Mesoscale Storm and Dry Period Parameters from Hourly Precipitation Data: Program Documentation

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September 1984

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MESOSCALE STORM AND DRY PERIOD
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DATA: PROGRAM DOCUMENTATION

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SUMMARY

Wet deposition of airborne chemical pollutants occurs primarily from precipitation. Precipitation rate, amount, duration, and location are important meteorological factors to be considered when attempting to understand the relationship of precipitation to pollutant deposition.

The Pacific Northwest Laboratory (PNL) has conducted studies and experiments in numerous locations to collect data that can be incorporated into theories and models that attempt to describe the complex relationship between precipitation occurrence and chemical wet deposition.

Model development often requires the use of average rather than random conditions as input. To provide mean values of storm parameters, the task, 'Climatological Analysis of Mesoscale Storms', was created as a facet of the Environmental Protection Agency's related-service project, 'Precipitation Scavenging Module Development'. Within this task computer programs have been developed at PNL which incorporate hourly precipitation data from National Weather Service stations to calculate mean values and frequency distributions of precipitation periods and of the interspersed dry periods. These programs have been written with a degree of flexibility that will allow user modification for applications to different, but similar, analyses.

This report describes in detail the rationale and operation of the two computer programs which produce the tables of averages and frequency distributions of storm and dry period parameters from the precipitation data. A listing of the programs and examples of the generated output are included in the appendices.

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1.0 INTRODUCTION

1.1 PURPOSE OF THE SYSTEM

In the acidic deposition project, climatological analyses of storms are important for a number of different but related reasons: to define "average" storms and variations about the averages; to develop precipitation scavenging "storm signatures;" to obtain Lagrangian statistics, both for the duration of storms and for the time periods between storms; and to enhance the value of data routinely reported by the MAP3S/Precipitation Chemistry Network (PCN) and those data made available from other networks such as in Canada (Scott 1982; The MAP3S/RAINE Research Community 1982).

A storm, as defined in this report, is a period of precipitation composed of one or more precipitation events at a station. An event continues as long as consecutive hours of precipitation are recorded. It frequently happens during a precipitation period that an hour with no precipitation is recorded.

Hourly precipitation data for each observing station in the United States are archived at the National Climatic Data Center (NCDC) in month-long or year-long series. This document describes a system of computer programs developed to produce statistics of storm parameters from the hourly precipitation data. The set of computer programs to be described in this report has been designed to operate on data in the monthly format.

1.2 SUMMARY OF THE SYSTEM OF COMPUTER PROGRAMS

The system consists of a two-step sequence of computer programs. This sequence transfers the original hourly precipitation data (HPD) into tables of storm statistics. These storm statistics include tables of frequency distributions of storm duration categories.

The original input data ("original" in terms of entry to this system--an initial conversion of the NCDC data may be needed to make it compatible with the user's hardware and software facilities) are binary coded decimal (BCD) climatological hourly precipitation data in a card image format from the

National Climatic Data Center (NCDC), Asheville, North Carolina (U.S. Department of Commerce). These data are arranged by station, a year's worth of data for each station. Recent Station File Data can be obtained on monthly tapes from the NCDC.

The first program, NCCTAP, converts the BCD data from the National Climatic Data Center tape (for stations selected by the operator), to a digitized data file on disc. This program is a derivation of a program named PAK developed by T.D. Fox and others at PNL for transforming hourly precipitation data from station-file format (arranged by station) to synoptic-file (arranged by date).

The second program, WETDRY, operates on the file produced by NCCTAP to construct statistics of storms and dry periods from the hourly precipitation data, and arranges these periods in frequency distribution tables with attendant averages and extremes (Figure 1).

1.3 DOCUMENTATION PREFACE

In the following chapters, the main programs and their subroutines will be discussed in detail. The text will describe not only how to use the programs, but also how they function. Information required to run the programs is presented. Problems and difficulties inherent in the data base and/or programs will be discussed.

Some users may find the programs useful in their present form. Others may wish to modify the programs to suit particular needs. The structure and logic of each program is described with this need in mind.

Each chapter will discuss, the purpose, structure, subroutines, input and output data types and formats, and diagnostic messages of the programs. It is intended that each chapter be reasonably self contained, so there is therefore considerable redundancy between chapters in the stating of program purposes, description of file structures, and definition of terms. Moreover, cross-referencing information is usually present in descriptions of the interrelationships of system elements, so that characteristics treated more fully in other chapters may be reviewed, if necessary.

FIGURE 1. Steps Used in Producing Storm and Dry Period Frequency Distribution Tables From Hourly Precipitation Data Tapes in National Climatic Data Center Format

The generic programs were originally developed for use on the UNIVAC 8800 computer. The later editions described in this documentation are being run on a VAX-11 computer.

Figure 1. Steps used in the preparation of wet and dry period frequency distribution tables for hourly precipitation data sets in North Carolina. Data format.

2.0 DATA CONVERSION PROCEDURE BY PROGRAM NCCTAP

2.1 INTRODUCTION

Program NCCTAP is the first of the two computer programs that are used to generate storm statistics. NCCTAP decodes hourly precipitation data (HPD) written on magnetic tape in binary coded data (BCD), which is a standard code used to represent groups of binary digits as character information (alpha-numerics and punctuation). The information is written on the tape in station-file format (a grouping of the hourly precipitation data by station). After the proper decoding, NCCTAP rewrites the information to disc file.

