88		95

TABLE B-3 PROBABILITY (%) OF DRY DAY GIVEN THAT THE PREVIOUS DAY IS WET P(DRY/WET)

DRY<3 MM P(WET/WET)=1-P(DRY/WET)

YARITAGUA YARACUY STATE NUMBER 1289

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	100	0	0	0	60	66	64	100	100	50	66	100
2	0	0	100	100	66	50	55	62	50	100	50	33
3	50	0	0	0	40	42	40	71	80	50	33	50
4	100	0	0	0	66	33	70	66	80	75	75	75
5	0	100	0	100	33	75	50	0	75	100	100	100
6	100	0	0	0	50	40	57	58	66	66	66	0
7	0	0	0	0	66	66	50	57	33	50	100	66
8	0	0	100	100	60	50	54	66	50	60	66	100
9	0	0	0	0	100	66	50	80	33	100	50	33
10	0	0	0	0	33	100	50	66	75	0	100	80
11	0	0	0	100	57	50	40	33	75	33	100	100
12	100	0	0	50	57	16	44	83	66	100	100	0
13	100	0	0	100	40	57	50	80	75	100	100	0
14	100	0	0	0	66	66	100	40	50	80	100	0
15	0	0	0	66	33	25	50	57	75	50	100	100
16	100	0	0	0	28	50	62	80	75	60	100	0
17	0	0	0	0	75	66	50	75	100	83	100	100
18	0	66	100	0	40	0	75	75	100	33	50	100
19	100	100	0	50	71	36	62	60	66	100	100	100
20	0	0	100	40	66	55	50	83	80	100	100	0
21	0	0	0	85	66	55	62	50	100	100	100	100
22	100	0	0	50	66	40	50	100	80	100	50	100
23	0	0	0	16	42	66	83	100	50	100	66	0
24	0	0	0	62	71	71	60	0	100	66	75	0
25	0	100	0	50	83	36	66	71	100	75	80	0
26	0	0	0	50	40	45	33	83	0	66	100	0
27	0	0	0	83	85	44	28	60	75	75	100	0
28	0	0	100	50	100	42	62	40	80	100	100	100
29	0	0	0	57	50	63	44	50	60	33	66	0
30	0		0	40	25	33	37	75	100	100	100	100
31	100		0		62		54	75		50		0

TABLE B-4 PROBABILITY (%) OF DRY DAY P(DRY)

DRY<3 MM P(WET)=1-P(DRY)

EL PORTACHUELO ARAGUA STATE NUMBER 1432

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	85	70	80	90	75	75	70	70	50	60	60	70
2	90	80	90	85	60	65	85	60	60	75	65	70
3	80	80	70	80	75	55	65	70	50	75	50	75
4	75	75	95	85	75	60	70	70	50	55	60	70
5	90	80	90	80	75	50	70	45	80	90	65	70
6	75	80	90	85	60	65	55	75	70	50	65	80
7	90	80	90	85	60	50	70	75	55	45	75	65
8	70	80	95	85	80	80	60	60	50	75	70	65
9	85	80	85	80	80	60	65	60	60	50	65	75
10	90	90	75	80	75	80	55	55	50	70	50	70
11	95	85	70	100	80	70	70	55	65	65	55	75
12	90	80	85	80	75	65	50	75	40	65	50	55
13	75	85	80	75	75	80	60	55	50	70	40	55
14	85	80	85	75	80	70	55	60	55	70	50	85
15	85	80	75	75	75	60	55	55	80	55	65	85
16	90	95	85	75	80	65	50	85	65	75	55	60
17	75	70	90	75	60	55	50	75	45	60	70	65
18	85	90	85	80	55	65	50	55	45	55	50	55
19	80	90	75	60	85	70	40	60	60	65	45	75
20	75	75	85	65	80	60	65	75	65	65	70	70
21	95	85	95	70	75	50	65	70	60	65	50	80
22	80	75	85	80	55	85	70	65	60	60	55	85
23	80	75	90	80	75	70	45	65	80	75	60	75
24	90	75	80	65	75	60	45	55	60	65	65	85
25	85	80	85	60	75	50	65	85	60	60	70	70
26	80	100	90	75	60	45	75	55	65	45	60	85
27	80	95	90	70	75	65	50	60	55	15	45	85
28	80	90	85	75	75	80	55	45	75	60	55	80
29	65	100	95	40	75	60	75	70	65	80	65	80
30	55		95	60	85	75	45	60	75	60	65	80
31	55		90		70		80	65		60		70

TABLE B-5 PROBABILITY (%) OF DRY DAY GIVEN THAT THE PREVIOUS DAY IS DRY P(DRY/DRY)

DRY<3 MM P(WET/DRY)=1-P(DRY/DRY)

EL PORTACHUELO ARAGUA STATE NUMBER 1432

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	78	90	83	94	83	78	66	68	53	60	58	84
2	100	85	100	94	66	66	78	71	70	75	58	85
3	77	87	72	88	83	69	76	66	58	80	69	85
4	75	87	100	87	86	81	69	71	50	60	70	73
5	93	86	94	82	86	58	71	50	70	100	75	71
6	77	81	94	81	73	60	71	88	75	44	69	85
7	100	87	88	88	50	53	100	80	57	70	76	62
8	77	93	94	82	91	80	64	60	54	77	66	69
9	92	93	84	88	87	68	75	66	70	53	78	84
10	100	93	76	87	81	75	53	66	50	90	53	80
11	94	94	86	100	86	68	81	63	70	64	60	100
12	89	88	85	80	81	64	42	90	30	61	45	66
13	77	87	82	87	80	76	40	53	62	84	40	63
14	93	88	87	86	80	75	58	63	60	64	87	100
15	94	81	82	86	75	57	54	50	72	64	50	88
16	94	100	93	80	86	58	54	100	68	81	69	64
17	72	73	94	80	62	46	70	76	23	73	72	83
18	86	92	88	80	75	72	70	60	55	58	50	76
19	82	94	82	68	81	76	30	63	77	72	50	81
20	81	83	86	83	82	57	50	75	58	69	100	80
21	93	100	100	84	81	58	53	66	69	84	50	100
22	78	76	89	85	66	90	61	64	75	69	60	87
23	81	93	100	87	72	70	57	69	83	83	72	70
24	93	93	88	75	86	78	66	53	68	73	75	86
25	83	86	87	92	86	58	66	100	58	76	84	76
26	82	100	88	83	73	50	69	58	58	41	85	85
27	81	95	88	73	83	100	60	72	61	22	58	88
28	81	94	88	71	86	76	60	58	63	66	55	76
29	75	100	100	46	80	56	81	77	60	75	81	75
30	84		100	87	86	83	53	71	84	56	61	81
31	63		89		76		88	50		66		87

TABLE B-6 PROBABILITY (%) OF DRY DIY GIVEN THAT THE PREVIOUS DAY IS WET P(DRY/WET)

DRY<3 MM P(WET/WET)=1-P(DRY/WET)

EL PORTACHUELO ARAGUA STATE NUMBER 1432

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	100	44	50	50	62	66	80	100	42	60	62	42
2	33	66	50	0	40	60	100	33	50	75	75	33
3	100	50	50	33	62	28	0	75	37	60	14	50
4	75	25	83	75	40	33	71	66	50	40	50	60
5	80	60	0	66	40	37	66	33	90	77	50	66
6	50	75	50	100	20	70	16	63	50	100	57	66
7	60	50	100	66	75	42	33	60	50	20	71	75
8	0	25	100	100	62	80	50	60	44	72	80	57
9	66	25	100	33	50	25	50	50	50	40	33	57
10	33	75	66	50	50	87	57	37	50	50	42	40
11	100	0	20	100	60	75	55	44	60	66	50	16
12	100	33	83	0	50	66	66	55	57	71	55	20
13	50	75	66	25	60	85	80	60	41	42	40	44
14	60	33	75	40	80	50	50	55	50	83	25	66
15	33	75	33	40	75	66	55	62	88	33	80	66
16	66	75	60	60	60	75	44	66	50	66	28	33
17	100	0	66	60	50	71	30	66	85	20	66	37
18	80	83	50	80	25	55	30	40	36	50	50	14
19	66	50	33	25	88	57	50	55	45	55	40	66
20	50	0	80	37	66	66	75	75	75	57	45	40
21	100	40	66	42	50	37	85	80	42	28	50	33
22	100	66	0	66	20	80	85	66	37	42	50	75
23	75	20	33	50	77	66	16	57	75	62	44	100
24	75	20	0	25	40	16	27	57	25	40	50	80
25	100	60	75	0	40	37	63	66	62	28	42	33
26	66	100	100	62	20	40	85	33	75	50	0	83
27	75	0	100	60	62	36	20	44	42	9	25	66
28	75	0	50	83	40	85	50	25	88	58	54	100
29	25	100	66	20	60	75	66	63	80	87	44	100
30	0		0	41	80	62	20	33	57	75	71	75
31	44		100		33		72	87		50		0

TABLE B-7 PROBABILITY (%) OF DRY DAY P(DRY)

DRY<3 MM P(WET)=1-P(DRY)

AGUA FRIA MIRANDA STATE NUMBER 1436

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	90	95	95	90	75	50	40	75	50	65	75	90
2	85	90	90	95	80	65	70	45	70	65	75	80
3	95	100	90	100	85	40	45	55	55	70	85	80
4	80	100	100	90	75	45	70	55	40	65	75	75
5	80	95	95	100	75	45	60	80	70	85	85	90
6	95	95	95	95	90	60	50	70	60	80	70	75
7	95	85	95	95	70	55	45	65	65	45	70	90
8	80	100	95	90	80	65	50	65	60	75	65	80
9	95	95	100	95	85	65	60	65	75	70	90	80
10	100	90	90	100	95	60	50	60	50	65	80	75
11	85	95	100	95	80	80	50	65	55	65	80	80
12	95	100	100	95	65	75	70	70	55	85	70	85
13	95	100	100	90	80	50	55	60	60	70	70	75
14	90	95	95	90	80	40	70	50	75	75	80	90
15	100	90	90	85	95	75	55	65	80	80	80	95
16	100	90	95	85	75	50	45	70	65	65	80	80
17	90	90	95	75	70	40	55	65	50	60	60	80
18	95	95	95	90	60	45	60	80	50	55	60	85
19	85	90	100	70	75	65	50	65	65	70	65	95
20	95	90	95	75	75	45	55	65	80	50	85	90
21	100	90	100	65	75	55	65	70	70	65	75	90
22	100	80	100	80	60	75	50	75	55	75	90	100
23	95	90	95	85	50	65	45	75	75	75	85	100
24	90	95	100	85	60	55	55	55	60	80	85	90
25	85	100	100	80	60	65	65	70	80	65	75	80
26	100	100	100	80	70	40	40	50	80	70	80	95
27	90	100	100	95	65	55	65	60	60	55	75	100
28	80	95	90	65	75	55	65	55	60	65	80	95
29	90	100	90	60	60	60	50	70	65	55	90	85
30	75		95	75	75	50	60	60	80	90	75	100
31	80		90		75		75	70		75		90

TABLE B-8 PROBABILITY (%) OF DRY DAY GIVEN THAT THE PREVIOUS DAY IS DRY P(DRY/DRY)

DRY<3 MM P(WET/DRY)=1-P(DRY/DRY)

AGUA FRIA MIRANDA STATE NUMBER 1436

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	88	93	94	94	73	46	40	80	57	75	86	100
2	88	89	94	100	86	70	75	46	80	69	80	83
3	100	100	94	100	93	53	50	66	64	61	86	81
4	78	100	100	90	76	75	77	72	36	71	70	75
5	81	95	95	100	93	66	71	90	87	92	86	100
6	100	100	94	95	93	77	50	68	57	76	70	77
7	94	84	94	94	66	58	60	71	50	56	71	86
8	78	100	94	89	78	54	66	76	61	88	78	77
9	100	95	100	100	93	76	60	61	75	73	92	87
10	100	89	90	100	100	53	58	61	40	71	77	75
11	85	94	100	95	84	91	80	75	60	76	81	86
12	94	100	100	94	81	81	90	92	54	84	68	93
13	94	100	100	89	100	53	50	85	72	82	78	88
14	89	95	95	88	93	50	72	41	91	85	85	100
15	100	89	89	94	100	87	50	80	73	80	75	100
16	100	94	100	94	78	40	45	61	62	68	87	78
17	90	100	100	82	73	50	77	78	69	84	68	93
18	94	100	100	100	71	62	63	76	50	58	66	87
19	84	89	100	72	91	77	50	62	70	72	58	100
20	94	88	95	92	86	46	70	76	76	50	92	89
21	100	100	100	80	86	55	72	69	68	90	76	94
22	100	88	100	76	73	90	38	71	64	76	100	100
23	95	93	95	93	58	73	60	86	81	80	83	100
24	94	100	100	82	70	53	55	53	73	86	82	90
25	88	100	100	88	83	81	90	81	83	68	88	83
26	100	100	100	75	83	46	38	35	81	69	73	93
27	90	100	100	100	71	75	87	60	56	57	81	100
28	83	95	90	68	84	72	76	58	66	54	86	95
29	87	100	88	76	73	45	53	63	66	61	93	84
30	83		94	91	91	58	60	64	92	81	77	100
31	93		89		86		91	75		77		90

TABLE B-9 PROBABILITY (%) OF DRY DAY GIVEN THAT THE PREVIOUS DAY IS WET P(DRY/WET)

DRY<3 MM P(WET/WET)=1-P(DRY/WET)

AGUA FRIA MIRANDA STATE NUMBER 1436

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	100	100	100	50	80	60	40	80	33	25	40	60
2	50	100	0	50	60	60	66	40	60	57	60	50
3	66	100	50	100	50	14	33	45	33	85	80	75
4	100	0	100	0	66	25	63	33	44	50	100	75
5	75	0	0	100	20	27	33	66	58	71	80	60
6	75	0	100	0	80	45	50	75	66	100	66	50
7	100	100	100	100	100	50	30	50	87	0	66	100
8	100	100	100	100	83	77	36	42	57	63	33	100
9	75	0	100	50	50	42	60	71	75	60	85	50
10	100	100	0	100	66	71	37	57	80	50	100	75
11	0	100	100	0	0	62	20	50	50	42	75	60
12	100	100	0	100	0	50	50	28	55	85	75	50
13	100	0	0	100	42	40	66	0	44	0	50	0
14	100	0	0	100	25	30	66	62	50	50	66	60
15	100	100	100	0	75	66	66	50	100	80	100	50
16	0	50	50	33	0	80	44	85	75	50	50	100
17	0	0	0	33	60	30	36	33	14	14	25	25
18	100	50	0	60	33	33	55	85	50	50	50	75
19	100	100	100	50	50	54	50	75	60	66	75	66
20	100	100	0	33	40	42	40	42	85	50	71	100
21	100	0	100	20	40	54	55	71	75	40	66	50
22	0	0	0	85	20	55	71	83	33	71	60	100
23	0	75	0	50	37	40	30	40	66	60	100	0
24	0	50	100	100	50	57	54	60	20	60	100	0
25	50	100	0	33	25	44	33	55	75	50	0	50
26	100	0	0	100	50	28	42	83	75	71	100	100
27	0	0	0	75	50	41	50	60	75	50	50	100
28	50	0	0	0	57	33	42	50	50	77	60	0
29	100	100	100	28	20	77	42	77	62	42	75	100
30	0		100	50	50	37	60	50	57	100	50	100
31	40		100		40		50	62		50		0

TABLE B-10 PROBABILITY (%) OF DRY DAY P(DRY)

DRY<3 MM P(WET)=1-P(DRY)

VALERA TRUJILLO STATE NUMBER 2164

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	100	85	90	95	65	75	80	70	70	70	80	75
2	95	80	90	85	85	65	75	80	80	85	70	90
3	100	90	85	75	80	85	95	70	70	70	70	100
4	90	75	100	85	85	75	100	80	75	75	80	80
5	90	90	90	70	70	80	95	75	65	60	65	75
6	95	95	100	80	60	70	80	85	85	85	75	90
7	90	95	90	85	75	70	60	75	90	80	85	80
8	95	95	85	80	90	90	80	90	95	60	80	90
9	95	100	85	80	85	85	80	75	70	65	65	70
10	90	80	70	70	80	90	75	60	65	80	90	80
11	90	90	95	50	65	90	85	75	80	70	75	75
12	85	90	90	65	65	65	90	80	70	80	70	65
13	80	90	90	70	90	80	85	75	80	80	90	90
14	80	95	100	80	75	95	85	75	75	85	80	90
15	95	95	100	65	85	85	90	80	65	85	65	90
16	90	95	95	80	75	85	70	80	50	80	65	85
17	100	95	95	80	85	95	85	65	75	65	90	85
18	85	90	85	85	70	85	75	80	70	75	85	90
19	95	95	85	80	75	80	80	65	80	80	75	80
20	90	95	95	65	70	80	75	80	75	85	70	80
21	95	80	80	80	85	70	85	80	75	75	70	90
22	95	95	70	75	70	85	80	80	85	65	70	95
23	95	80	95	60	85	85	100	50	75	75	75	95
24	95	100	90	50	80	80	70	80	85	75	70	95
25	90	95	70	55	75	80	95	70	80	80	65	90
26	80	95	90	55	80	70	75	80	65	70	60	80
27	85	95	95	95	85	90	90	80	70	55	80	95
28	85	95	95	85	80	90	95	80	70	85	95	85
29	80	80	80	70	80	95	75	80	70	80	70	95
30	65		95	75	80	85	90	70	85	70	95	85
31	65		80		65		75	85		60		90

TABLE B-11 PROBABILITY (%) OF DRY DAY GIVEN THAT THE PREVIOUS DAY IS DRY P(DRY/DRY)

DRY<3 MM P(WET/DRY)=1-P(DRY/DRY)

VALERA TRUJILLO STATE NUMBER 2164

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	100	92	89	93	60	76	82	73	76	82	83	73
2	95	88	94	89	84	66	87	85	78	78	68	86
3	100	93	83	82	88	92	93	81	68	70	71	100
4	90	83	100	80	87	82	100	71	71	85	92	80
5	88	93	90	76	76	80	95	81	60	60	68	81
6	100	94	100	78	57	68	78	86	76	83	76	93
7	94	94	90	81	83	71	68	76	88	76	86	77
8	94	94	83	88	93	92	91	93	94	56	88	87
9	94	100	82	75	88	94	81	72	68	75	62	72
10	89	80	70	75	82	88	81	66	78	76	92	85
11	88	87	100	50	68	94	86	75	76	75	72	81
12	94	88	89	70	76	72	94	86	75	92	80	66
13	82	88	94	84	92	84	83	81	85	75	92	84
14	81	94	100	78	83	100	88	73	75	87	77	100
15	93	94	100	68	93	84	94	80	60	88	62	100
16	89	100	95	92	76	82	72	81	61	82	69	83
17	100	100	94	81	100	94	92	62	60	68	100	88
18	85	94	84	87	82	84	76	84	60	76	88	88
19	100	100	88	82	78	82	80	68	78	86	82	83
20	89	94	94	68	73	81	75	84	68	81	73	81
21	100	84	78	100	100	75	93	87	66	70	71	87
22	94	93	75	81	70	92	82	87	86	60	71	94
23	94	78	100	60	85	94	100	56	70	76	85	100
24	94	100	94	33	88	76	70	70	100	86	66	94
25	94	95	77	60	68	81	92	62	88	86	64	89
26	83	94	92	54	86	75	73	85	68	75	61	83
27	87	94	94	90	93	92	86	81	76	57	75	93
28	88	94	94	84	88	94	94	81	71	90	100	84
29	88	94	84	76	87	94	78	81	71	82	68	100
30	75		93	71	81	84	93	68	92	75	92	89
31	76		78		68		77	92		57		88

TABLE B-12 PROBABILITY (%) OF DRY DAY GIVEN THAT THE PREVIOUS DAY IS WET P(DRY/WET)

DRY<3 MM P(WET/WET)=1-P(DRY/WET)

VALERA TRUJILLO STATE NUMBER 2164

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	100	71	100	100	80	71	66	40	33	0	75	100
2	0	33	50	0	85	60	25	66	83	100	75	100
3	100	75	100	33	33	71	100	25	75	66	66	100
4	0	0	100	100	75	33	100	100	83	50	50	0
5	100	80	0	33	33	80	0	50	80	60	50	50
6	50	100	100	83	66	75	100	80	100	87	71	80
7	0	100	0	100	62	66	25	66	100	100	80	100
8	100	100	100	33	80	83	62	80	100	75	33	100
9	100	100	100	100	50	0	75	100	100	50	75	50
10	100	0	66	50	66	100	50	40	33	85	85	66
11	100	100	83	50	50	50	80	75	85	50	100	50
12	0	100	100	60	42	0	66	60	50	50	40	60
13	66	100	50	42	85	71	100	50	66	100	83	100
14	75	100	100	83	0	75	66	80	75	75	100	0
15	100	100	0	50	60	100	66	80	80	66	75	0
16	100	0	0	57	66	100	50	75	28	66	57	100
17	100	0	100	75	40	100	66	75	90	50	71	66
18	0	0	100	75	0	100	66	71	100	71	50	100
19	66	50	66	66	66	66	80	50	83	60	33	50
20	100	100	100	50	60	75	75	71	100	100	60	75
21	50	0	100	42	50	50	60	50	100	100	66	100
22	100	100	50	50	66	66	66	50	80	80	66	100
23	100	100	83	60	83	33	100	25	100	71	50	0
24	100	100	0	75	33	100	0	90	40	40	80	100
25	0	0	0	50	100	75	100	100	33	60	66	100
26	50	100	83	55	60	50	100	66	50	50	57	50
27	75	100	100	100	50	83	100	75	57	50	87	100
28	66	100	100	100	33	50	100	75	66	77	75	100
29	33	100	0	33	50	100	0	75	66	66	100	66
30	25		100	83	75	100	80	75	66	50	100	0
31	42		100		50		50	66		66		100

TABLE B-13 PROBABILITY (%) OF DRY DAY P(DRY)

DRY<3 MM P(WET)=1-P(DRY)

VALLE DE LA PASCUA GUARICO STATE NUMBER 2584

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	100	100	100	100	85	60	40	60	60	90	75	100
2	100	100	100	100	75	40	70	45	70	90	100	100
3	100	100	100	100	85	65	40	60	55	75	100	85
4	100	100	100	100	85	45	55	75	60	80	100	100
5	100	100	100	100	85	55	65	60	80	90	75	95
6	90	100	100	100	85	50	55	75	75	90	95	100
7	100	95	100	100	100	50	50	70	80	75	90	95
8	90	100	100	100	80	75	60	50	85	90	80	100
9	100	100	100	100	90	65	50	60	75	95	90	85
10	100	100	100	100	95	70	70	55	55	85	100	90
11	95	100	100	100	95	70	55	50	65	75	85	95
12	100	100	100	95	85	65	60	70	75	90	100	90
13	100	100	100	95	75	55	75	75	80	100	95	100
14	95	100	100	95	95	55	75	50	85	80	90	100
15	100	100	100	100	95	60	50	65	80	90	95	95
16	95	100	95	100	80	35	70	60	70	95	90	90
17	100	90	100	100	85	30	65	60	60	85	85	85
18	100	100	95	90	80	50	75	35	75	85	90	95
19	95	100	95	95	80	50	55	75	65	90	90	95
20	95	100	100	90	90	55	70	70	60	75	80	100
21	100	100	100	95	65	45	85	80	80	85	95	100
22	95	100	100	95	65	65	55	70	85	90	80	100
23	100	100	100	80	55	75	40	65	70	80	95	100
24	100	100	95	90	75	55	50	70	85	85	90	100
25	100	100	100	80	65	55	75	65	85	95	100	95
26	100	100	100	85	75	45	65	55	70	80	90	100
27	100	95	100	80	85	50	55	50	95	75	100	100
28	100	100	100	90	70	70	65	60	80	95	90	100
29	100	100	100	95	70	60	50	70	80	75	85	95
30	100		95	85	90	50	60	65	75	90	85	100
31	95		95		75		70	65		85		95

TABLE 8-14 PROBABILITY (%) OF DRY DAY GIVEN THAT THE PREVIOUS DAY IS DRY P(DRY/DRY)

DRY<3 MM P(WET/DRY)=1-P(DRY/DRY)

VALLE DE LA PASCUA GUARICO STATE NUMBER 2584

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	100	100	100	100	88	60	30	71	69	93	82	100
2	100	100	100	100	76	41	87	41	75	88	100	100
3	100	100	100	100	80	87	50	66	57	77	100	85
4	100	100	100	100	88	69	50	83	54	86	100	100
5	100	100	100	100	88	55	54	66	75	93	75	95
6	90	100	100	100	94	54	61	83	75	88	100	100
7	100	95	100	100	100	50	45	80	86	83	89	95
8	90	100	100	100	80	80	70	57	81	86	83	100
9	100	100	100	100	93	60	33	90	70	94	93	85
10	100	100	100	100	100	69	90	50	53	84	100	100
11	95	100	100	100	94	78	64	63	72	76	85	94
12	100	100	100	95	89	50	72	70	84	86	100	89
13	100	100	100	100	76	53	75	71	73	100	95	100
14	95	100	100	94	100	72	80	53	87	80	89	100
15	100	100	100	100	94	54	53	70	76	87	94	95
16	95	100	95	100	78	41	60	53	68	94	94	89
17	100	90	100	100	87	42	78	66	71	84	88	83
18	100	100	95	90	88	83	76	50	83	94	88	100
19	95	100	100	94	87	70	53	100	66	88	88	100
20	94	100	100	94	93	50	81	60	61	77	88	100
21	100	100	100	100	66	36	85	71	83	93	93	100
22	95	100	100	100	84	66	52	62	93	94	78	100
23	100	100	100	84	69	84	54	64	70	83	93	100
24	100	100	95	100	81	60	75	76	85	81	89	100
25	100	100	100	83	73	72	90	64	82	94	100	95
26	100	100	100	87	84	45	60	53	76	78	90	100
27	100	95	100	94	93	55	53	54	92	81	100	100
28	100	100	100	100	82	70	72	50	78	93	90	100
29	100	100	100	94	64	50	53	66	81	73	83	95
30	100		95	89	92	50	60	64	68	86	88	100
31	95		100		72		83	61		83		95

TABLE B-15 PROBABILITY (%) OF DRY DAY GIVEN THAT THE PREVIOUS DAY IS WET P(DRY/WET)

DRY<3 MM P(WET/WET)=1-P(DRY/WET)

VALLE DE LA PASCUA GUARICO STATE NUMBER 2584

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	100	100	0	100	66	60	50	83	42	80	33	100
2	0	0	0	0	66	37	58	50	62	100	100	0
3	0	0	0	0	100	50	16	54	50	50	0	0
4	0	0	0	0	66	0	58	62	66	60	0	100
5	0	0	0	0	66	54	77	40	87	75	0	0
6	0	0	0	0	33	44	42	62	75	100	80	100
7	100	0	0	0	100	50	55	40	60	0	100	0
8	0	100	0	0	0	70	50	33	100	100	50	100
9	100	0	0	0	75	80	75	30	100	100	75	0
10	0	0	0	0	50	71	50	62	60	100	100	33
11	0	0	0	0	100	50	33	33	55	66	0	100
12	100	0	0	0	0	100	44	70	57	100	100	100
13	0	0	0	0	66	57	75	83	100	100	0	100
14	0	0	0	100	80	33	60	40	75	0	100	0
15	100	0	0	100	100	66	40	60	100	100	100	0
16	0	0	0	0	100	25	80	71	75	100	0	100
17	100	0	100	0	75	23	33	50	33	100	50	100
18	0	100	0	0	33	35	71	12	62	33	100	66
19	0	0	0	100	50	30	60	61	60	100	100	0
20	100	0	100	0	75	60	55	100	57	50	0	100
21	100	0	0	50	50	55	83	100	75	60	100	0
22	0	0	0	0	28	63	66	100	50	66	100	0
23	100	0	0	0	28	57	22	66	66	50	100	0
24	0	0	0	50	66	40	33	57	83	100	100	0
25	0	0	100	50	40	33	60	66	100	100	100	0
26	0	0	0	75	57	44	80	57	33	100	0	100
27	0	0	0	0	60	45	57	44	100	50	100	0
28	0	100	0	50	0	70	55	70	100	100	0	0
29	0	0	0	100	83	83	42	75	75	100	100	0
30	0		0	0	83	50	60	66	100	100	66	100
31	0		0		100		50	71		100		0

APPENDIX C

TABLE C-1 PROBABILITY (%) OF DRY DAY P(DRY)

DRY<5 MM P(WET)=1-P(DRY)

YARITAGUA YARACUY STATE NUMBER 1289

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	95	100	95	95	85	90	70	80	80	95	90	90
2	90	100	100	100	75	70	55	65	75	95	85	85
3	95	95	100	100	85	75	55	80	80	85	80	80
4	100	100	100	90	85	60	80	65	80	90	90	90
5	100	100	100	100	85	80	85	45	80	90	90	95
6	100	100	100	95	70	75	60	70	90	90	75	85
7	100	100	95	85	80	60	50	60	90	85	90	90
8	100	100	100	100	90	75	75	80	90	85	90	85
9	100	100	100	100	85	75	70	80	85	100	80	95
10	100	100	100	95	70	60	75	70	85	95	85	95
11	100	100	100	95	80	75	65	75	85	85	95	100
12	100	100	100	95	80	80	55	90	90	75	85	100
13	95	100	100	95	70	80	65	75	85	85	95	100
14	100	100	100	85	70	65	90	75	85	95	90	90
15	95	100	100	95	65	50	70	75	80	80	95	100
16	100	100	100	95	65	70	75	80	85	80	90	95
17	100	90	95	85	85	90	70	65	90	100	95	95
18	100	95	100	80	80	60	65	75	90	90	95	95
19	100	100	95	80	85	65	85	80	75	95	85	95
20	100	100	100	65	85	65	65	85	80	85	90	95
21	100	100	100	90	75	65	75	75	80	80	90	95
22	100	100	100	75	70	65	70	95	85	85	95	100
23	100	100	100	65	65	80	80	95	90	95	80	100
24	100	95	100	80	70	55	75	65	85	90	80	100
25	100	100	100	70	85	50	75	80	100	90	95	100
26	100	100	100	75	70	75	65	80	90	80	90	100
27	100	100	95	95	90	75	60	80	80	85	95	95
28	100	100	100	65	95	55	60	60	80	90	95	100
29	100	100	100	85	85	70	80	75	85	75	95	100
30	100		100	80	70	45	55	80	95	90	85	100
31	100		100		75		55	85		100		95

TABLE C-2 PROBABILITY (%) OF DRY DAY GIVEN THAT THE PREVIOUS DAY IS DRY P(DRY/DRY)

DRY<5 MM P(WET/DRY)=1-P(DRY/DRY)

YARITAGUA YARACUY STATE NUMBER 1289

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	94	100	95	95	93	100	66	81	76	94	90	88
2	94	100	100	100	76	72	64	68	81	94	88	88
3	100	95	100	100	100	78	54	76	73	84	88	82
4	100	100	100	90	88	66	81	68	81	88	93	93
5	100	100	100	100	94	83	87	69	75	88	88	94
6	100	100	100	95	76	81	58	77	93	94	77	89
7	100	100	95	89	78	60	50	57	100	88	86	88
8	100	100	100	100	87	83	100	83	94	88	94	83
9	100	100	100	100	83	66	80	81	88	100	83	94
10	100	100	100	95	70	46	78	68	82	95	81	94
11	100	100	100	94	85	91	66	85	88	89	94	100
12	100	100	100	94	87	86	53	86	88	70	84	100
13	95	100	100	94	81	75	72	77	83	80	94	100
14	100	100	100	89	71	62	84	73	88	94	89	90
15	95	100	100	100	78	61	66	80	76	84	94	100
16	100	100	100	100	76	60	85	80	87	87	89	95
17	100	90	95	89	76	92	73	62	88	100	94	94
18	100	100	100	94	88	66	64	69	88	90	94	94
19	100	100	95	87	93	91	92	86	77	94	84	94
20	100	100	100	68	88	61	64	81	80	84	88	100
21	100	100	100	92	76	61	76	82	75	76	88	94
22	100	100	100	77	66	76	73	93	81	81	94	100
23	100	100	100	80	71	76	71	94	94	94	84	100
24	100	95	100	92	69	43	81	68	83	94	81	100
25	100	100	100	75	85	54	73	84	100	94	100	100
26	100	100	100	85	70	90	73	75	90	83	89	100
27	100	100	95	93	92	86	76	81	83	87	94	95
28	100	100	100	68	94	60	58	62	75	88	94	100
29	100	100	100	92	89	81	83	75	93	72	94	100
30	100		100	82	76	50	62	80	94	86	84	100
31	100		100		78		54	87		100		95

TABLE C-3 PROBABILITY (%) OF DRY DAY GIVEN THAT THE PREVIOUS DAY IS WET P(DRY/WET)

DRY<5 MM P(WET/WET)=1-P(DRY/WET)

YARITAGUA YARACUY STATE NUMBER 1289

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	100	0	0	0	50	60	72	88	100	100	0	100
2	0	0	100	100	66	50	33	50	50	100	50	50
3	50	0	0	0	40	66	55	85	100	100	33	66
4	100	100	0	0	66	40	77	50	75	100	75	75
5	0	0	0	100	33	75	75	0	100	100	100	100
6	0	0	0	0	33	50	66	63	75	50	50	0
7	0	0	0	0	83	60	50	66	0	50	100	100
8	0	0	100	100	100	62	50	75	50	66	50	100
9	0	0	0	0	100	100	40	75	50	100	50	100
10	0	0	0	0	66	100	66	75	100	0	100	100
11	0	0	0	100	66	50	60	50	66	0	100	100
12	0	0	0	100	50	60	57	100	100	100	100	0
13	0	0	0	100	25	100	55	50	100	100	100	0
14	100	0	0	0	66	75	100	80	66	100	100	0
15	0	0	0	66	33	28	100	60	100	0	100	100
16	100	0	0	0	42	80	50	80	75	50	100	0
17	0	0	0	0	100	83	60	75	100	100	100	100
18	0	50	100	0	33	0	66	85	100	0	100	100
19	0	100	0	50	50	25	71	60	50	100	100	100
20	0	0	100	50	66	71	66	100	80	100	100	0
21	0	0	0	85	66	71	71	33	100	100	100	100
22	0	0	0	50	80	42	60	100	100	100	100	100
23	0	0	0	20	50	85	100	100	66	100	0	0
24	0	0	0	57	71	100	50	0	100	0	75	0
25	0	100	0	50	83	44	80	71	100	50	75	0
26	0	0	0	50	66	60	40	100	0	50	100	0
27	0	0	0	100	83	40	28	75	50	75	100	0
28	0	0	100	0	100	40	62	50	100	100	100	100
29	0	0	0	71	0	55	75	75	50	100	100	0
30	0		0	66	33	33	25	80	100	100	100	0
31	0		0		66		55	75		100		0

TABLE C-4 PROBABILITY (%) OF DRY DAY P(DRY)

DRY<5 MM P(WET)=1-P(DRY)

EL PORTACHUELO ARAGUA STATE NUMBER 1432

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	90	75	80	95	75	80	80	85	50	75	65	70
2	90	85	95	90	60	65	85	60	65	75	70	75
3	90	85	80	85	80	70	70	70	60	75	75	85
4	80	85	95	90	75	75	75	75	55	65	65	75
5	90	95	95	85	85	55	70	70	100	90	65	75
6	80	90	90	85	75	75	70	80	75	75	70	85
7	90	85	95	85	65	55	75	80	60	55	80	80
8	75	80	95	90	80	90	70	65	60	75	70	70
9	90	85	95	90	85	75	70	70	65	55	65	80
10	90	90	75	80	85	80	60	65	70	80	50	75
11	95	85	70	100	85	85	75	65	75	75	60	75
12	90	90	90	90	80	75	60	75	45	65	55	60
13	75	90	90	85	75	85	70	70	70	75	55	60
14	85	85	100	90	90	75	65	70	55	70	55	85
15	90	90	80	80	75	75	65	55	85	60	65	85
16	90	95	95	80	80	65	55	85	75	85	60	75
17	85	85	95	85	75	65	65	80	65	60	80	75
18	95	90	95	80	60	75	55	55	65	60	55	65
19	85	95	80	60	90	80	55	60	70	70	45	85
20	80	85	85	80	80	75	65	75	70	75	85	80
21	100	85	100	75	80	55	75	70	65	65	60	90
22	85	85	95	90	75	90	80	70	75	65	65	85
23	85	85	90	90	80	75	50	80	80	80	75	80
24	95	85	80	65	75	65	55	70	70	70	75	95
25	90	95	85	70	85	50	80	90	75	60	75	75
26	90	100	95	80	75	50	80	70	75	55	65	85
27	85	95	90	85	80	70	65	65	60	20	55	95
28	90	95	90	75	90	85	60	50	80	60	60	95
29	75	100	95	50	80	65	85	75	65	85	70	90
30	70		100	70	90	80	60	60	80	65	75	85
31	65		90		75		85	75		70		75

TABLE C-5 PROBABILITY (%) OF DRY DAY GIVEN THAT THE PREVIOUS DAY IS DRY P(DRY/DRY)

DRY<5 MM P(WET/DRY)=1-P(DRY/DRY)

EL PORTACHUELO ARAGUA STATE NUMBER 1432

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	86	92	84	100	71	86	81	88	53	75	64	80
2	94	86	100	94	66	68	81	64	70	73	53	92
3	88	88	84	88	91	84	82	66	61	80	85	86
4	77	88	93	88	81	71	78	78	50	66	73	76
5	93	100	100	88	93	53	73	73	100	92	76	80
6	83	89	94	82	82	72	71	85	75	72	76	93
7	100	83	94	88	60	46	85	87	60	60	78	82
8	77	94	94	88	84	90	73	68	58	81	68	75
9	93	100	94	88	87	77	85	84	66	60	78	85
10	94	88	73	83	94	80	57	64	76	90	53	81
11	94	94	86	100	94	87	83	76	78	68	70	100
12	89	94	85	90	88	82	53	84	46	66	50	73
13	77	94	88	88	75	80	50	73	77	84	54	75
14	93	83	100	88	93	82	71	71	64	66	81	100
15	100	88	80	83	72	73	69	57	72	64	54	88
16	94	100	100	87	86	60	53	100	70	91	69	76
17	83	89	94	81	81	61	72	82	53	70	75	86
18	94	94	94	76	60	69	61	62	61	66	56	73
19	84	100	84	68	83	86	45	63	84	75	45	84
20	82	89	87	100	83	75	54	75	64	71	100	88
21	100	94	100	81	81	60	61	66	71	73	64	87
22	85	88	95	93	81	90	73	71	92	76	58	83
23	88	94	94	94	73	77	56	85	80	92	76	76
24	100	88	88	66	87	80	90	75	81	75	73	100
25	89	100	87	92	86	61	81	100	78	71	86	78
26	88	100	94	85	82	60	75	66	73	58	86	86
27	83	95	89	87	86	100	68	71	60	18	76	94
28	94	94	94	76	100	78	76	61	66	50	54	94
29	77	100	100	60	77	64	100	80	62	75	83	89
30	86		100	90	93	92	58	66	84	58	78	83
31	71		90		77		83	66		69		88