NCCTAP performs some preliminary error analyses of the data. The types of errors for which NCCTAP checks include:

- illegal characters in the data
- inconsistencies between reported and actual data sums

NCCTAP flags data that are reported missing or that represent precipitation accumulated over more than one hour.

The following discussion of NCCTAP deals with the major functional aspects of its structure, followed by a brief description of each of its subroutines. Input and output formats will then be described. Finally, the meaning of diagnostic messages will be presented.

2.2 SUMMARY OF MAJOR FUNCTIONS

A flow chart showing the major functions performed by NCCTAP is shown in Figure 2. Some details of the program functions are discussed below.

2.2.1 Initialization

The initialization section of NCCTAP sets counters and flags to initial values. Control information (such as input-file unit numbers, a print-control flag, and state-climatic numbers of desired states) is read from cards or a prepared data file.

FIGURE 2. Flowchart Showing Major Functions of Program NCCTAP

2.2.2 Station and State Processing Control

NCCTAP's main loop is a DO-loop, which is executed once for each state from which data are to be obtained. Within this loop, the state climatic numbers and 4-digit climatic station numbers are used to control the execution sequence. Initially within the loop, successive calls to subroutine READ3 (which reads two card-image records, or one day's data, per call) are made until the state climatic number (MSTATE) from tape matches the one specified on card input [NSTT(NS)]. Then, each pair of records is processed until a new 4-digit climatic station-number or state-climatic-number is read. Either of these occurrences causes the appropriate action (end-of-station or end-of-state processing) to take place.

2.2.3 Processing the Hourly Data

The hourly BCD data are decoded in the main program loop. Each hour's data consist of either three numeric digits, or special characters (blank or "-") representing specific nonstandard situations. NCCTAP interprets the three characters for each hour and produces appropriate output data. If an hour's entry has a blank in the first column, the data are missing, and the NCCTAP output for that hour is -99. If an hour's entry has a "-" as the first character, the data represent a "trace" and the NCCTAP output for that hour is zero. If a "-" appears as the second character, the NCCTAP output for that hour is -9, meaning part of an accumulation period. An accumulation period consists of hours during which precipitation occurred, but the hourly amounts are not known. The total sum of the missing hourly amounts is given as the last hourly value for the period. Otherwise, the digits are decoded and used to build a binary integer representation of the precipitation amount in hundredths of inches.

2.2.4 End-of-Station and End-of-State Processing

Data from each state are processed one station at a time while data from each station are processed by days. In a single execution of a program loop two 12 hour records (80 characters each) for one day's data are read and interpreted. The state and station climatic numbers, read with these daily data, are checked on each execution of the loop. When the climatic number of

a station or state is read that is different from the one being processed, the loop is exited and end-of-station or end-of-state processing takes place. In both cases, the output record for the station last processed is written. As each valid day's precipitation record is read, it is written to a disc file, which will eventually form the data file to be used by the analysis program WETDRY. An optional print variable, KPR, provides a means of generating a printout of what has been written to disc. Following the daily printout for each station, the number of data-days processed for that station is printed.

2.2.5 Normal Termination

NCCTAP terminates normally after the final state (specified in the state numbers in array NSTT) has been processed.

2.3 SUBROUTINES IN NCCTAP

There are two subroutines called directly by NCCTAP. These are READ3 and UNPK4. READ3 in turn calls two others, NEXTAP and MISS. Each subroutine is discussed below in terms of its structure and functions.

2.3.1 Subroutine READ3

Subroutine READ3 (MSTATE, NUMB, IYR, IMO, IDA, IPR, IPRD, NSTN, LU, LLU, IJK, NSTT, NS) reads one day's data (two card image records) from the BCD card-image input file. The parameters are defined as follows:

<u>Name</u>	<u>Dimension</u>	<u>Definition</u>
MSTATE		State climatic number of the data returned from READ3.
NUMB		4-digit climatic station number of the data returned from READ3.
IYR		2-digit year of the data returned.
IMO		2-digit month number of the data return.
IDA		2-digit day-of-month of the data returned.

IPR	(24, 3)	IPR (I,J) is the Jth character of the three characters that give the precipitation amount in hour 1 of the data returned. (IPR(1, 1) and IPR(1, 2) are alphanumeric; IPR(1, 3) is an integer).
IPRD	(4)	IPRD(J) is the Jth character of the four characters that give the daily precipitation sum returned. (IPRD(1) and IPRD(3) are alphanumeric; IPRD(2) and IPRD(4) are integers.)
NSTN	(50, 50)	The requested number (up to 50) of stations per state (up to 50) to be extracted from the original data tapes.
LU		The unit number from which the input file is currently being read.
LLU		The unit number of the final unit from which the input file will be read.
IJK		Flag to indicate that station number just read is not station number wanted.
NSTT	(50)	A two-digit state number corresponding to the alphabetical order of states in the original data tape.
NS		The index (or argument) for NSTT.