TABLE C-6 PROBABILITY (%) OF DRY DIY GIVEN THAT THE PREVIOUS DAY IS WET P(DRY/WET)

DRY<5 MM P(WET/WET)=1-P(DRY/WET)

EL PORTACHUELO ARAGUA STATE NUMBER 1432

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	100	42	0	50	83	60	75	100	40	75	66	40
2	50	80	75	0	40	50	100	33	60	80	100	33
3	100	66	0	50	62	42	0	75	57	60	50	80
4	100	66	100	100	50	83	66	66	62	60	40	66
5	75	66	0	50	60	60	60	60	100	85	42	60
6	50	100	0	100	33	77	66	66	0	100	57	60
7	50	100	100	66	80	80	50	50	60	40	83	66
8	50	0	100	100	71	88	60	50	62	66	75	50
9	80	25	100	100	75	50	33	42	62	40	33	66
10	50	100	100	50	33	80	66	66	57	66	42	50
11	100	0	20	100	33	75	62	42	66	100	50	0
12	100	66	100	0	33	33	80	57	40	60	62	20
13	50	50	100	50	75	100	100	60	63	57	55	37
14	60	100	100	100	80	33	50	66	33	80	22	62
15	33	100	0	50	100	80	57	50	100	50	77	66
16	50	50	75	50	60	80	57	66	100	75	42	66
17	100	0	100	100	50	71	55	66	100	0	87	40
18	100	66	100	100	60	85	42	25	71	50	50	40
19	100	50	0	25	100	60	66	55	42	62	44	85
20	66	0	75	50	50	75	77	75	83	83	72	33
21	100	33	100	50	75	40	100	80	50	40	33	100
22	0	66	0	80	50	88	100	66	42	42	75	100
23	66	33	0	50	100	50	25	66	80	57	71	100
24	66	66	0	50	25	20	20	50	25	50	80	75
25	100	66	75	28	80	28	77	66	66	33	40	0
26	100	100	100	66	33	40	100	100	80	50	0	80
27	100	0	100	75	60	40	50	50	60	22	14	100
28	66	100	50	66	50	100	28	28	100	62	66	100
29	50	100	50	20	100	66	62	70	75	100	50	100
30	20		100	50	75	57	66	40	71	100	66	100
31	50		0		50		87	87		71		0

TABLE C-7 PROBABILITY (%) OF DRY DAY P(DRY)

DRY<5 MM P(WET)=1-P(DRY)

AGUA FRIA MIRANDA STATE NUMBER 1436

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	95	95	100	95	80	60	60	85	60	70	75	90
2	100	95	95	95	90	70	75	60	75	75	80	95
3	100	100	90	100	85	55	65	55	55	75	95	90
4	90	100	100	100	80	50	80	70	45	80	90	85
5	85	100	100	100	90	60	75	85	80	90	90	95
6	95	100	95	95	90	65	60	80	70	90	85	90
7	100	95	100	100	70	55	55	80	80	70	80	90
8	90	100	100	95	80	75	60	75	75	85	70	85
9	100	95	100	95	90	75	75	75	100	80	90	80
10	100	90	90	100	95	70	70	65	60	75	95	90
11	90	100	100	100	80	85	55	65	65	65	90	80
12	95	100	100	95	70	85	70	80	70	85	75	95
13	95	100	100	90	85	65	65	75	65	75	85	85
14	95	100	100	90	90	50	85	70	90	75	80	90
15	100	95	95	85	100	80	65	65	90	80	95	95
16	100	90	95	95	75	65	55	85	75	75	85	80
17	90	95	95	80	70	55	60	75	60	70	65	90
18	95	100	95	90	65	55	70	80	70	70	80	85
19	85	95	100	70	85	75	65	75	80	80	70	100
20	95	95	100	85	85	55	70	85	95	60	95	95
21	100	90	100	70	80	60	85	80	85	75	85	95
22	100	90	100	85	80	80	60	85	70	85	90	100
23	100	95	100	85	65	70	65	80	80	75	95	100
24	95	95	100	90	65	60	60	70	75	85	85	95
25	85	100	100	80	75	70	80	75	90	75	90	95
26	100	100	100	85	70	50	65	65	80	70	90	95
27	95	100	100	95	75	60	75	70	65	60	85	100
28	90	95	90	70	85	75	85	65	75	70	95	95
29	90	100	90	75	65	65	65	80	65	70	95	95
30	85		95	75	95	60	65	75	85	90	75	100
31	80		95		75		85	75		80		95

TABLE C-8 PROBABILITY (%) OF DRY DAY GIVEN THAT THE PREVIOUS DAY IS DRY P(DRY/DRY)

DRY<5 MM P(WET/DRY)=1-P(DRY/DRY)

AGUA FRIA MIRANDA STATE NUMBER 1436

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	94	93	100	94	80	60	66	88	66	76	81	100
2	100	94	95	94	87	75	83	58	83	78	80	100
3	100	100	94	100	83	64	66	58	66	73	93	89
4	90	100	100	100	82	63	76	72	45	73	89	83
5	88	100	100	100	93	80	81	92	88	87	88	100
6	94	100	95	95	88	83	66	82	62	88	83	94
7	100	95	100	100	66	53	75	87	71	77	76	88
8	90	100	100	95	78	63	81	75	81	92	75	83
9	100	95	100	100	100	86	75	73	100	82	92	88
10	100	89	90	100	100	66	73	73	60	75	94	93
11	90	100	100	100	84	85	78	76	75	73	94	77
12	94	100	100	95	81	82	90	100	69	84	72	100
13	94	100	100	89	100	70	57	81	78	88	86	89
14	94	100	100	88	94	61	84	60	100	86	82	94
15	100	95	95	94	100	90	64	71	88	80	93	100
16	100	89	100	100	75	56	69	76	77	68	84	78
17	90	100	100	84	73	61	72	82	66	86	64	93
18	94	100	100	100	78	63	75	80	75	71	76	83
19	84	95	100	72	92	81	71	68	71	78	68	100
20	94	94	100	92	82	53	69	93	100	62	100	95
21	100	94	100	76	88	54	92	76	84	83	84	94
22	100	88	100	85	75	91	52	87	76	86	88	100
23	100	94	100	88	62	68	66	82	85	82	94	100
24	95	100	100	88	61	64	61	75	87	86	84	95
25	84	100	100	83	92	75	100	85	93	70	100	94
26	100	100	100	81	73	57	56	60	77	73	88	94
27	95	100	100	94	78	80	76	76	62	64	88	100
28	94	95	90	73	86	75	86	71	76	66	94	95
29	88	100	88	92	70	60	58	84	66	64	94	94
30	88		94	80	92	76	61	81	92	85	78	100
31	94		94		78		100	80		83		95

TABLE C-9 PROBABILITY (%) OF DRY DAY GIVEN THAT THE PREVIOUS DAY IS WET P(DRY/WET)

DRY<5 MM P(WET/WET)=1-P(DRY/WET)

AGUA FRIA MIRANDA STATE NUMBER 1436

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	100	100	100	100	80	60	50	133	40	33	50	60
2	100	100	0	100	100	62	62	66	62	66	80	50
3	0	100	0	100	100	33	60	50	20	80	100	100
4	0	0	100	0	66	33	85	66	44	100	100	100
5	50	0	0	0	75	40	50	66	72	100	100	66
6	100	0	0	0	100	37	40	66	100	100	100	0
7	100	0	100	100	100	57	25	50	100	0	100	100
8	0	100	0	0	83	88	33	75	50	66	50	100
9	100	0	0	0	50	40	75	80	100	66	83	33
10	0	100	0	100	50	80	60	40	0	75	100	75
11	0	100	100	0	0	83	0	42	50	40	0	100
12	100	0	0	0	25	100	44	42	71	85	100	75
13	100	0	0	100	50	33	83	50	33	0	80	0
14	100	0	0	100	66	28	85	100	71	40	66	66
15	100	0	0	0	100	70	66	50	100	80	100	50
16	0	100	0	66	0	100	28	100	50	100	100	100
17	0	50	0	0	60	42	44	33	40	20	66	75
18	100	100	0	50	33	44	62	80	62	66	85	100
19	100	0	100	50	71	66	50	100	100	83	75	100
20	100	100	0	66	100	60	71	60	75	50	83	0
21	100	0	0	33	33	66	66	100	100	62	100	100
22	0	100	0	83	100	62	100	75	33	80	100	100
23	0	100	0	66	75	75	62	66	66	33	100	0
24	0	0	0	100	71	50	57	50	25	80	100	0
25	100	100	0	50	42	62	50	50	80	100	33	100
26	100	0	0	100	60	33	100	80	100	60	100	100
27	0	0	0	100	66	40	71	57	75	50	50	100
28	0	0	0	0	80	75	80	50	71	75	100	0
29	100	100	100	33	33	80	100	71	60	83	100	100
30	50		100	60	100	28	71	50	71	100	0	100
31	0		100		0		57	60		50		0

TABLE C-10 PROBABILITY (%) OF DRY DAY P(DRY)

DRY<5 MM P(WET)=1-P(DRY)

VALERA TRUJILLO STATE NUMBER 2164

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	100	90	95	95	75	80	80	80	70	80	80	75
2	100	80	95	95	85	75	85	80	85	90	75	90
3	100	100	85	80	80	85	95	75	90	80	80	100
4	95	85	100	95	90	75	100	85	85	80	90	85
5	90	90	90	75	80	85	95	80	70	80	70	80
6	95	95	100	85	65	75	85	95	95	85	80	95
7	95	95	90	95	75	75	65	75	90	80	90	85
8	95	95	95	85	90	95	80	95	95	70	90	90
9	95	100	90	80	95	90	85	80	80	65	70	75
10	95	90	75	80	80	90	85	80	75	85	90	85
11	95	90	95	60	85	95	85	80	85	70	80	80
12	85	90	90	75	70	70	100	85	80	80	75	75
13	95	90	90	85	90	85	95	80	85	85	95	95
14	80	95	100	80	75	95	85	80	85	85	90	90
15	95	95	100	70	85	95	90	85	75	90	75	95
16	90	95	100	85	85	90	75	85	65	80	75	90
17	100	95	95	80	85	95	90	70	75	70	90	90
18	90	90	90	90	75	90	80	85	80	80	85	90
19	95	100	85	90	75	85	80	80	80	80	80	80
20	90	100	95	75	80	90	80	90	85	85	80	80
21	100	90	80	85	95	75	90	85	85	75	85	95
22	95	95	80	80	85	85	90	90	90	80	80	95
23	95	80	100	65	95	90	100	65	80	85	75	95
24	95	100	90	70	80	85	75	85	90	85	80	95
25	100	95	75	65	80	85	100	75	80	80	70	90
26	85	100	95	70	85	85	85	90	70	80	70	80
27	85	95	95	100	85	95	90	85	85	75	85	95
28	85	95	95	95	90	95	100	90	70	90	100	85
29	85	80	90	75	90	95	75	90	85	80	80	95
30	65		95	75	80	90	95	75	90	75	95	90
31	65		85		75		80	90		75		90

TABLE C-11 PROBABILITY (%) OF DRY DAY GIVEN THAT THE PREVIOUS DAY IS DRY P(DRY/DRY)

DRY<5 MM P(WET/DRY)=1-P(DRY/DRY)

VALERA TRUJILLO STATE NUMBER 2164

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	100	92	94	94	66	80	77	81	77	83	80	73
2	100	88	100	100	86	75	100	87	85	87	75	86
3	100	100	84	84	88	86	94	87	94	77	86	100
4	95	85	100	93	93	82	100	80	83	81	93	85
5	89	88	90	78	83	86	95	82	64	81	66	82
6	100	94	100	86	62	70	84	93	92	81	78	93
7	94	94	90	94	84	80	64	73	89	76	93	84
8	94	94	94	89	93	93	92	100	94	68	94	88
9	94	100	89	76	94	94	87	78	78	71	66	77
10	94	90	77	81	84	88	82	81	87	76	92	93
11	94	88	100	68	93	100	88	81	86	76	77	82
12	89	88	89	66	70	73	100	93	88	92	75	75
13	100	88	94	86	92	85	95	82	93	81	93	93
14	78	94	100	76	83	100	84	81	82	88	89	94
15	93	94	100	75	93	94	94	81	76	94	77	100
16	89	100	100	85	82	89	77	82	66	77	80	89
17	100	100	95	82	88	94	93	70	69	75	100	94
18	90	94	89	93	82	89	77	85	73	85	88	88
19	100	100	88	88	73	83	81	82	75	87	82	83
20	89	100	94	72	80	88	81	93	81	81	81	81
21	100	90	78	93	100	77	87	88	82	70	87	93
22	95	94	87	88	89	93	88	94	88	80	76	94
23	94	78	100	62	94	94	100	66	77	87	81	100
24	94	100	90	69	84	83	75	76	100	94	80	94
25	100	95	77	71	75	82	100	70	83	88	75	89
26	85	100	100	69	87	88	85	86	75	75	71	83
27	88	95	94	100	94	94	88	83	92	75	78	93
28	88	94	94	95	94	100	100	88	64	86	100	84
29	94	94	94	78	100	94	75	94	85	77	80	100
30	76		94	73	77	89	100	72	94	81	93	94
31	76		84		75		84	93		80		88

TABLE C-12 PROBABILITY (%) OF DRY DAY GIVEN THAT THE PREVIOUS DAY IS WET P(DRY/WET)

DRY<5 MM P(WET/WET)=1-P(DRY/WET)

VALERA TRUJILLO STATE NUMBER 2164

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	100	85	100	100	100	80	100	50	0	50	80	100
2	0	0	0	0	80	75	25	50	83	100	75	100
3	0	100	100	0	33	80	100	25	66	100	60	100
4	0	0	100	100	75	33	100	100	100	75	75	0
5	100	100	0	0	50	80	0	66	100	75	100	66
6	50	100	100	80	75	100	100	100	100	100	83	100
7	100	100	0	100	57	60	66	100	100	100	75	100
8	100	100	100	0	80	100	57	80	100	75	50	100
9	100	100	100	100	100	0	75	100	100	50	100	50
10	100	0	50	75	0	100	100	75	25	100	83	60
11	100	100	80	25	50	50	66	75	80	33	100	66
12	0	100	100	87	66	0	100	50	33	50	75	75
13	66	100	50	80	83	83	0	66	50	100	100	100
14	100	100	100	100	0	66	100	75	100	66	100	0
15	100	100	0	50	60	100	66	100	66	66	50	50
16	100	0	0	83	100	100	50	100	60	100	60	100
17	100	0	0	66	66	100	80	66	85	50	60	50
18	0	0	100	75	33	100	100	83	100	66	50	100
19	50	100	50	100	80	100	75	66	100	50	66	50
20	100	0	100	100	80	100	75	75	100	100	75	75
21	100	0	100	60	75	50	100	50	100	100	75	100
22	0	100	50	33	0	60	100	66	100	80	100	100
23	100	100	100	75	100	66	100	50	100	75	50	0
24	100	100	0	71	0	100	0	100	50	33	80	100
25	100	0	50	50	100	100	100	100	50	33	50	100
26	0	100	80	71	75	66	0	100	50	100	66	50
27	66	0	100	100	33	100	100	100	66	75	100	100
28	66	100	100	0	66	0	100	100	100	100	100	100
29	33	100	0	0	0	100	0	50	83	100	0	66
30	0		100	80	100	100	80	100	66	50	100	0
31	42		100		75		0	80		60		100

TABLE C-13 PROBABILITY (%) OF DRY DAY P(DRY)

DRY<5 MM P(WET)=1-P(DRY)

VALLE DE LA PASCUA GUARICO STATE NUMBER 2584

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	100	100	100	100	90	65	55	75	75	90	75	100
2	100	100	100	100	85	50	70	55	80	95	100	100
3	100	100	100	100	85	65	50	70	60	80	100	95
4	100	100	100	100	85	60	60	75	75	85	100	100
5	100	100	100	100	85	60	70	70	80	95	90	100
6	100	100	100	100	85	50	60	75	80	95	95	100
7	100	95	100	100	100	55	55	75	85	75	95	95
8	90	100	100	100	80	80	70	55	85	95	85	100
9	100	100	100	100	95	80	55	60	85	100	95	85
10	100	100	100	100	95	85	75	65	55	85	100	100
11	95	100	100	100	95	75	70	60	70	80	95	95
12	100	100	100	95	90	70	70	80	85	95	100	90
13	100	100	100	95	90	75	75	80	85	100	95	100
14	100	100	100	95	95	65	85	65	90	85	95	100
15	100	100	100	100	95	70	65	65	85	95	95	95
16	95	100	95	100	85	55	70	65	70	95	90	90
17	100	95	100	100	85	40	70	80	75	90	85	95
18	100	100	95	90	85	60	75	40	85	85	90	95
19	100	100	95	95	90	65	65	75	85	90	90	100
20	100	100	100	90	90	70	70	70	70	95	90	100
21	100	100	100	95	65	60	85	90	85	90	95	100
22	100	100	100	95	80	75	75	80	85	95	80	100
23	100	100	100	80	65	85	50	70	80	85	100	100
24	100	100	95	90	80	60	55	85	95	85	100	100
25	100	100	100	85	65	70	75	80	85	95	100	100
26	100	100	100	85	80	65	70	65	80	85	95	100
27	100	95	100	85	85	65	65	65	95	75	100	100
28	100	100	100	90	70	75	75	65	90	95	95	100
29	100	100	100	95	70	65	60	80	80	75	95	95
30	100		95	85	90	55	60	70	80	90	90	100
31	95		95		75		70	70		85		100

TABLE C-14 PROBABILITY (%) OF DRY DAY GIVEN THAT THE PREVIOUS DAY IS DRY P(DRY/DRY)

DRY<5 MM P(WET/DRY)=1-P(DRY/DRY)

VALLE DE LA PASCUA GUARICO STATE NUMBER 2584

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	100	100	100	100	94	66	45	78	78	87	82	100
2	100	100	100	100	83	61	81	60	80	94	100	100
3	100	100	100	100	82	70	57	81	68	78	100	95
4	100	100	100	100	88	69	50	85	83	87	100	100
5	100	100	100	100	88	66	58	73	73	94	90	100
6	100	100	100	100	94	58	64	78	81	94	94	100
7	100	95	100	100	100	50	50	86	93	78	94	95
8	90	100	100	100	80	90	81	53	82	93	89	100
9	100	100	100	100	93	75	50	81	82	100	100	85
10	100	100	100	100	100	81	90	58	52	85	100	100
11	95	100	100	100	94	70	73	76	81	82	95	95
12	100	100	100	95	94	60	85	83	92	93	100	89
13	100	100	100	100	88	78	78	81	82	100	95	100
14	100	100	100	94	94	66	86	62	94	85	94	100
15	100	100	100	100	94	69	70	69	83	94	94	95
16	95	100	95	100	84	57	61	53	70	94	94	89
17	100	95	100	100	82	54	85	84	85	89	88	94
18	100	100	95	90	94	87	71	37	86	88	88	100
19	100	100	100	94	94	83	60	100	88	88	88	100
20	100	100	100	94	94	61	76	60	70	94	100	100
21	100	100	100	100	66	57	85	85	85	89	94	100
22	100	100	100	100	92	75	70	77	94	100	78	100
23	100	100	100	84	68	86	60	68	82	84	100	100
24	100	100	95	100	84	64	70	92	93	82	100	100
25	100	100	100	83	75	83	81	76	84	94	100	100
26	100	100	100	88	84	71	60	68	88	84	95	100
27	100	95	100	100	93	53	64	69	93	82	100	100
28	100	100	100	94	82	76	84	53	89	93	95	100
29	100	100	100	94	64	60	60	76	83	73	94	95
30	100		95	89	92	53	66	68	75	86	89	100
31	95		100		72		83	64		83		100

TABLE C-15 PROBABILITY (%) OF DRY DAY GIVEN THAT THE PREVIOUS DAY IS WET P(DRY/WET)

DRY<5 MM P(WET/WET)=1-P(DRY/WET)

VALLE DE LA PASCUA GUARICO STATE NUMBER 2584

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	0	100	0	100	66	60	66	100	66	100	33	100
2	0	0	0	0	100	28	55	40	80	100	100	0
3	0	0	0	0	100	60	33	55	25	100	0	0
4	0	0	0	0	66	42	70	50	62	75	0	100
5	0	0	0	0	66	50	87	60	100	100	0	0
6	0	0	0	0	33	37	50	66	75	100	100	0
7	0	0	0	0	100	60	62	40	50	0	100	0
8	0	100	0	0	0	66	55	60	100	100	0	100
9	100	0	0	0	100	100	66	33	100	100	66	0
10	0	0	0	0	0	100	55	75	66	0	100	100
11	0	0	0	0	100	100	60	28	55	66	0	0
12	100	0	0	0	0	100	33	75	66	100	100	100
13	0	0	0	0	100	66	66	75	100	100	0	100
14	0	0	0	100	100	60	80	75	66	0	100	0
15	0	0	0	100	100	71	33	57	100	100	100	0
16	0	0	0	0	100	50	85	85	66	100	0	100
17	100	0	100	0	100	22	33	71	50	100	50	100
18	0	100	0	0	33	41	83	50	80	50	100	0
19	0	0	0	100	66	37	80	58	66	100	100	100
20	0	0	100	0	50	85	57	100	66	100	0	0
21	0	0	0	50	50	66	83	100	83	100	100	0
22	0	0	0	0	57	75	100	100	33	50	100	0
23	0	0	0	0	50	80	20	75	66	100	100	0
24	0	0	0	50	71	33	40	66	100	100	0	0
25	0	0	100	100	25	50	66	100	100	100	0	0
26	0	0	0	66	71	50	100	50	33	100	0	0
27	0	0	0	0	50	85	66	57	100	33	100	0
28	0	100	0	66	0	71	57	85	100	100	0	0
29	0	0	0	100	83	80	60	85	50	100	100	0
30	0		0	0	83	57	50	75	100	100	100	100
31	0		0		100		50	83		100		0

APPENDIX D

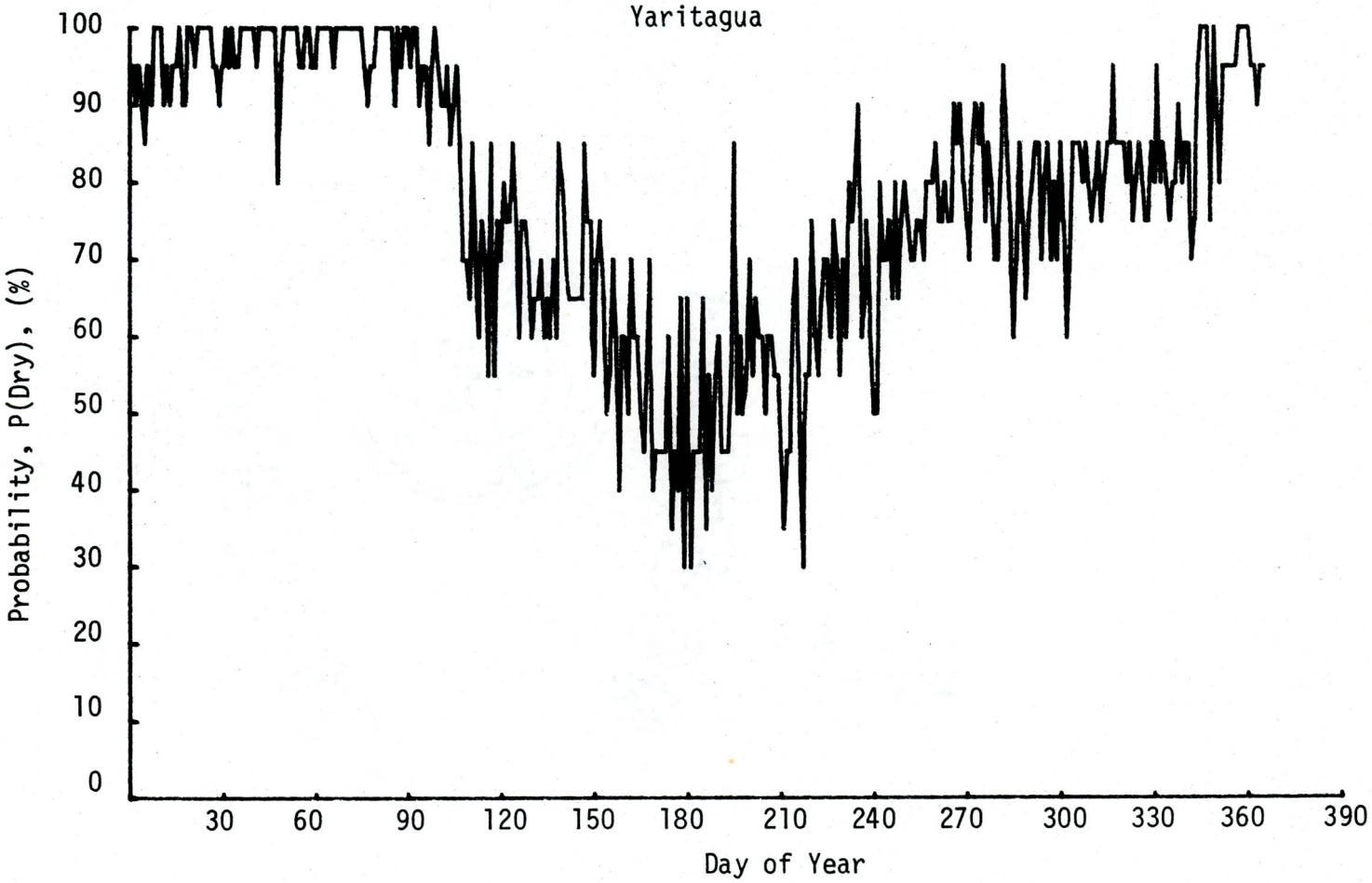

Figure D-1. Initial probability P(Dry) vs. day of year for dry days defined as <1 mm of precipitation for Yaritagua station.

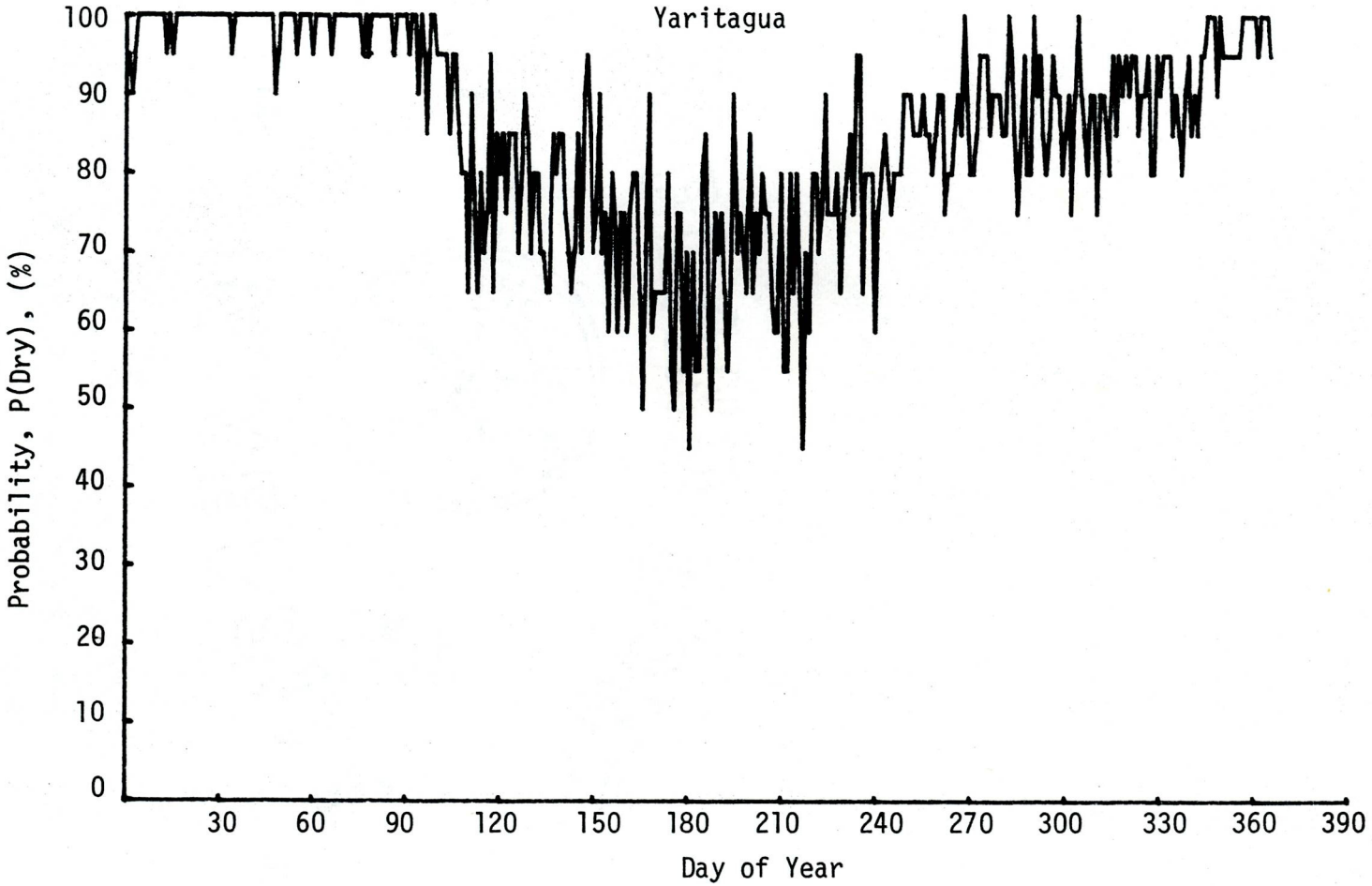

Figure D-2. Initial probability P(Dry) vs. day of year for dry days defined as <5 mm of precipitation for Yaritagua station.

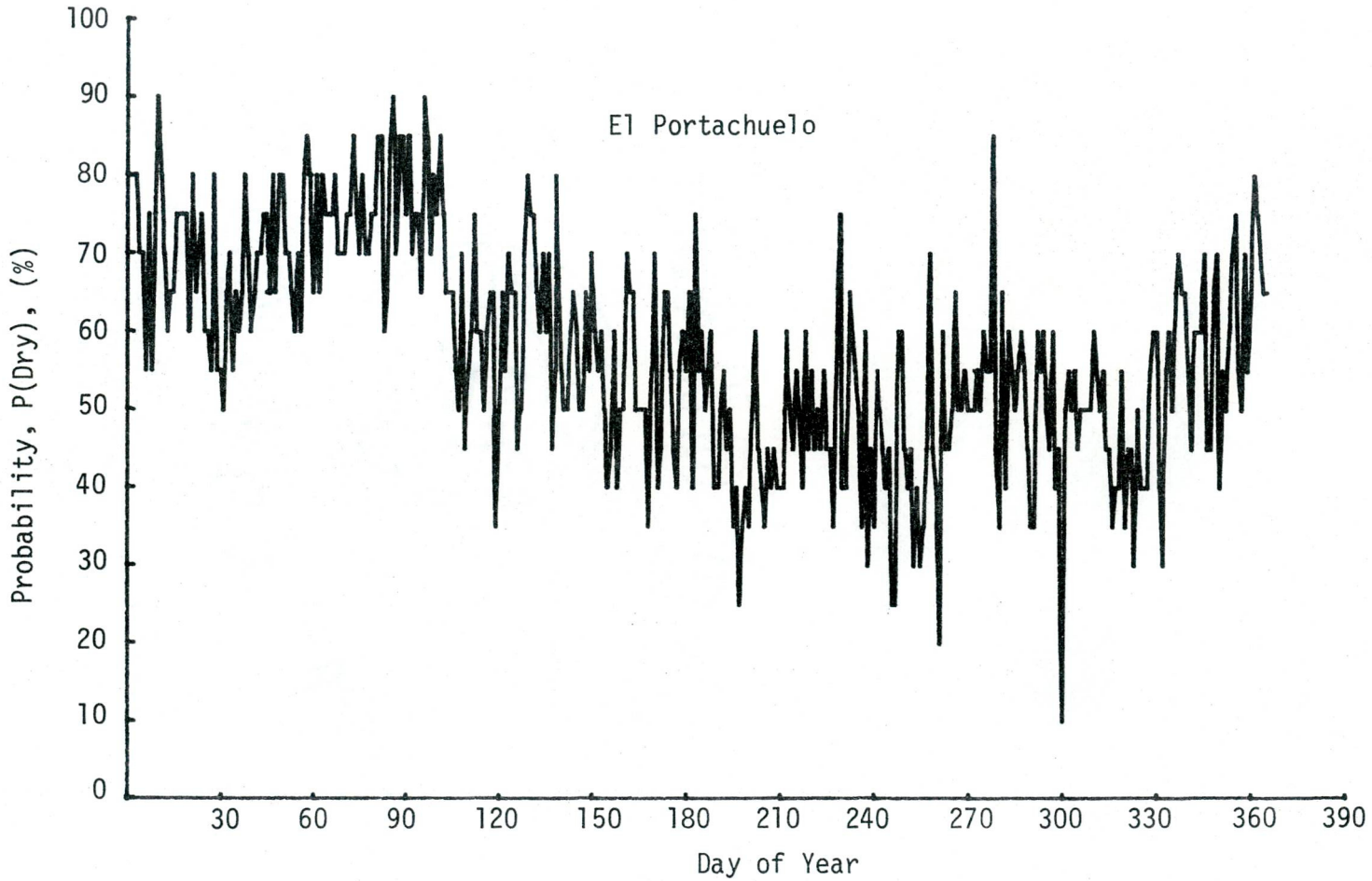

Figure D-3. Initial probability P(Dry) vs. day of year for dry days defined as <1 mm of precipitation for El Portacheulo station.

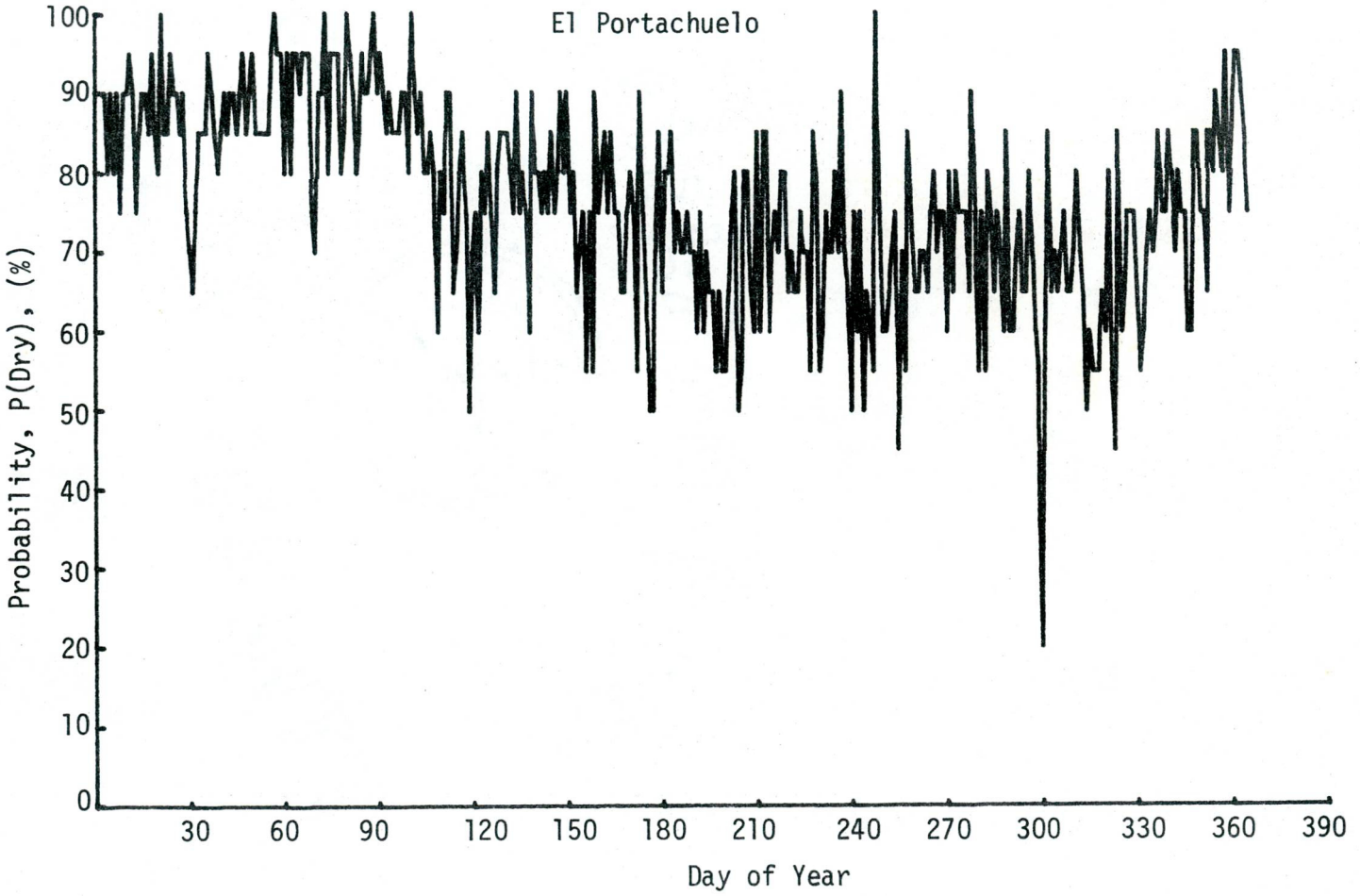

Figure D-4. Initial probability P(Dry) vs. day of year for dry days defined as <5 mm of precipitation for El Portachuelo station.