READ3 checks for an end-of-file (EOF), which indicates the end of data on one tape reel. If an EOF is encountered, subroutine NEXTAP is called to increment the read-unit number LU. If LU becomes greater than LLU (the number of the final unit holding input data), then MSTATE is set to 199, causing end-of-state processing to occur in NCCTAP, and ultimate termination of the program.

READ3 also checks for two kinds of errors in the input data: card image records that are out of order and nonnumeric character data. In both cases, an appropriate error message is printed, and a call is made to subroutine MISS, which returns a card-image version of missing data for the bad record to be passed back to NCCTAP. If more than 200 bad records of these types are encountered, READ3 prints a message and terminates program execution.

2.3.2 Subroutine NEXTAP

Subroutine NEXTAP (LU, LLU) is called by READ3 whenever an EOF (end-of-file) is encountered on reading LU. It increases every other time it is called. During testing with multivolume data sets, it was found that an EOF often (but not always) appeared at the beginning of the next tape, as well as at its end. NEXTAP is designed to ignore the extra EOF. If the extra EOF is not there, the program just hits the EOF at the end of the volume twice before incrementing LU. If the extra EOF is at the beginning of the data, it is encountered without incrementing LU. If LU becomes greater than the final unit number (LLU), a message is printed saying the EOF on the last unit has been reached, and final processing takes place in READ3 and NCCTAP.

2.3.3 Subroutine MISS

The purpose of subroutine MISS (IPR, IPRD, LT) is to transform a bad record into a correctly formatted one showing only missing hourly values. Parameter definitions are as follows:

<u>Name</u>	<u>Dimension</u>	<u>Definition</u>
IPR	(24, 3)	IPR (I, J) is the Jth character of the Ith hour's precipitation amount.
IPRD	(4)	IPRD (J) is the Jth character of the daily precipitation sum.
LT		The record number (1 or 2) of the daily data record pair.

MISS sets IPR (I, 1) to a blank, for I = 1, 2, ..., 12, when LT = 1, or for I = 13, 14, ..., 24, when LT = 2. MISS also sets IPRD (1) to a blank.

2.3.4 Subroutine UNPK4 (IPRW, LPR, IP)

Subroutine UNPK4 decodes the four-digit daily sum of precipitation obtained in array IPRW, and returns its integer equivalent in IP. Parameter definitions are:

<u>Name</u>	<u>Dimension</u>	<u>Definition</u>
IPRW	(4)	IPRW (J) is the Jth character read from input in the daily sum of hourly precipitation. If J = 2 or 4 IPRW (J) is an integer. If J = 1 or 3, IPRW (J) is alphanumeric.

LPR (14) LPR (K) is the Kth of 13 possible characters ('0', '1', '2', '3', '4', '5', '6', '7', '8', '9', '-', (blank), '+') for comparison with the elements of IPRW.

IP The integer equivalent of the coded daily precipitation sum, which is returned to NCCTAP.

Because the first and third characters may be coded with a special character, they must be checked by UNPK4 individually. UNPK4 does this checking and constructs IP according to the rules in Table 1.

TABLE 1. Decoding Rules for IPRW

<u>Character</u>	<u>Value</u>	<u>Meaning</u>	<u>IP Is Set To:</u>
IPRW (1)	blank	missing	-99
IPRW (1)	" _ "	trace	0
IPRW (3)	" _ "	accumulating	-9

2.4 INPUT TO NCCTAP

The input to program NCCTAP is of two types: the BCD-coded precipitation data and program control data.

2.4.1 BCD-Coded Precipitation Data

The hourly precipitation used as input to NCCTAP is in the format described in the U.S. Weather Service Reference Manual for Deck 488-USWS Hourly Precipitation (U.S. Dept. of Commerce 1960), except that only the first two of the four cards per data day described in that manual are used.

Precipitation data in this format may be obtained from the National Climatic Data Center (NCDC), Asheville, North Carolina. The data are available, one year's worth at a time, for desired stations in station-file format, although it is possible to obtain month-long data files from NCDC for recent months. NCCTAP will also read data from cards punched in this format, by setting the precipitation input unit number (LU) to that for card input (unit 5).

The sources of data are divided into two groups:

- (1) The data for National Weather Service first-order stations are taken from monthly local climatic data (LCD) sheets.
- (2) NWS second-order stations and cooperative stations mail their rain gage charts to the National Weather Records Center (NWRC), where they are evaluated and the data punched on cards. The data eventually are included on the TD-9657 Hourly Precipitation tapes. In the 48 contiguous states, there are approximately 3100 reporting stations. First-order NWS stations report hourly precipitation to the nearest 1/100 inch. Many of the other stations have used a "Fischer-Porter" precipitation gage since 1963. This type of gage records precipitation amounts to the nearest 1/10 inch.

A few characteristics of the data format, as it is received on tape from NCDC and used by NCCTAP, are discussed below.

The data is written in BCD 80-character (card-image) records, with two records required for one day's data. The data are organized by state climatic number (assigned alphabetically) and by four-digit climatic station number within each state. A full year's (or month's) data are grouped together for each station (STA-FILE format). Except on the first day of each station-month (which is always included), data are recorded only for days on which measurable precipitation was observed, or on the first and last days of periods of missing or accumulating data (see Section 2.2.3). At times, observations for a number of hours are missed and the observation at the end of that period is actually an "accumulation" over that entire period. Such periods are specially coded in the data.

Data for one year may reside on more than one tape volume. If it does, and if the installation recognizes the end of a tape volume as an end-of-file, then each volume should be assigned to a separate tape unit. The first should be assigned to unit 9, the second to unit 10, and so on. NCCTAP switches from one unit to the next when an end-of-file is reached (see subroutine NEXTAP).

The data tapes as received contain hourly precipitation information for approximately 3100 stations. However, most of these stations appear to use the Fischer-Porter type rain gage that records precipitation only in tenths of inches. Monthly or annual precipitation totals may not be significantly affected by such coarse measurements, but precipitation-event rates calculated from such records are fictitious. For our purposes, only those first order NWS stations that report precipitation in hundreths of an inch are used. Such stations make up less than 10 percent of the original data. The time increment for precipitation data is one hour. It is certainly possible that a short-duration precipitation event may occur near the end of one hour and briefly into the next hour. Such an event would be analyzed as a 2-hour event. Such bias on short duration events cannot be avoided because of the data format. We mention this to point out that the shorter duration storm and precipitation-event statistics are less reliable than those for longer storms and events.

2.4.2 Program Control Data (Card Input)

The input from cards of program control information for NCCTAP is described in Table 2.2.

TABLE 2.. NCCTAP Control Data (Card) Input

<u>Card #</u>	<u>Cols</u>	<u>Format</u>	<u>Name</u>	<u>Definition</u>
1	1-5	I5	NSTA	Number of states from which data are to be obtained
1	6-10	I5	KPR	Print Control (1 = print every record, 0 = print no records)
1	11-15	I5	LU	First precipitation input tape unit number
1	16-20	I5	LLU	Last precipitation input tape unit number
2	1-80	40I2	NSTT (I) I = 1, NSTA	Array of state-climatic-numbers of states whose data are to be obtained (numbers should be in ascending order). More than one of these cards may be needed.

2.5 OUTPUT FROM NCCTAP

The output from NCCTAP is of two types: precipitation data files (on tape or disc) and printed output.

2.5.1 Precipitation File Output

NCCTAP's primary output, the STA-FILE precipitation data, is written to an output file assigned to unit 3^(a). Each record is produced with the following write statement: WRITE(3, 56) MSTATE, NUMB, IMO, IDA, IYR, (IP(I), I = 1, 24), IPD

Data put on the monthly disc files are arranged by state, station, and day.

2.5.2 Printed Output from NCCTAP

The standard output from program NCCTAP is a listing of the states and stations from which data have been processed. Setting the optional control parameter, KPR, to one rather than zero results in output of the state number, the station number, date, hourly precipitation amounts, and the daily precipitation sum for each day's record. Because excessive output may result, this option should be taken only when testing with a small amount of data, or when a hard copy is needed to examine data that may need EDIT changes (see 3.1.1).

2.6 DIAGNOSTIC MESSAGES FROM NCCTAP

Most of the diagnostic messages printed by NCCTAP refer to errors in the input data set. They are printed to inform the user of these errors and how NCCTAP handles them. NCCTAP usually continues past the point of error, so the messages are often imbedded in the standard output. Each of NCCTAP'S diagnostic messages is discussed briefly below.

(a) Provision is not made for output files that take up more than one tape volume. If the installation does not accommodate multi-volume files, NCCTAP can be run more than once on separate sets of states.

2.6.1 "Missing State in Source Data, State No. NN"

If a state is requested whose data do not appear in the input data set, this message is printed (nn is the state climatic number). The program proceeds to the next requested state.

2.6.2 "Inconsistent Precip Sum"

If all of the hourly precipitation values are present, but their sum does not equal the reported daily sum, this message is printed, followed by the state and station numbers, date, hourly, and daily precipitation values.

2.6.3 "Daily Total Missing, Hourly Value Considered Valid"

When the reported daily sum is actually an accumulation, or is coded as missing, this message is printed.

2.6.4 "These Data Will Be Considered Missing"

Print out of the data values are followed by this message, if the value reported for the daily sum is different from the computed sum of hourly values.

2.6.5 "Read No. r, Card No. c, Station ssnnnn, Date yymmdd, Data For This Date Considered Missing"

This message is printed when there is an extra BCD record, or the two daily records are out of order. Here, r is the record number (1 or 2) of the daily pair of records that was expected, c is the number that was read, ssnnnn are the state and station numbers, and yymmdd are the year, month, and day of the record.

2.6.6 "NSPS Exceeded 50 Stations for State"

If inadvertently, more than 50 stations for a single state are called for, this message is printed, and control goes to the next state. If a larger limit for stations-per-state is desired, the value of NSPS can be EDITED to suit the needs of the user.

2.6.7 "Too Many Bad Records, Job Terminated"

If there are more than 200 occurrences of the card-out-of-order or the illegal-data-in-field errors, the program terminates execution after printing this message.

2.6.8 "Reached EOF On Tape tt"

This message is printed if the end-of-file mark on the last designated tape unit is encountered. Here tt is equal to LLU, the last designated tape unit.