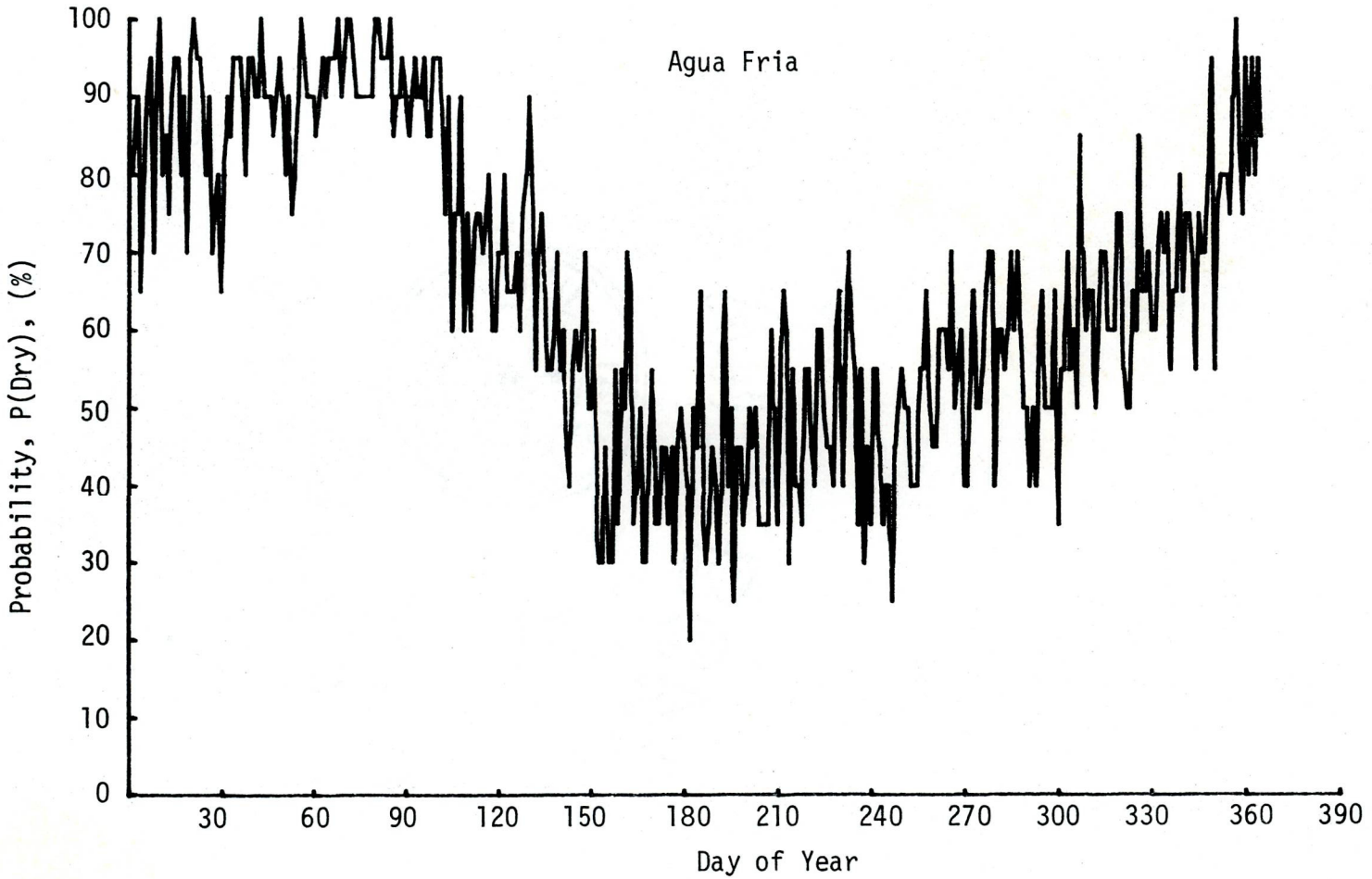

Figure D-5. Initial probability P(Dry) vs. day of year for dry days defined as <1 mm of precipitation for Agua Fria station.

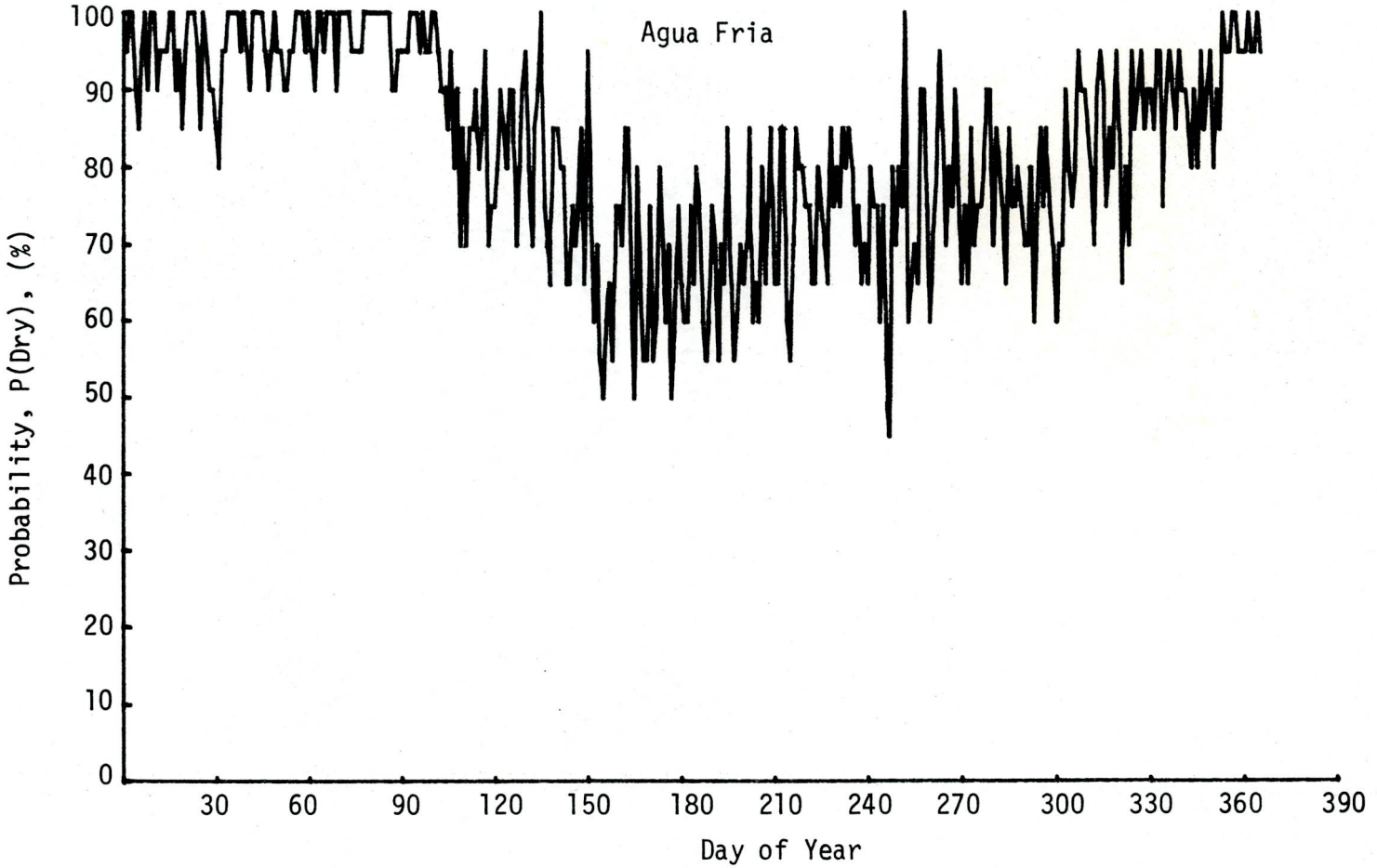

Figure D-6. Initial probability P(Dry) vs. day of year for dry days defined as <5 mm of precipitation for Agua Fria station.

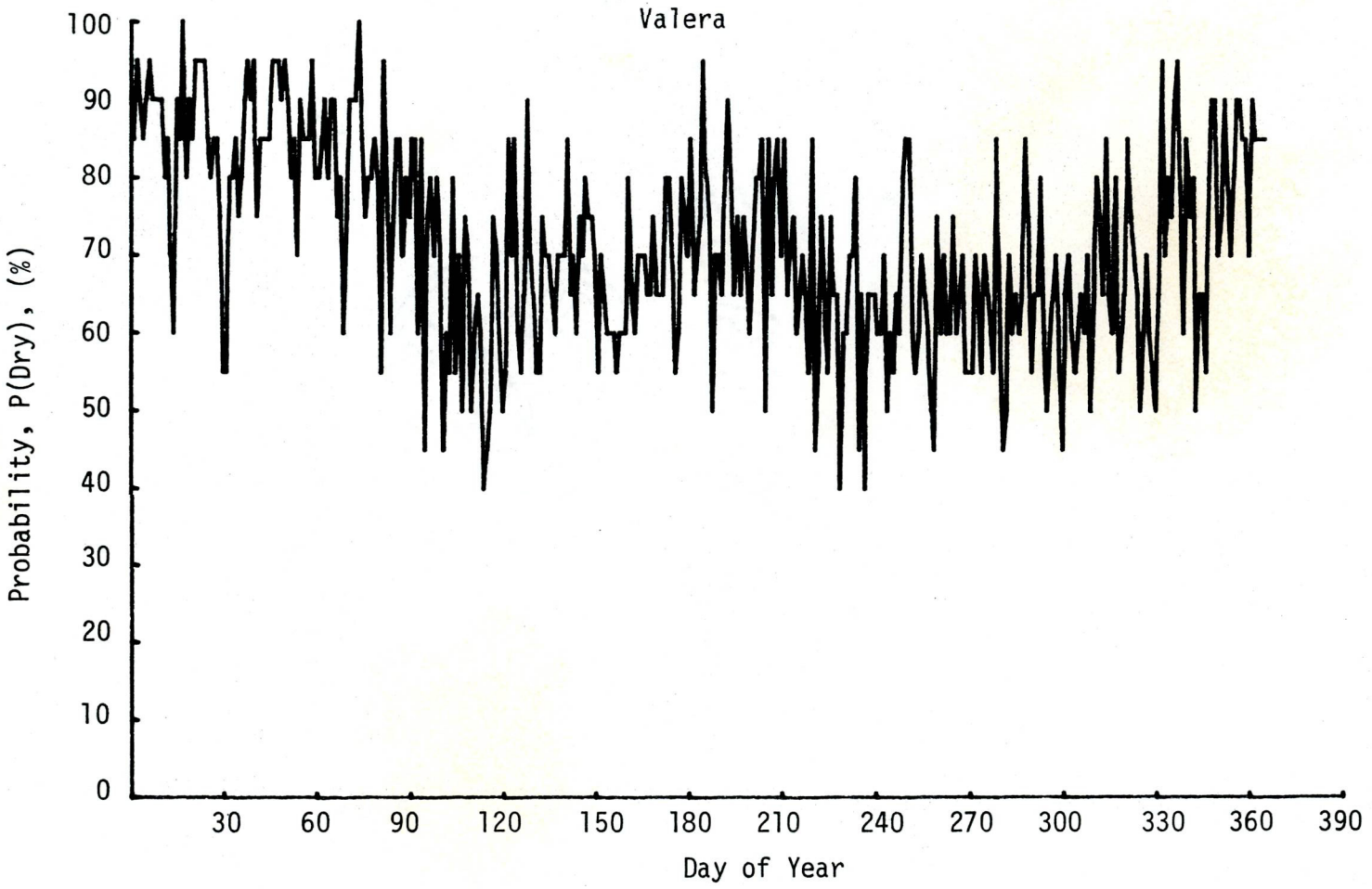

Figure D-7. Initial probability P(Dry) vs. day of year for dry days defined as <1 mm of precipitation for Valera station.

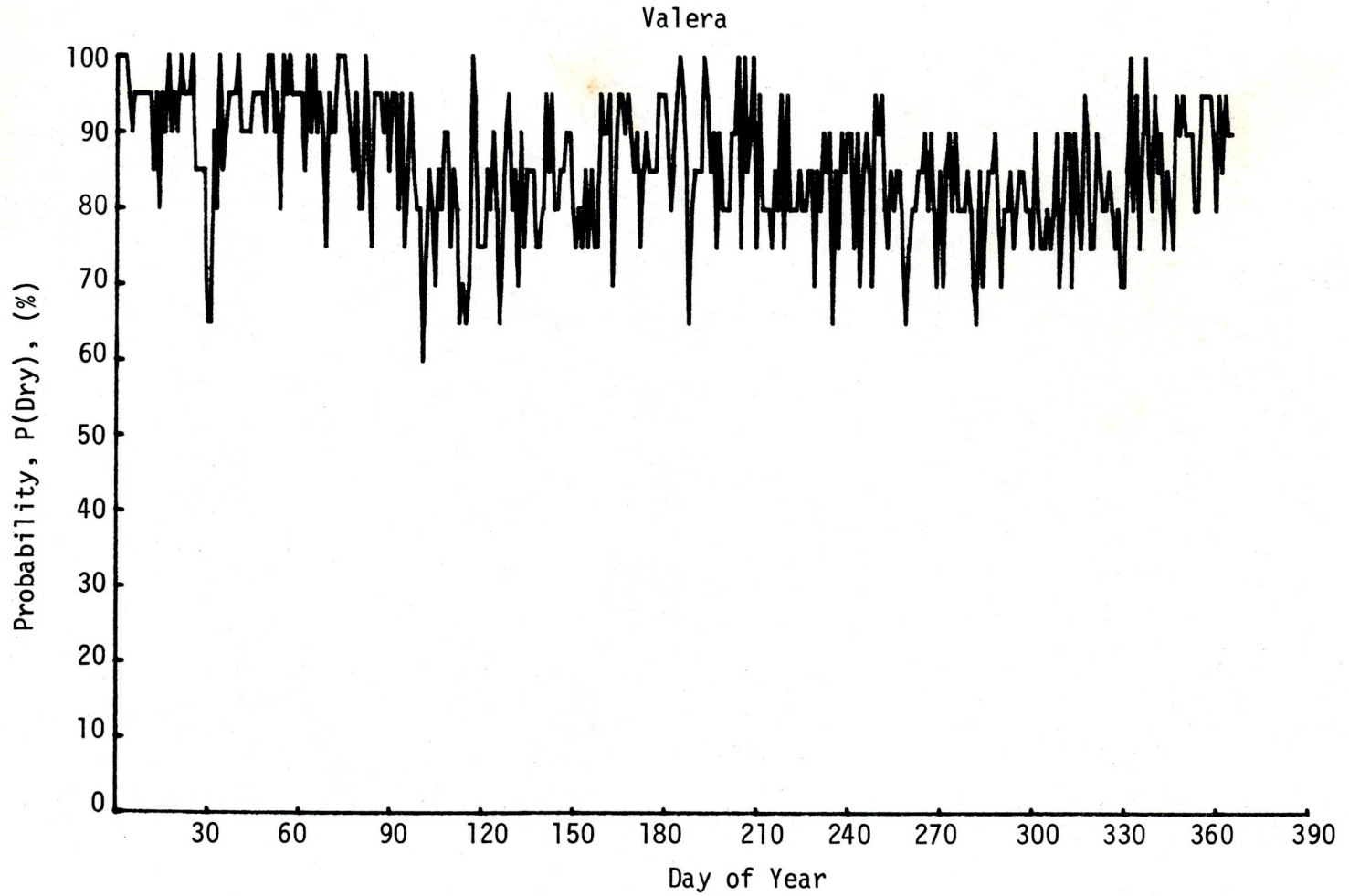

Figure D-8. Initial probability P(Dry) vs. day of year for dry days defined as <5 mm of precipitation for Valera station.

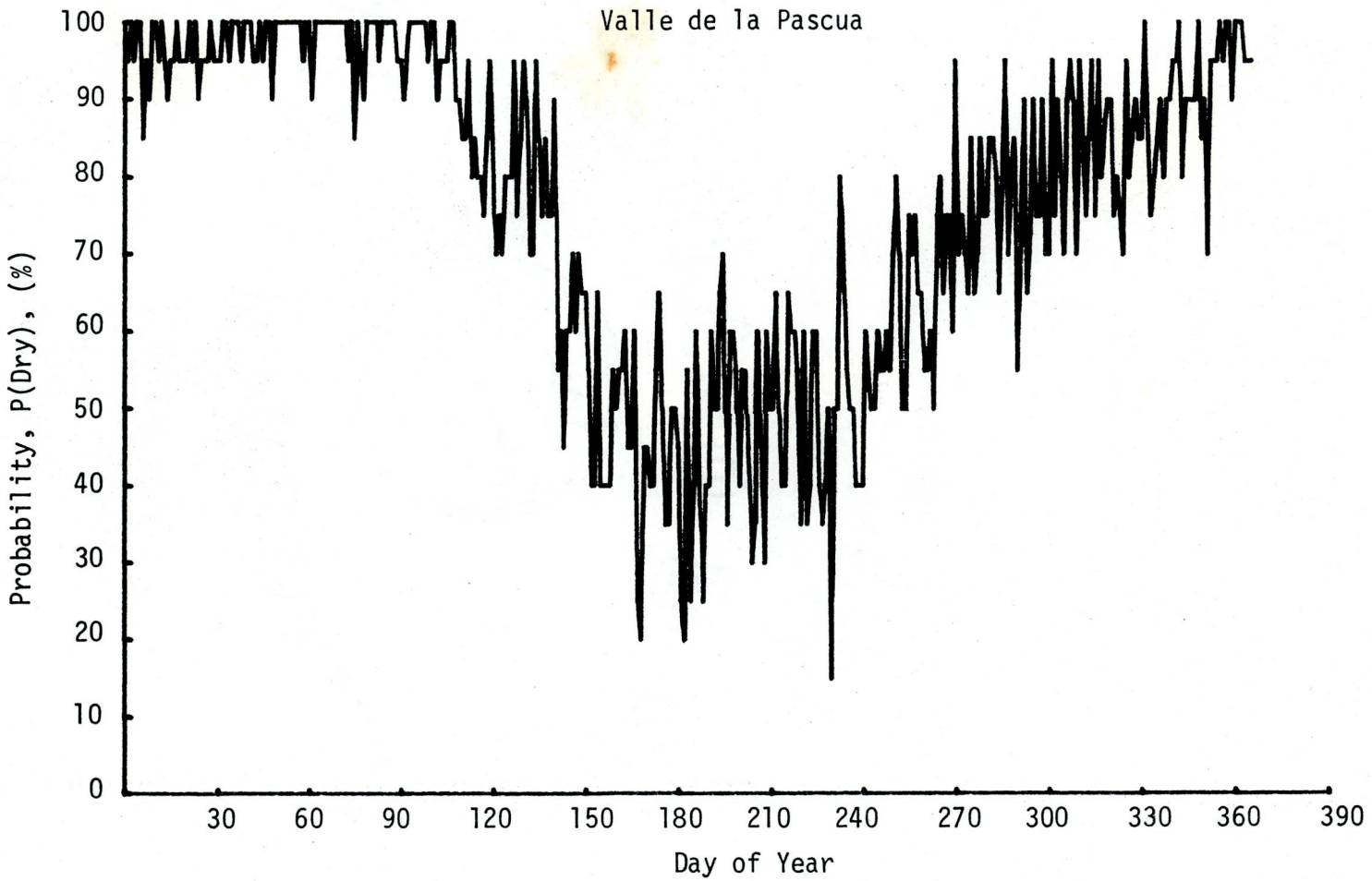

Figure D-9. Initial probability P(Dry) vs. day of year for dry days defined as <1 mm of precipitation for Valle de la Pascua station.