3.0 DATA FILE EDITING

3.1. VISUAL CHECK

Once the hourly precipitation data have been extracted from the original monthly NCDC Hourly Precipitation Data tapes and written to disc file, that file needs to be edited to remove or correct anomalous data that cannot be digested by the WETDRY program. Our method is to print a hard copy of the selected data, as it is being written to disc file, by using the print control parameter KPR.

There are two types of "errors" common in the NCDC source data. The first is represented by a string of hourly data composed of -9's in the decoded form. This represents a situation for which hourly distribution is not available, but for which the total accumulation is available. A certain amount of subjectivity must be used to determine whether such data should be estimated or discarded. For example, if 3 hourly amounts are shown as accumulating (-9), but the total accumulation for the period is recorded as 0.03 inch, it may be preferable to estimate an even distribution of 0.01 inch per hour rather than exclude the record in analysis. On the other hand, a 36-hour period of accumulating data with a total accumulation of 2.00 inches would require considerable knowledge of the precipitation record from nearby stations before an estimate of hourly distribution could be considered. The second type of error shows on the printout from NCCTAP as -99, signifying unknown or missing data. These data are generally deleted from the disc file. Here too, subjective decisions are needed. Should a 24-hour record be composed entirely of -99 values and should that be the only record for the month, then an abnormally long dry period will result if the record is deleted. It may be advisable to delete the entire station month. Another possibility is to change the -99's to zero amounts (except for assigning a few hours of 0.01 on those days which have missing data). Such small amounts for short periods have little effect on the frequency statistics, but do preserve the occurrence of a precipitation day. All such changes should be fully documented.

3.2 CORRECTIONS BY EDITOR

Once the changes have been made on the printout and documented, the data file is accessed and the changes and deletions made to the file. The composite seasonal file is likely to be quite large (about 7000 blocks for 1 month for the approximately 200 National Weather Service stations in the 48 states).

Our procedure is to let NCCTAP create a file for each month's data. This way, each month is edited separately. Once editing is complete, the months are appended to create a seasonal file for input to program WETDRY.

4.0 DATA ANALYSES SEQUENCE BY PROGRAM WETDRY

4.1 INTRODUCTION

The original version of program WETDRY was developed in 1980 to provide estimates of average storm parameters for input into in-cloud conversion models (Scott 1982).

Program WETDRY uses the hourly precipitation data file for selected stations that has been created by program NCCTAP from TD-9657 data tapes. The file should be checked for errors or anomalous data, and the proper corrections made before submitting it to WETDRY for the analysis run.

Program WETDRY reads hourly precipitation data from the input file and interprets the periods of continuous or near-continuous precipitation as storms, and the hours between 'storms' as dry periods. Storm and dry period durations are measured in whole hours. The user has the option of allowing a few dry hours to occur within a single storm. In this case, the storm is made up of one or more precipitation events, which represent periods of uninterrupted precipitation. For each storm identified by the program, the precipitation amount, number of wet hours, number of events, sum of event rates, and the number of 'dry' hours occurring within the storm are determined.

Once the data have all been read and each hour has been assigned to a storm, dry period, or to some category for unusable data, the program calculates a series of averages and frequency distributions, identifies maxima in the data, performs internal audits and checks, and produces a printout of lists and tables.

There have been several versions of this program as a result of a continuing effort to eliminate bias in the output and to maximize the use of the rather limited data base at PNL. The operating versions and main feature associated with each one are listed in Table 3.

Version 2 of WETDRY processed all the data fed to it as either a storm or dry period. Because of the arrangement of the data (i.e., by month

TABLE 3. Evolution of Program WETDRY

<u>Version</u>	<u>Feature</u>
WETDRY2	Treated all periods, including month-end, as full storms and dry periods.
WETDRY3	Dropped all month-end and month-beginning periods from analyses.
WETDRY4	Dropped all month-end and month-beginning wet-periods; paired continuing dry periods.
WETDRY7	Recovers all usable month-end continuing storms and dry periods.

rather than by station), month-end and month- beginning periods are not complete as read from the file. When such periods are treated as complete in the analyses, they produce a bias toward greater frequency of shorter duration periods.

In response to this situation, Version 3 of WETDRY was written. It excluded all month-end and -beginning periods, but excluding data also causes some bias in the analyses, especially when the data base is limited. As a rule, there are more dry hours than wet at stations in the United States, so there is greater probability of bias in dry period analyses than wet.

Since the data base at Pacific Northwest Laboratory is limited to less than 3 full years, it is desirable to make maximum use of that which is available. WETDRY4 is the program version that recovers month-end and -beginning dry periods that span months within a season. The first period of the first month and the last period of the third month in a season are excluded for each station because the duration of these dry periods is unknown.

Recovery of month-end and -beginning wet periods is considerably more complicated because of the storm parameters (precipitation amount, number of events, event rates, number of wet hours, etc.) that must be handled in such a way that they can each be recovered after all the data are read. WETDRY7 is the version which recovers both wet and dry periods that span sequential seasonal months. As in Version 4, the first period of the first month and

the last period of the third month are not recoverable. The flow chart of major WETDRY functions is shown in Figure 3.

4.2 SUMMARY OF THE MAJOR WETDRY FUNCTIONS

4.2.1 Dimensions and Data Statements

Our analyses are based on the following array sizes:

Storm Frequency Table	300 Classes (1 hour each)
Dry Period Frequency Table	42 Classes (20 hours each)
Max Number of Events in a Storm	20 Events
First and Last Monthly Period	
Arrays	90 Stations, 4 Years, 12 Months

There are three DATA statements. The first, which indicates the number of days in a calendar month plus 1, is used to flag the end of a station-month when the last precipitation day occurs before month end. The second DATA statement sets the class limits (in hours) for the dry period frequency analysis. The third DATA statement lists the four-digit station numbers in the same order as they will appear in the data file produced by NCCTAP. The user must be sure that there is no duplication of station number (for example it is possible for stations in different states to have the same station number). In the event such duplication occurs, the elements of the DATA statement could be rewritten using a six-digit composite number made up of state number and station number.

4.2.2 Primary Initialization

All the variables that serve as counters for the input data as it is read are initialized at the beginning of the program. At statement no. 5, certain variables are initialized as each new station-month is encountered. Input control data are described in Section 4.4.1.

4.2.3 Reading the Precipitation Data Record

The READ statement reads one record at a time. The record consists of state number, station number, month number, year, day, 24 values of hourly

FIGURE 3. Flowchart Showing Major Functions of Program WETDRY

precipitation (integer form), and the daily total precipitation (integer) (see Table 4). Amounts are reported in 1/100ths inches of water without decimals. Immediately following the READ statement is a WRITE statement that is generally used only on small data files, as a verification that the data are being properly read. The WRITE statement is normally commented out when the program is run with data files of more than a few stations and months. Two commands are built into the READ: 1) if unrecognizable data are encountered, control goes to statement 350, and the program is stopped with a message indicating where the trouble occurred; 2) when an end of file is encountered control goes to statement no. 12 for setting flags and last month and year indicators. A check is made to compare the sum of hourly precipitation values with the daily total precipitation. A message announces the location of any inconsistencies.

TABLE 4. Variables Read in Each Hourly-Daily Precipitation Record

<u>Name</u>	<u>Dimension</u>	<u>Definition</u>
MSTATE	I2	Two digit climatic State number
NUM	I4	Four digit climatic Station number
MO	I2	Two digit Month number
DA	I2	Two digit Day number
YR	I2	Two digit Year number
IP	(24)I3	Three digit hourly Precipitation amount
IPD	I4	Four digit daily sum of 24-hour Precipitation

4.2.4 Secondary Initializations

After the first record in the data file is read, certain run parameters are set. Among these are determination of the season. Values are assigned to M1, M2 and M3, which represent the months of the season for which the data occur. The first year and month in the data set are also noted at this time (FYR and FMO). When the EOF is reached at the end of the data file, the last month and last year (LMO and LYR) are set. A number of other values are assigned in this section of the program that are used later in table headings, etc. Checks are made to detect instances of unknown accumulations

(-9) and missing data (-99) that may have been overlooked in the hand-editing process.

A maximum number of read cycles is established: MAXM. A guide to the value of this number is the number of stations times the number of months times 15. This assumes that on the average precipitation will occur on no more than half the days in each month. If greater frequency is likely, the above calculation should be appropriately increased. MAXM provides an emergency stop to the program should there be an inadvertent endless loop in the READ cycle. The value of MAXM is set or changed via EDITOR.

Except for day 1, only days with precipitation are included in the data file. Thus dry days must be inferred. There are three situations when dry periods longer than one day in duration may occur. The first is 'within-month', that is, when precipitation days are separated by one or more dry days. The procedures at statement no. 315 handle this situation. The other situations happen when the last period of precipitation ends more than one day before the end of the station-month, or if there should happen to be no precipitation during the month at a station. In these cases, the statements at no. 325 cause a count of dry days until JDAY exceeds NDMO, and control goes to month-end processing. There may be an event or storm to process before proceeding to treat the next record. The accumulation register for total hours in data, ITHRS, is incremented 24 hours at a time in the above routines.

To establish the number of dry days to be included within end-of-month periods following the last precipitation record, the elements, MM, in DATA statement MDAYS correspond to the number of days in each month plus one, (the last MM element, number 13, is for February of leap year). The variable JDAY is incremented each time a daily record is read or each time a dry day is added. At the end of each day's tally, NDMO is compared with JDAY. As long as JDAY is less, the program continues to process data one day at a time; when JDAY exceeds NDMO, control is passed to routines to perform end of station-month operations before proceeding to the next record processing.

As each daily precipitation record is read, the daily total precipitation is accumulated in GSIPD, the grand sum of regional precipitation. At the end of data processing, the sum of individual hourly amounts used, plus those not used, will be compared against this grand sum to guarantee that all the hourly precipitation data have been treated.

When a new year is encountered from the READ, variables MON(NN), IYR(NN), and Y are incremented or set. The arrays are used later in table headings, and Y provides the value for 'year' when assigning month-end periods to arrays.