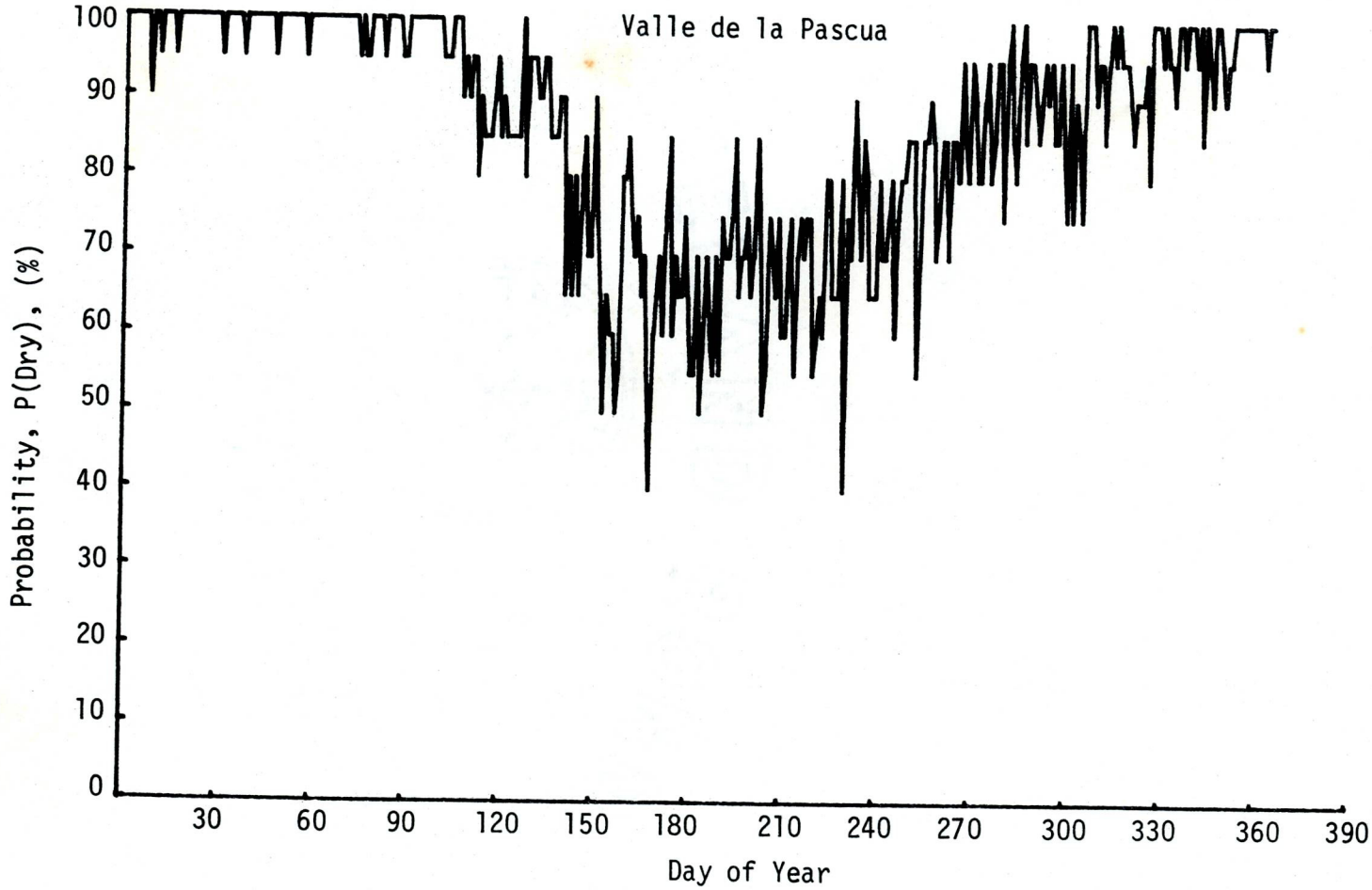

Figure D-10. Initial probability P(Dry) vs. day of year for dry days defined as <5 mm of precipitation for Valle de la Pascua station.

APPENDIX E

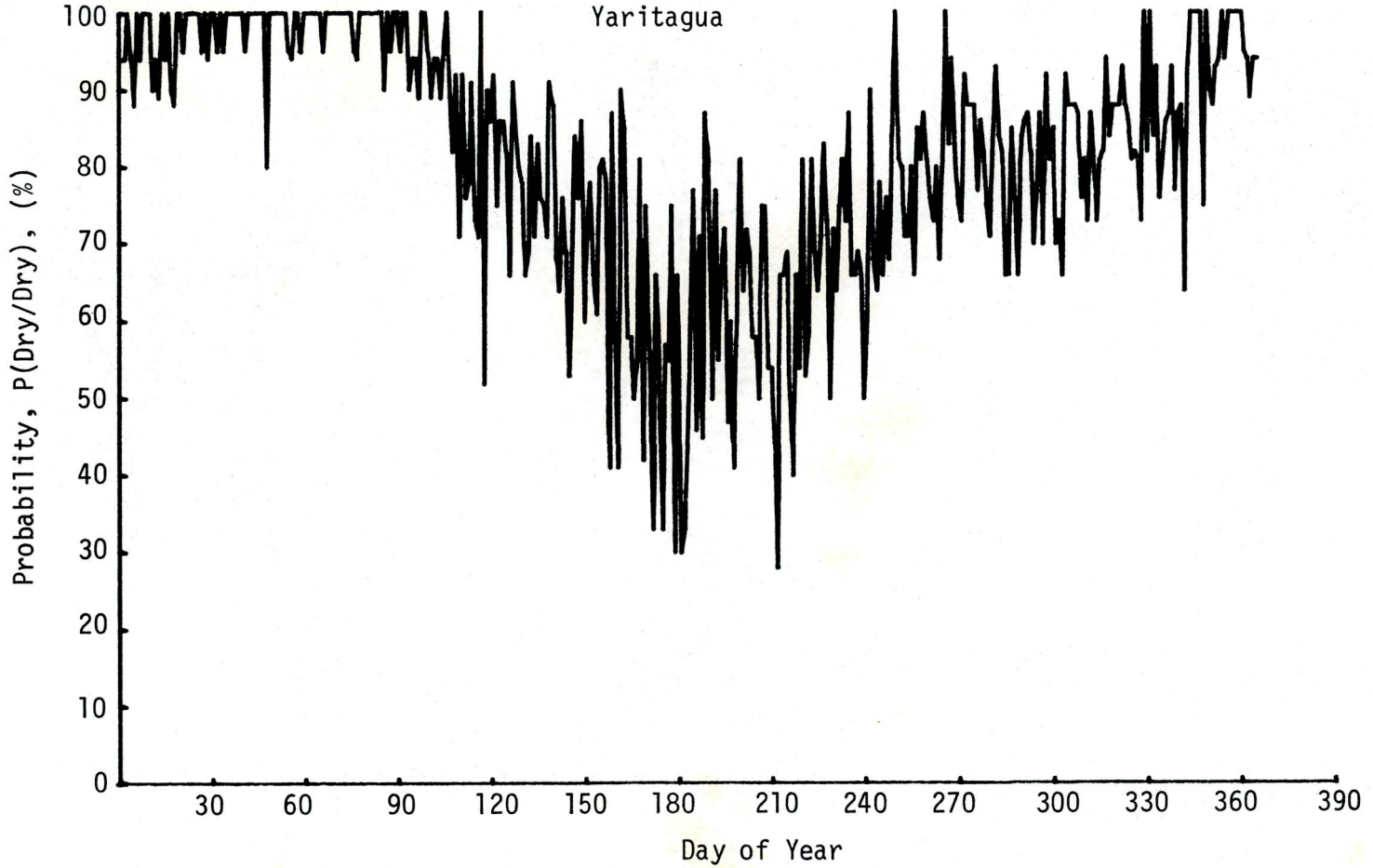

Figure E-1. Conditional probability P(Dry/Dry) vs. day of year for dry days defined as <1 mm of precipitation for Yaritagua station.

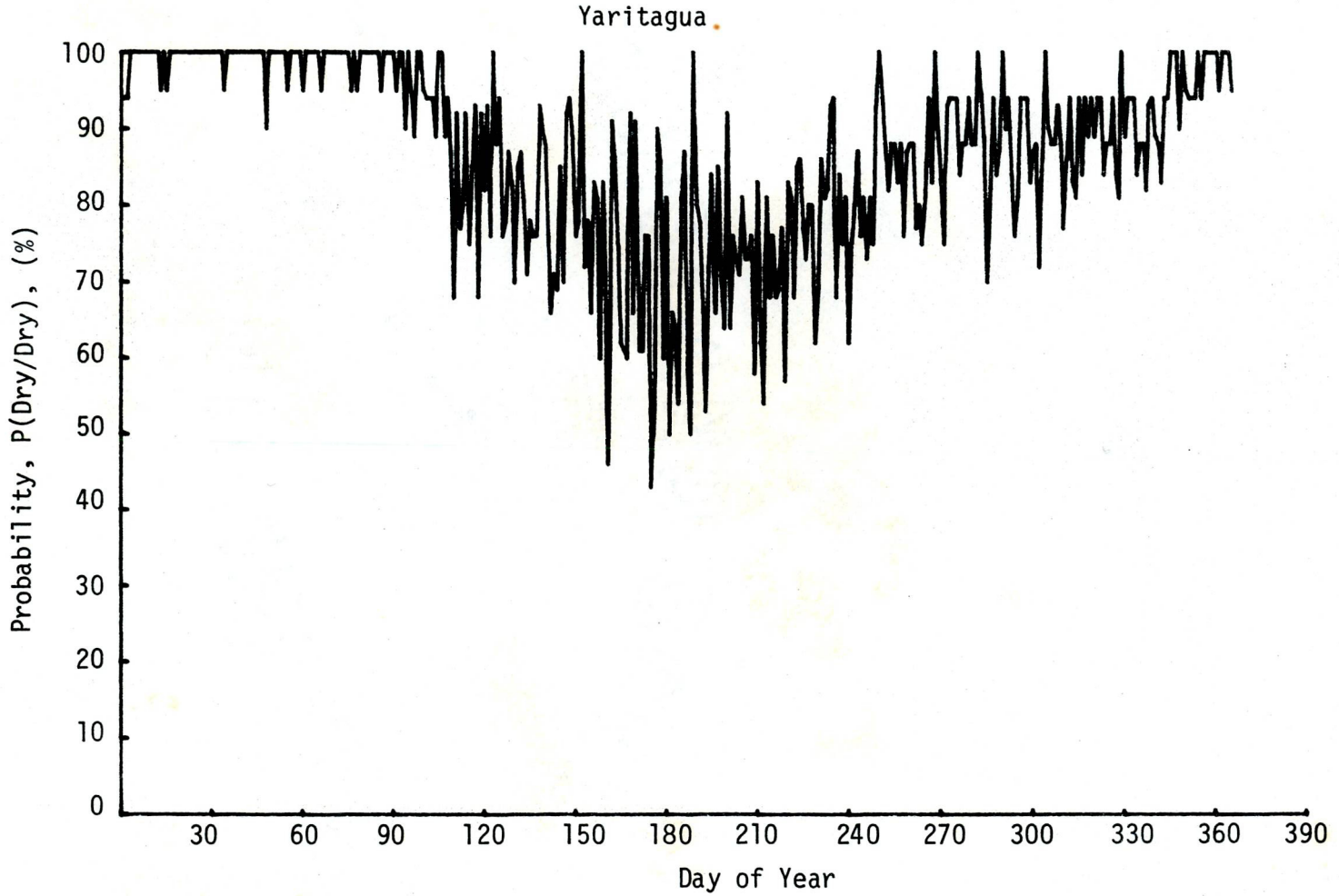

Figure E-2. Conditional probability P(Dry/Dry) vs. day of year for dry days defined as <5 mm of precipitation for Yaritagua station.

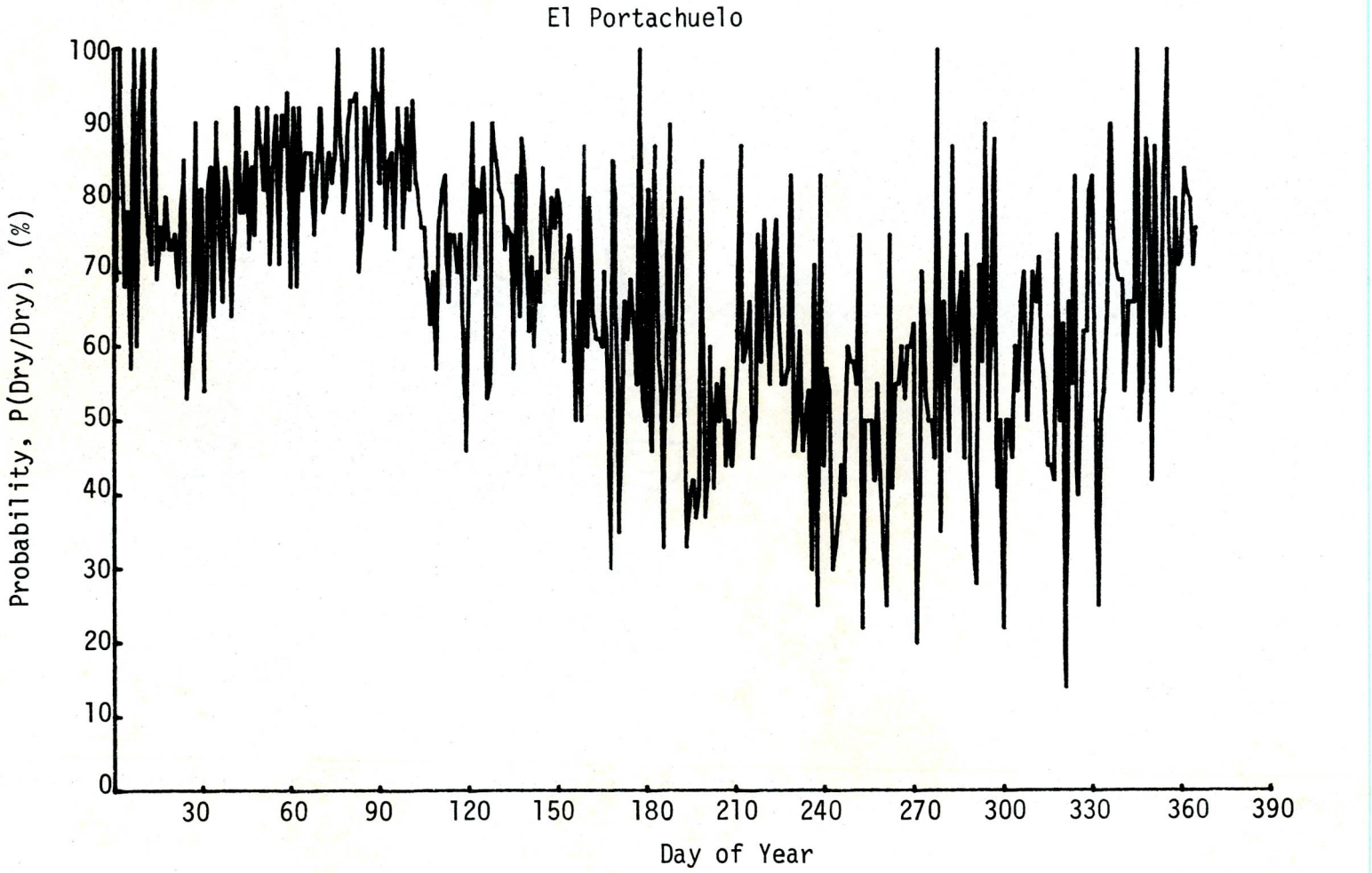

Figure E-3. Conditional probability P(Dry/Dry) vs. day of year for dry days defined as <1 mm of precipitation for El Portachuelo station.

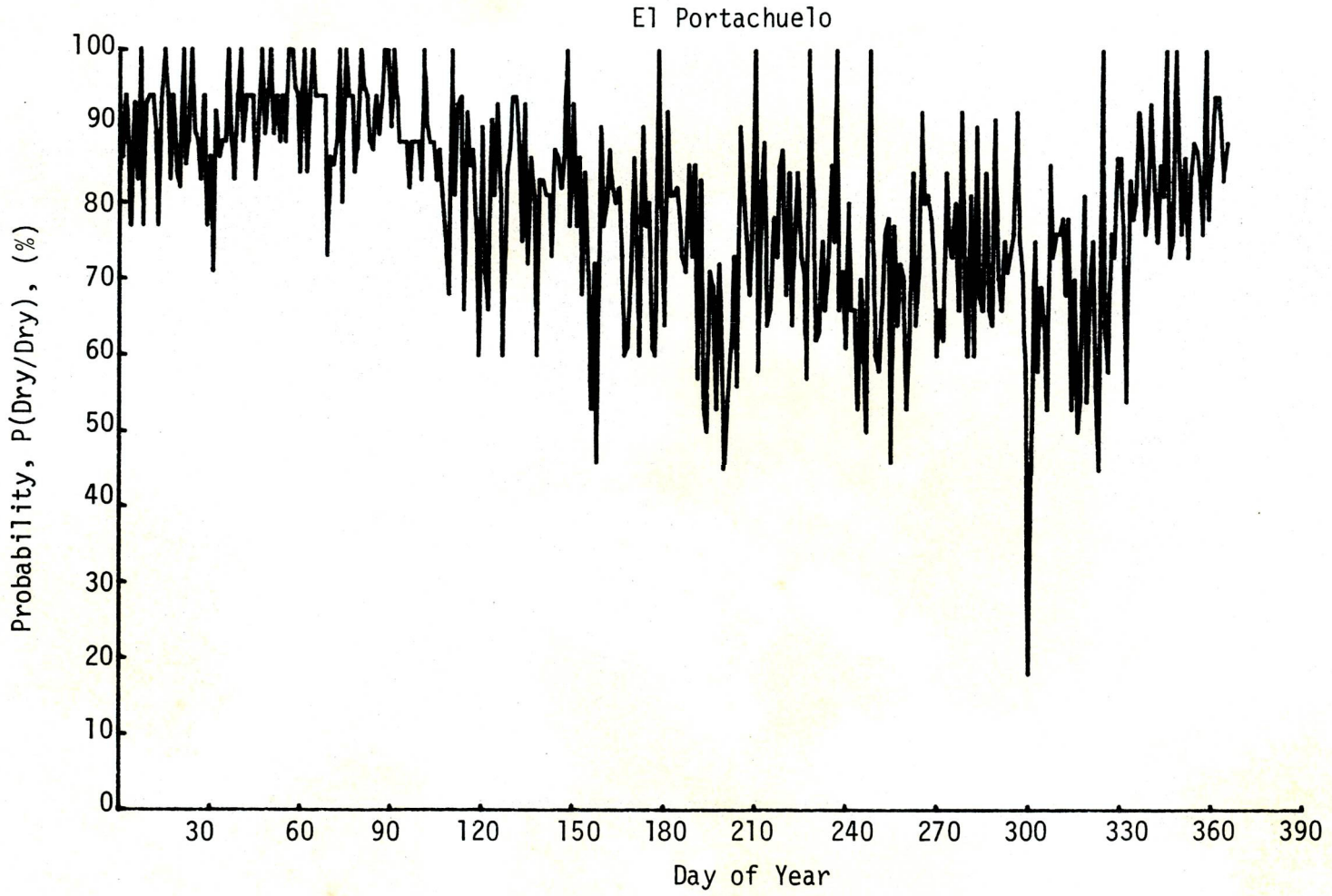

Figure E-4. Conditional probability P(Dry/Dry) vs. day of year for dry days defined as <5 mm of precipitation for El Portachuelo station.

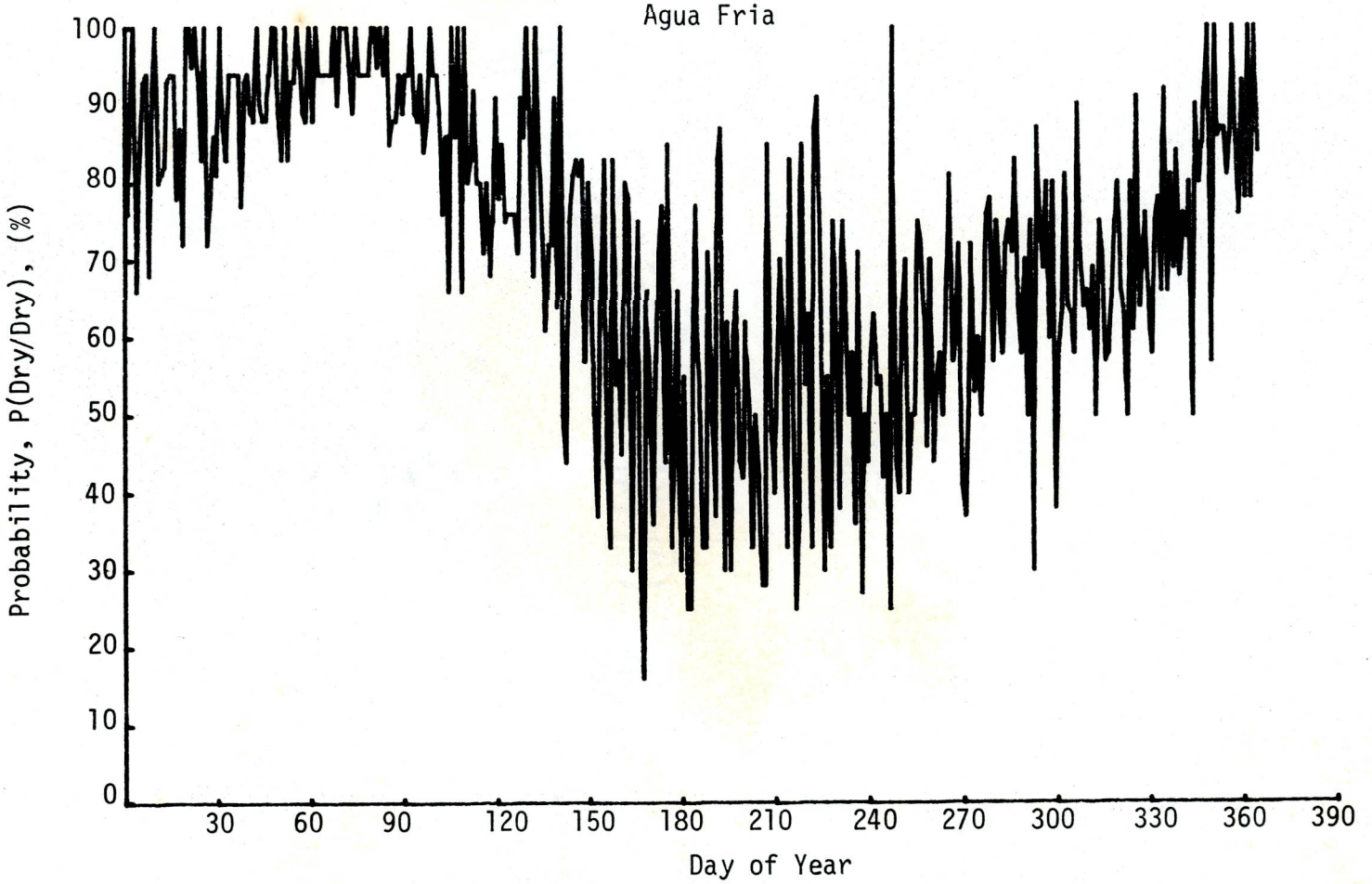

Figure E-5. Conditional probability P(Dry/Dry) vs. day of year for dry days defined as <1 mm of precipitation for Agua Fria station.

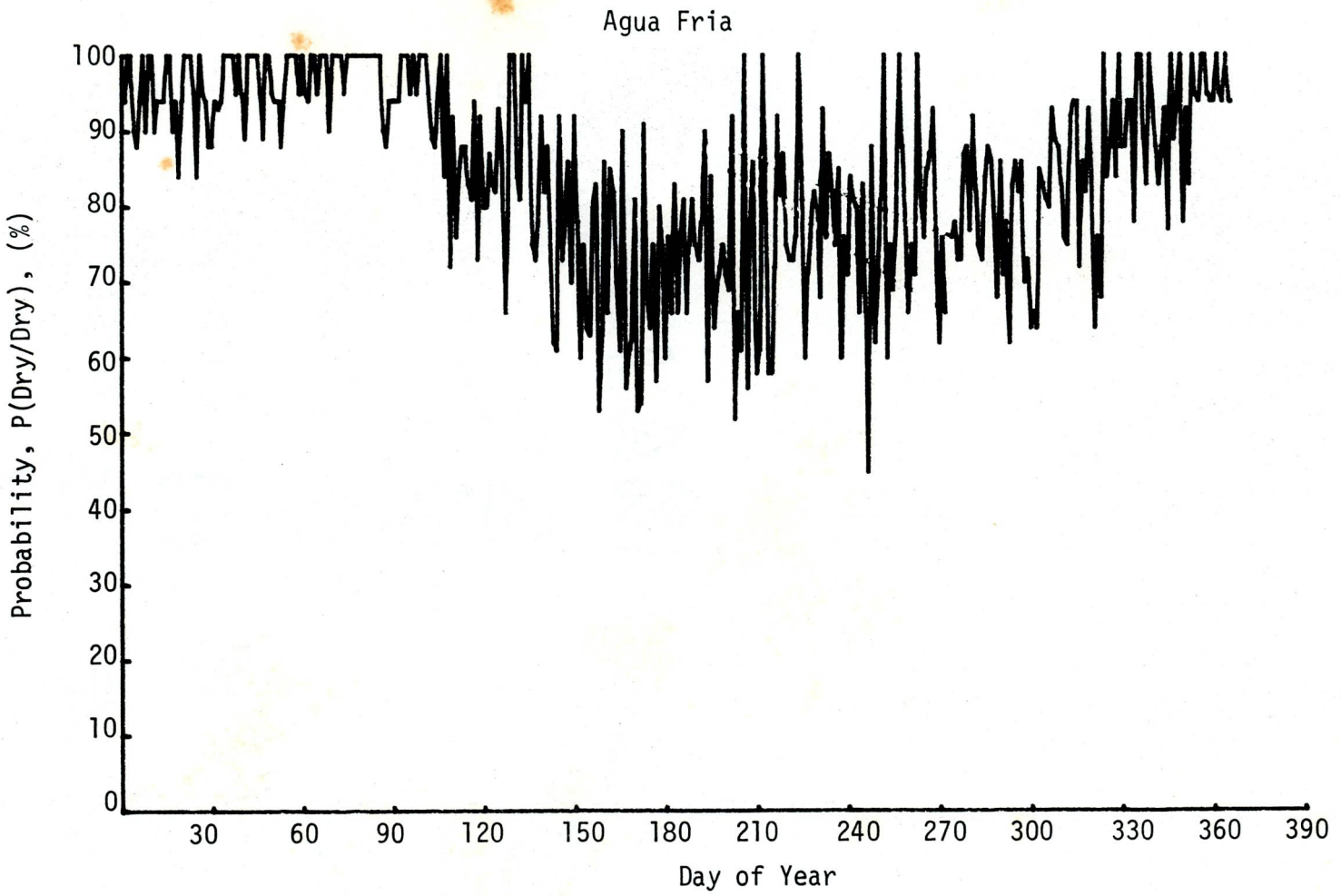

Figure E-6. Conditional probability P(Dry/Dry) vs. day of year for dry days defined as <5 mm of precipitation for Agua Fria station.

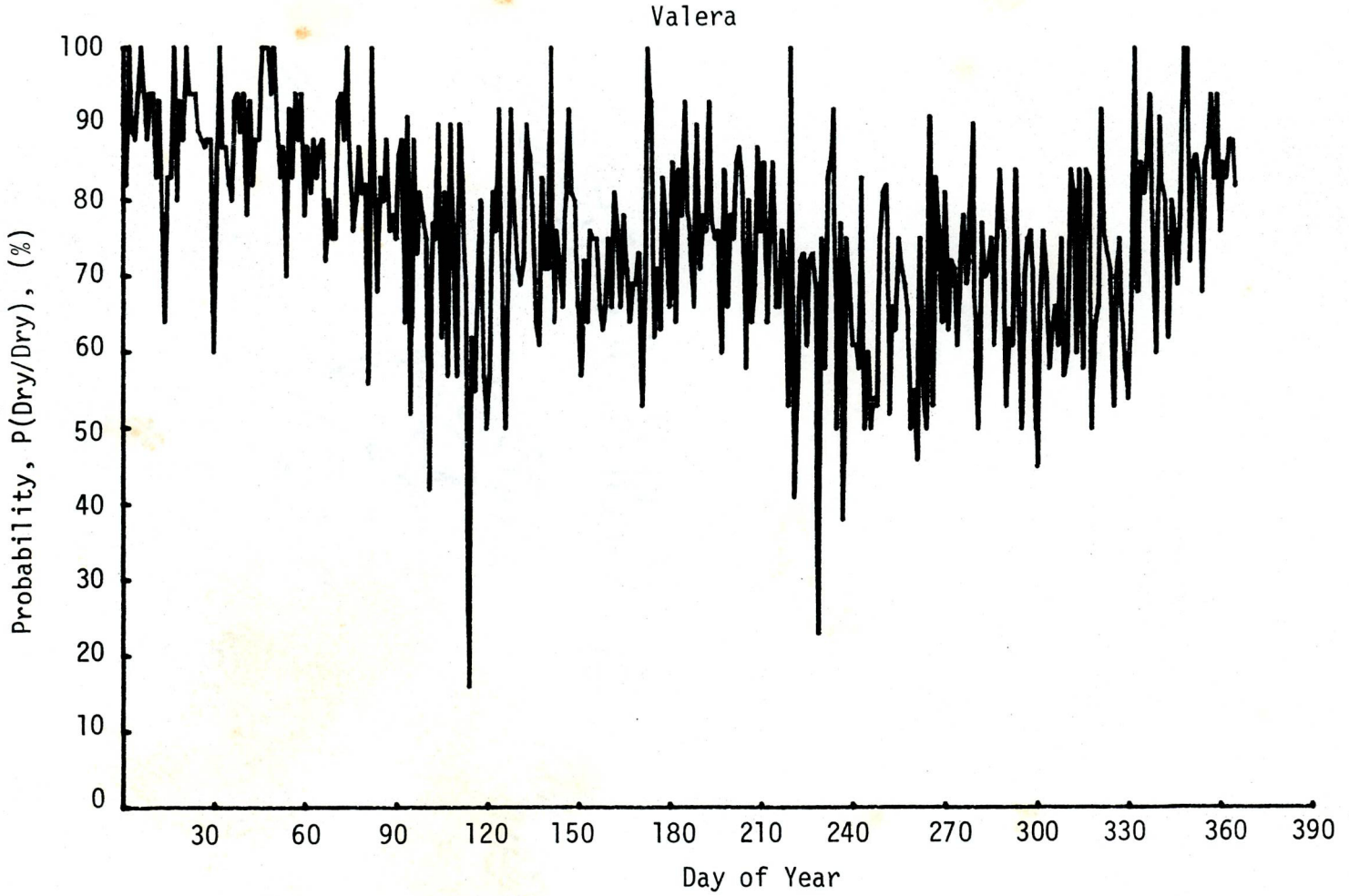

Figure E-7. Conditional probability P(Dry/Dry) vs. day of year for dry days defined as <1 mm of precipitation for Valera station.

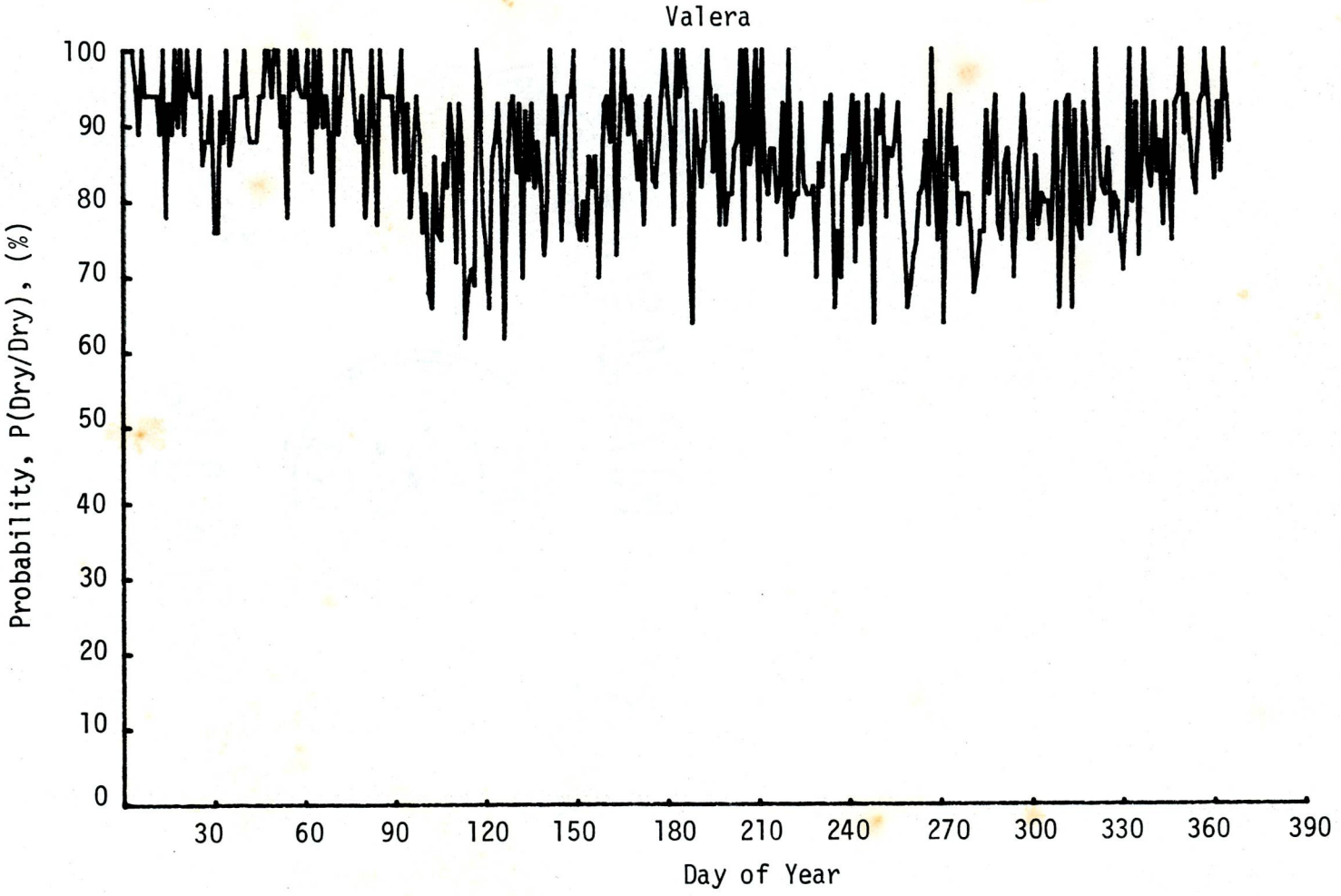

Figure E-8. Conditional probability P(Dry/Dry) vs. day of year for dry days defined as <5 mm of precipitation for Valera station.

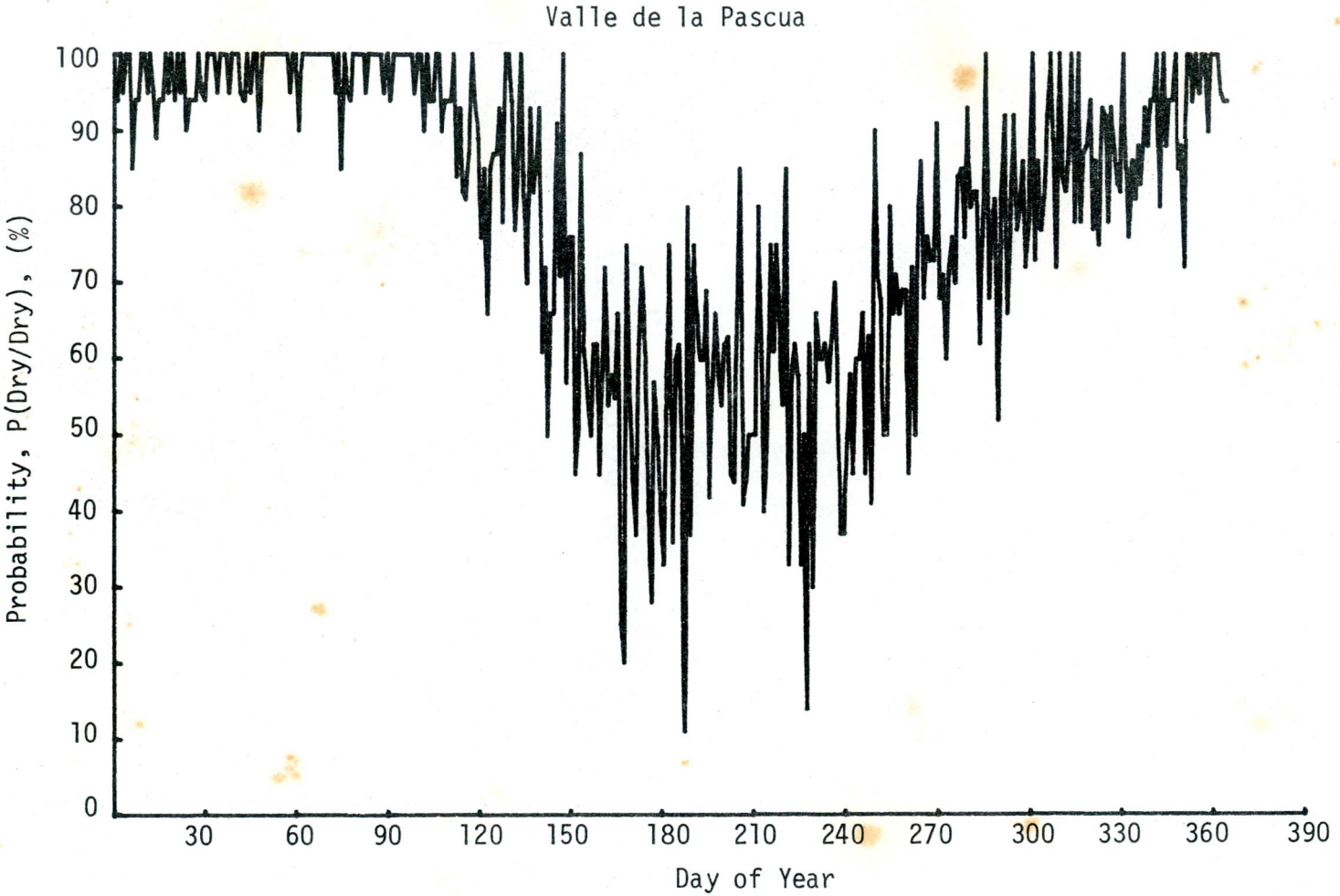

Figure E-9. Conditional probability P(Dry/Dry) vs. day of year for dry days defined as <1 mm of precipitation for Valle de la Pascua station.