4.2.5 Processing the 24-Hour Record

Each 24-hour record is processed, 1 hour at a time, in loop, DO 13D. Each hour is checked for missing data (-99), in case manual editing of the file created by NCCTAP failed to identify all such hours. The program is not stopped by the -99 indicator, but an error message is written identifying the location of such data. Each hour in the record is added to the total hour accumulation sum, ITHRS. If the tests of K (hour) and DA (day) indicate that the hour just encountered is the first hour of the first day of a station-month the following flags are set or incremented:

<u>Name</u>	<u>Definition</u>
NFD	Counter for number of station-months in the data
HR1 = 1	The first hour has a precipitation amount greater than zero
FP = 1	This is a first period for a station-month
FH = 1	This hour is a first hour for a station-month

Next, the value of IP(K) is determined to be either negative (error), zero (a dry hour), or positive (an hourly precipitation amount equal to the value of IP(K)/100). The handling of each of these possibilities is described below:

IP(K)<0:

- An accumulation period exists that was not detected in data file EDITING. A message is printed showing the data file location of the negative value.

IP(K)=0:

- Start a dry period duration, IDURD, count.
- If there is no unprocessed wet period, go to the next hour.
- If there is an unprocessed wet event, process it, but postpone event rate calculation.
- When event is processed, test to see if dry hour accumulation exceeds NDHR.
- If NDHR is exceeded and the unprocessed storm was a 'first period' storm, Section 4.2.6 describes the procedure for treating this situation. Otherwise the last storm is tested for maxima.
- Calculate the event rates.
- Call Subroutine STORM to process the storm.
- Proceed to the next hour; continue to add to IDURD until the dry period ends.

IP(K)>0:

- Increment wet hour accumulation counter, ITRHRS.
- Test for maximum hourly amount, MXIP.
- Set IFLAG indicating beginning or continuation of event.
- Start, or add to wet period duration count, IDURR.
- Start, or add to wet hour count for this event, IWETHR.
- Set event number within this storm, IV.
- If last dry period has not been processed, and if its duration is less than NDHR, the dry hours are added to IDURR as pseudo-wet hours. Accumulate the sum, IDH, of pseudo-wet hours in the storm, and in all the data, IDRY.
- If this should be a first wet period for a new station-month with first hour dry, assign the number of beginning dry hours to KD for later placement into a recoverable array.
- Add the hourly amount to the grand sum precipitation register, JPTOT.
- Add the hourly amount to the current storm amount accumulation register, ISTAM.
- Add the hourly amount to the current event amount accumulation register, IPEV.
- Reset the first hour flag, FH to zero.

- If there are no remaining untreated dry hours, go to the next hour. If there are remaining dry hours, process the dry period which has just ended.
- If the unprocessed dry period is a 'first period', the method of processing is described in Section 4.2.6. Otherwise test for maximum dry period duration, then process normally with Subroutine DRYPRD.
- Go to next hour.

After each 24-hour record has been processed, the following day end variables are set:

<u>Name</u>	<u>Definition</u>
LDA	The day (DA) of the record just finished.
LNUM	The station number (NUM) of the record just finished.
LASTATE	The state number (MSTATE) of the record just finished.
LM	The month (MO) of the record just finished.
LAYR	The year (YR) of the record just finished. In addition, the 24-hour record just processed is tested to see if it is the last day of the current station-month. If so, and if the last hour was wet, flag P24 is set to 1, and last-period-wet flag LP, is set to 2. If the last hour was dry, but the last period was wet, the flag LP, is set to 1.

If the last precipitation day was not the last day of the month, the next record is read to determine if there are more precipitation days for this station-month or if there are only dry days to the end of the month. This will be determined by whether DA as read is 1, indicating a new station-month, or if DA is some number greater than the day just processed, LDA. If the latter, the program adds dry hours (24 per dry day) until the next record

day is reached. Then control passes to loop DO 130 again for hourly processing. If the newly read DA equals 1 (signifying a new station-month), and if there are dry days at the end of the old station-month, the program adds dry hours at 24 per day until the end of the current month is reached (see Section 4.2.4). Before proceeding with a new station-month, any unprocessed periods in the old month must be treated. Whether wet or dry, if they are from the month-end period, they are processed with the routines described in Section 4.2.6. Otherwise, they are processed normally using Subroutine STORM or DRYPRD.

After all end period processing for a station-month has taken place, control goes to statement no. 5 ahead of the READ to initialize certain variables in preparation for a new station-month. Recall that the new record for Day 1 has already been read. When DA equals 1, the program skips over the READ and proceeds to process the first 24 hours of this first day of the new station-month before reading another record.

After all the data have been read and processed, an end-of- file is encountered on READ, and control passes to statement no. 12 where the state number is set to 99 to indicate that the EOF has been reached. The last month, last year and last state number are also identified at this point. Any last dry hours (or days) remaining in the last station-month are added in to the last period, or if the last period was a storm that has been processed, then control is passed to the program section which recovers month-beginning and -end periods (see 4.2.8).