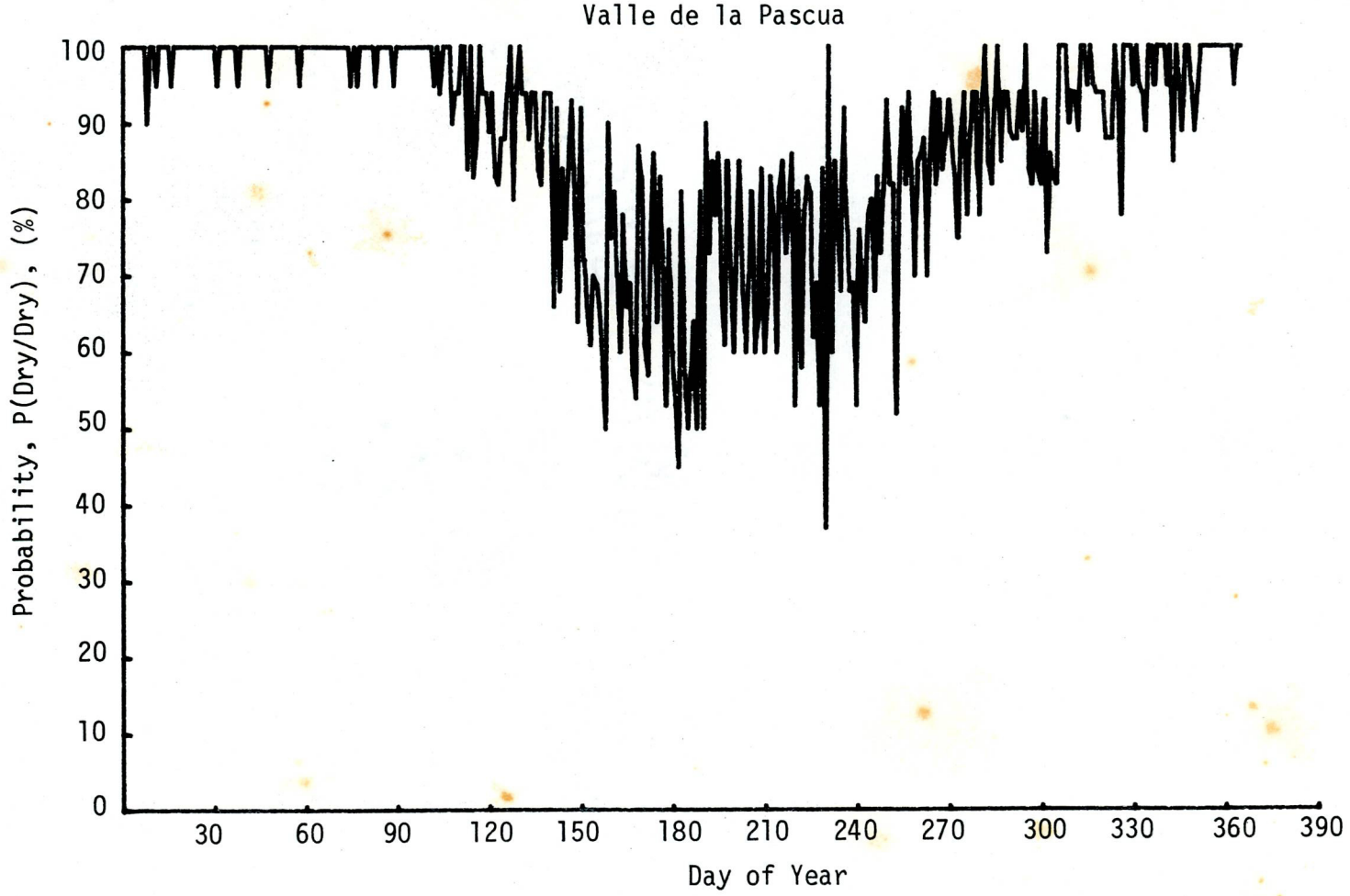

Figure E-10. Conditional probability P(Dry/Dry) vs. day of year for dry days defined as <5 mm of precipitation for Valle de la Pascua station.

APPENDIX F

```
C     ************************************************************
C     *                                                          *
C     *                                                          *
C     *                                                          *
C     * CALCULATION OF PROBABILITIES OF  SEQUENCES OF WET AND DRY DAYS *
C     *                                                          *
C     *                                                          *
C     *                                                          *
C     ************************************************************
C
C
C
C
C
C
C
      CHARACTER *80 T1,T2,T3,ST
      INTEGER RAIN(20,12,31),YEAR,MONTH,DAY(20),PREC(20),PROBD(12,31),
     *PROBDD(12,31),PROBDW(12,31),NDDDRY(12,31),NDDRY(12,31),NDDWET(12,3
     *1),NDWET(12,31)
      READ (5,15) NUMHEL
   15 FORMAT (76X,I4)
  555 READ (5,10) T1
   10 FORMAT (A80)
      READ (5,10) T2
      READ (5,10) T3
      READ (5,10) ST
      DO 13 I=1,20
      DO 12 J=1,12
      DO 11 K=1,31
   11 RAIN(I,J,K)=0
   12 CONTINUE
   13 CONTINUE
      DO 98 K=1,31
      DO 99 J=1,12
      NDDRY(J,K)=0
      NDDDRY(J,K)=0
      NDDWET(J,K)=0
      NDWET(J,K)=0
      PROBDD(J,K)=0
      PROBDW(J,K)=0
   99 CONTINUE
   98 CONTINUE
    1 READ (5,100,END=1000) YEAR,MONTH,(DAY(I),PREC(I) ,I=1,10),NUMSTA
  100 FORMAT (2I2,10(I2,1X,I3,1X),2X,I4)
```

```
      IF (NUMSTA.EQ.NUMHEL) GO TO 557
      NUMHEL=NUMSTA
      GO TO 200
  557 I=YEAR-50
      J=MONTH
      DO 20 IP=1,10
      IF (DAY(IP).EQ.0) GO TO 1
      IF (PREC(IP).EQ.0) GO TO 20
      K=DAY(IP)
      RAIN(I,J,K)=PREC(IP)
   20 CONTINUE
      GO TO 1
  200 DO 30 K=1,31
      DO 40 J=1,12
      DO 50 I=1,20
C
C
C
C     NUMBER OF DRY AND WET DAYS FOR ALL DAYS  EXECPT  THE  FIRST DAY OF
C     EACH MONTH.
C
C
      IF (RAIN(I,J,K).GE.10) GO TO 51
      NDDRY(J,K)=NDDRY(J,K)+1
   51 IF (RAIN(I,J,K).LT.10) GO TO 54
      NDWET(J,K)=NDWET(J,K)+1
   54 KP=K-1
      IF (K.EQ.1) GO TO 52
      IF (RAIN(I,J,K).LT.10.AND.RAIN(I,J,KP).LT.10)NDDDRY(J,K)=NDDDRY(J,
     *K)+1
      IF (RAIN(I,J,K).LT.10.AND.RAIN(I,J,KP).GE.10)NDDWET(J,K)=NDDWET(J,
     *K)+1
      GO TO 50
   52 IF (J.EQ.1) GO TO 501
      IF (J.EQ.2) GO TO 502
      IF (J.EQ.3) GO TO 503
      IF (J.EQ.4) GO TO 504
      IF (J.EQ.5) GO TO 505
      IF (J.EQ.6) GO TO 506
      IF (J.EQ.7) GO TO 507
      IF (J.EQ.8) GO TO 508
      IF (J.EQ.9) GO TO 509
      IF (J.EQ.10) GO TO 510
      IF (J.EQ.11) GO TO 511
      IF (J.EQ.12) GO TO 512
```

```
C      NUMBER OF DRY DAY GIVEN THAT THE PREVIOUS DAY IS DRY (FIRST DAY OF
C      EACH MONTH).
C
C
C      NUMBER OF DRY DAY GIVEN THAT THE PREVIOUS DAY IS WET (FIRST DAY OF
C      EACH MONTH).
C
C
  501 IF(RAIN(I,J,K).LT.10.AND.RAIN(I,12,31).LT.10)NDDDRY(J,K)=NDDDRY(J,
     *K)+1
      IF (RAIN(I,J,K).LT.10.AND.RAIN(I,12,31).GE.10)NDDWET(J,K)=NDDWET(J
     *,K)+1
      GO TO 50
  502 IF(RAIN(I,J,K).LT.10.AND.RAIN(I,1,31) .LT.10)NDDDRY(J,K)=NDDDRY(J,
     *K)+1
      IF (RAIN(I,J,K).LT.10.AND.RAIN(I,1,31).GE.10)NDDWET(J,K)=NDDWET(J,
     *K)+1
      GO TO 50
  503 IF(RAIN(I,J,K).LT.10.AND.RAIN(I,2,28) .LT.10)NDDDRY(J,K)=NDDDRY(J,
     *K)+1
      IF (RAIN(I,J,K).LT.10.AND.RAIN(I,2,28).GE.10)NDDWET(J,K)=NDDWET(J,
     *K)+1
      GO TO 50
  504 IF(RAIN(I,J,K).LT.10.AND.RAIN(I,3,31) .LT.10)NDDDRY(J,K)=NDDDRY(J,
     *K)+1
      IF (RAIN(I,J,K).LT.10.AND.RAIN(I,3,31).GE.10)NDDWET(J,K)=NDDWET(J,
     *K)+1
      GO TO 50
  505 IF(RAIN(I,J,K).LT.10.AND.RAIN(I,4,30) .LT.10)NDDDRY(J,K)=NDDDRY(J,
     *K)+1
      IF (RAIN(I,J,K).LT.10.AND.RAIN(I,4,30).GE.10)NDDWET(J,K)=NDDWET(J,
     *K)+1
      GO TO 50
  506 IF(RAIN(I,J,K).LT.10.AND.RAIN(I,5,31) .LT.10)NDDDRY(J,K)=NDDDRY(J,
     *K)+1
      IF (RAIN(I,J,K).LT.10.AND.RAIN(I,5,31).GE.10)NDDWET(J,K)=NDDWET(J,
     *K)+1
      GO TO 50
  507 IF(RAIN(I,J,K).LT.10.AND.RAIN(I,6,30) .LT.10)NDDDRY(J,K)=NDDDRY(J,
     *K)+1
      IF (RAIN(I,J,K).LT.10.AND.RAIN(I,6,30).GE.10)NDDWET(J,K)=NDDWET(J,
     *K)+1
      GO TO 50
  508 IF(RAIN(I,J,K).LT.10.AND.RAIN(I,7,31) .LT.10)NDDDRY(J,K)=NDDDRY(J,
     *K)+1
```

```
      IF (RAIN(I,J,K).LT.10.AND.RAIN(I,7,31).GE.10)NDDWET(J,K)=NDDWET(J,
     *K)+1
      GO TO 50
  509 IF(RAIN(I,J,K).LT.10.AND.RAIN(I,8,31) .LT.10)NDDDRY(J,K)=NDDDRY(J,
     *K)+1
      IF (RAIN(I,J,K).LT.10.AND.RAIN(I,8,31).GE.10)NDDWET(J,K)=NDDWET(J,
     *K)+1
      GO TO 50
  510 IF(RAIN(I,J,K).LT.10.AND.RAIN(I,9,30) .LT.10)NDDDRY(J,K)=NDDDRY(J,
     *K)+1
      IF (RAIN(I,J,K).LT.10.AND.RAIN(I,9,30).GE.10)NDDWET(J,K)=NDDWET(J,
     *K)+1
      GO TO 50
  511 IF(RAIN(I,J,K).LT.10.AND.RAIN(I,10,31).LT.10)NDDDRY(J,K)=NDDDRY(J,
     *K)+1
      IF (RAIN(I,J,K).LT.10.AND.RAIN(I,10,31).GE.10)NDDWET(J,K)=NDDWET(J
     *,K)+1
      GO TO 50
  512 IF(RAIN(I,J,K).LT.10.AND.RAIN(I,11,30).LT.10)NDDDRY(J,K)=NDDDRY(J,
     *K)+1
      IF (RAIN(I,J,K).LT.10.AND.RAIN(I,11,30).GE.10)NDDWET(J,K)=NDDWET(J
     *,K)+1
   50 CONTINUE
C
CCCCCC
C     PROBABILITY(DRY), PROBABILITY(DRY/DRY), PROBABILITY(DRY/WET) FOR
C     ALL DAYS EXCEPT THE FIRST DAY OF EACH MONTH.
CCCCCCC
C
      IF (J.EQ.2.AND.K.EQ.29) GO TO 1020
      PROBD(J,K)=NDDRY(J,K)*5
      GO TO 1021
 1020 PROBD(J,K)=(NDDRY(J,K)-15)*20
 1021 IF (K.EQ.1) GO TO 40
      IF (NDDRY(J,KP).EQ.0) GO TO 400
      PROBDD(J,K)=NDDDRY(J,K)*100/NDDRY(J,KP)
  400 IF (K.EQ.1) GO TO 40
      IF (NDWET(J,KP).EQ. 0) GO TO 40
      PROBDW(J,K)=NDDWET(J,K)*100/NDDWET(J,KP)
   40 CONTINUE
   30 CONTINUE
```

```
C       PROBABILITY(DRY/WET) FOR THE FIRST DAY OF EACH MONTH.
CC
C
        IF (NDWET(12,31).EQ. 0) GO TO 421
        PROBDW  (1,1)=NDDWET(1,1)*100/NDWET(12,31)
  421   IF (NDWET(1,31).EQ. 0) GO TO 422
        PROBDW  (2,1)=NDDWET(2,1)*100/NDWET(1,31)
  422   IF (NDWET(2,28).EQ. 0) GO TO 423
        PROBDW  (3,1)=NDDWET(3,1)*100/NDWET(2,28)
  423   IF (NDWET(3,31).EQ. 0) GO TO 424
        PROBDW  (4,1)=NDDWET(4,1)*100/NDWET(3,31)
  424   IF (NDWET(4,30).EQ. 0) GO TO 425
        PROBDW  (5,1)=NDDWET(5,1)*100/NDWET(4,30)
  425   IF (NDWET(5,31).EQ. 0) GO TO 426
        PROBDW  (6,1)=NDDWET(6,1)*100/NDWET(5,31)
  426   IF (NDWET(6,30).EQ. 0) GO TO 427
        PROBDW  (7,1)=NDDWET(7,1)*100/NDWET(6,30)
  427   IF (NDWET(7,31).EQ. 0) GO TO 428
        PROBDW  (8,1)=NDDWET(7,1)*100/NDWET(7,31)
  428   IF (NDWET(8,31).EQ. 0) GO TO 429
        PROBDW  (9,1)=NDDWET(9,1)*100/NDWET(8,31)
  429   IF (NDWET(9,30).EQ. 0) GO TO 430
        PROBDW  (10,1)=NDDWET(10,1)*100/NDWET(9,30)
  430   IF (NDWET(10,31).EQ. 0) GO TO 431
        PROBDW  (11,1)=NDDWET(11,1)*100/NDWET(10,31)
  431   IF (NDWET(11,30).EQ. 0) GO TO 432
        PROBDW  (12,1)=NDDWET(12,1)*100/NDWET(11,30)
C
CCC     PROBABILITY(DRY/DRY) FOR THE FIRST DAY OF EACH MONTH.
CCC
C
  432   IF (NDDRY(12,31).EQ.0) GO TO 402
        PROBDD(1,1)=NDDDRY(1,1)*100/NDDRY(12,31)
  402   IF (NDDRY(1,31).EQ.0) GO TO 403
        PROBDD(2,1)=NDDDRY(2,1)*100/NDDRY(1,31)
  403   IF (NDDRY(1,28).EQ.0) GO TO 404
        PROBDD(3,1)=NDDDRY(3,1)*100/NDDRY(2,28)
  404   IF (NDDRY(3,31).EQ.0) GO TO 405
        PROBDD(4,1)=NDDDRY(4,1)*100/NDDRY(3,31)
  405   IF (NDDRY(4,30).EQ.0) GO TO 406
        PROBDD(5,1)=NDDDRY(5,1)*100/NDDRY(4,30)
  406   IF (NDDRY(5,31).EQ.0) GO TO 407
        PROBDD(6,1)=NDDDRY(6,1)*100/NDDRY(5,31)
  407   IF (NDDRY(6,30).EQ.0) GO TO 408
```

```
      PROBDD(7,1)=NDDDRY(7,1)*100/NDDRY(6,30)
  408 IF (NDDRY(7,31).EQ.0) GO TO 409
      PROBDD(8,1)=NDDDRY(8,1)*100/NDDRY(7,31)
  409 IF (NDDRY(8,31).EQ.0) GO TO 410
      PROBDD(9,1)=NDDDRY(9,1)*100/NDDRY(8,31)
  410 IF (NDDRY(9,30).EQ.0) GO TO 411
      PROBDD(10,1)=NDDDRY(10,1)*100/NDDRY(9,30)
  411 IF (NDDRY(10,31).EQ.0) GO TO 412
      PROBDD(11,1)=NDDDRY(11,1)*100/NDDRY(10,31)
  412 IF (NDDRY(11,30).EQ.0) GO TO 413
      PROBDD(12,1)=NDDDRY(12,1)*100/NDDRY(11,30)
  413 WRITE (6,31) T1
   31 FORMAT ('1',//////////,28X,A80)
      PRINT 32
   32 FORMAT ('0',T29,'DRY<1 MM                                        P(WET)=1-P(DR
     *Y)')
      WRITE (6,34) ST
   34 FORMAT ('-',27X,A80)
      PRINT 18
   18 FORMAT ('-',T29,'DAY JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV D
     *EC')
      PRINT 19
   19 FORMAT (' ',T29,'==========================================================
     *==')
      DO 70 K=1,29
      WRITE(6,300)  K,(PROBD(J,K), J=1,12)
   70 CONTINUE
  300 FORMAT (29X,I2,12(1X,I3))
      WRITE(6,5000) PROBD(1,30),(PROBD(J,30), J=3,12)
 5000 FORMAT (29X,2H30,1X,I3,4X,10(1X,I3))
      WRITE(6,5001) PROBD(1,31),PROBD(3,31),PROBD(5,31),PROBD(7,31),PROB
     *D(8,31),PROBD(10,31),PROBD(12,31)
 5001 FORMAT (29X,2H31,1X,I3,4X,1X,I3,4X,1X,I3,4X,1X,I3,1X,I3,4X,1X,I3,4
     *X,1X,I3)
      WRITE(6,31) T2
      PRINT 42
   42 FORMAT (' ',T43,'THE PREVIOUS DAY IS DRY    P(DRY/DRY)')
      PRINT 43
   43 FORMAT ('0',T29,'DRY<1 MM                         P(WET/DRY)=1-P(DRY/DR
     *Y)')
      WRITE (6,34) ST
      PRINT 88
   88 FORMAT ('-',T29,'DAY JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV D
     *EC')
      PRINT 888
```

```
 888 FORMAT (' ',T29,'==========================================================
    *==')
     DO 71 K=1,29
     WRITE (6,301) K,(PROBDD(J,K), J=1,12)
  71 CONTINUE
 301 FORMAT (29X,I2,12(1X,I3))
     WRITE (6,5002) PROBDD(1,30),(PROBDD(J,30), J=3,12)
5002 FORMAT (29X,2H30,1X,I3,4X,10(1X,I3))
     WRITE(6,5003) PROBDD(1,31),PROBDD(3,31),PROBDD(5,31),PROBDD(7,31),
    *PROBDD(8,31),PROBDD(10,31),PROBDD(12,31)
5003 FORMAT (29X,2H31,1X,I3,4X,1X,I3,4X,1X,I3,4X,1X,I3,1X,I3,4X,1X,I3,4
    *X,1X,I3)
     WRITE (6,31) T3
     PRINT 522
 522 FORMAT (' ',T43,'THE PREVIOUS DAY IS WET    P(DRY/WET)')
     PRINT 53
  53 FORMAT ('0',T29,'DRY<1 MM                     P(WET/WET)=1-P(DRY/WE
    *T)')
     WRITE (6,34) ST
     PRINT 67
  67 FORMAT ('-',T29,'DAY JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV D
    *EC')
     PRINT 999
 999 FORMAT (' ',T29,'==========================================================
    *==')
     DO 666 K=1,29
     WRITE (6,302) K,(PROBDW(J,K),J=1,12)
 666 CONTINUE
 302 FORMAT (29X,I2,12(1X,I3))
     WRITE(6,5004) PROBDW(1,30),(PROBDW(J,30), J=3,12)
5004 FORMAT (29X,2H30,1X,I3,4X,10(1X,I3))
     WRITE(6,5005) PROBDW(1,31),PROBDW(3,31),PROBDW(5,31),PROBDW(7,31),
    *PROBDW(8,31),PROBDW(10,31),PROBDW(12,31)
5005 FORMAT (29X,2H31,1X,I3,4X,1X,I3,4X,1X,I3,4X,1X,I3,1X,I3,4X,1X,I3,4
    *X,1X,I3)
     IF (NUMHEL.NE.9999) GO TO 555
     PRINT 997
 997 FORMAT ('1',T2,'END')
1000 STOP
     END
```