4.2.6 Treatment of Incomplete Periods

The first period and last period of each station-month are incomplete periods. Recall that the data file is arranged by year, seasonal month, state, and station. Thus, each storm or dry period is processed as it is encountered, and treated as a regional event independent of time or precise location. The original version of WETDRY made no distinction between storm and dry periods that occurred within a month from those that began or ended a month. End periods so treated have a high probability of being incomplete periods. In the statistical analyses, inclusion of these incomplete periods

introduces a bias toward greater frequency of shorter duration storms and dry periods. To combat this problem, the next version of WETDRY dropped all end periods from the analyses. This, of course, biased the analyses to some extent since not all the data were being used. Another difficulty in using this approach at PNL stems from our rather limited data base of only about 30 months. In order to make maximum use of the PNL data base and to reduce bias in the analyses caused by the above reasons, Version 7 of Program WETDRY was developed.

This version identifies monthly beginning and ending periods, and if they continue from the proceeding month or continue into the following month they are assigned to arrays for recovery and pairing later. In a season for which 3 months of data are present, four of the six month-end periods for each station can normally be paired and recovered later. However, the first period of the first seasonal month, and the last period of the last seasonal month are never available for analysis, but hours from such periods are accounted for in the total hour audit. If a season is incomplete, but two consecutive months are present, then only two of the six end-periods can be included for analyses. A season with only one month or with the central month missing will have all its end-period data consigned to the unused data registers. The routines for treating 'first' periods are quite similar to those treating 'last' periods. Detailed description of the procedure will be limited then to 'first' periods, with appropriate comments describing any differences used in treating the 'last periods'.

Before any precipitation data are read or analyzed, user input informs the program of the completeness of the seasons making up the data file. The code and rationale are described in Section 4.4.1. Briefly, there are code numbers, MMF (one for each year that is represented in the seasonal data file), which are used to inform the program of the completeness of the seasonal data for each year. The coded values of MMF have the following meanings:

MMF(KYR) = 0	All three months of the season are present in the yearly data.
--------------	--

MMF(KYR) = 1 Month 1 of the season is missing for KYR.
 MMF(KYR) = 2 Month 3 of the season is missing for KYR.
 MMF(KYR) = 3 Month 2 is missing, or there are data for only one
 month of the season for this KYR.
 MMF(KYR) = 9 There are no seasonal data for this KYR.

A more detailed description of this coding procedure is found in Section 4.4.1.

After the first 24-hour record is read for each station-month, enough information is available for the program to determine whether the first period is wet or dry. Consider the situation of the first period for a station-month being 'wet', i.e. a storm. In this case, the procedures in loop DO 130 will have set flag FP = 1, indicating that a first period is in progress. If the first hour of this period has a measurable amount of precipitation, flag HR1 will be greater than zero. These flags will be sufficient to lead control to the 'First Period Wet' routine, which does the following:

- Determines the station sequence number, I, and assigns that number to the first dimension in the 'First Period Wet' array.
- Tests for seasonal month. If it is the first seasonal month, control skips to the unusable data section as the first period of the first month cannot be paired.
- Tests for WINTER season. If it is WINTER, and Month-1 is December, set year number, Y, to YY (for previous year). This will accomodate the year break that is present in WINTER.
- Test for completeness of season as coded by MMF (of Y or YY).
- If the period in question can be paired later, its duration is assigned to variable FPW(NW, Y, MO) where NW = station sequence no., Y = year, MO = month.
- If the first hour of the period was wet, then calculation of the first event rate is postponed untill recovery (since the last hours of the other leg of the period may also be wet).

- If the first hours of the period were dry (but fewer than NDHR), these hours are placed in array KFD because, at this stage, it is unknown whether they will form part of a dry or a wet period.
- Event rates are calculated for all events except in the case of the first event described above.
- The sum of the event rates is assigned to XRATF (NW, Y, MO)
- The storm amount is assigned to ISTAMF (NW, Y, MO).
- The sum of pseudo-wet hours (dry hours less than NDHR) is put in IDHF (NW, Y, MO).
- If the period cannot be paired for any reason, then the above values for number of wet hours, dry hours that would have been allowed to count as wet, and the amount of precipitation in the period are assigned to:

MWH Missing Wet Hours

MDH Missing Pseudo-wet Hours

MP Missing Storm Precipitation Amount,

and the following Grand Sums are reduced by the appropriate amounts:

ITRHS-NUMWET Grand Sum of Wet Hours by wet hours in
this storm.

IDRY-IDH Grand Sum of Pseudo-wet hours by pseudo-wet
hours in this storm.

JPTOT-ISTAM Grand Sum of precipitation by this storm
amount.

Treating a 'Last Period Wet' is very similar. However, in that case it is the last period in Month 3 of a complete season that cannot be paired.

The routine for treating first and last dry periods is considerably shorter since duration is the only parameter used. For a 'First Period Dry', the procedure is:

- The station sequence number, I, is found and assigned to array index ND.
- Test for seasonal month. If month equals M1, control skips to the unusable data section.

- Test for WINTER season. If season is WINTER, the single code for MMF(KYR) cannot represent KYR for both December and the following January. Thus, for WINTER seasons, if December is missing, set YY = Y-1. Otherwise, using the year, Y, as read for January or February will, in such cases, result in choosing the wrong MMF(KYR) code.
- Depending on season completeness code, MMF(Y or YY), either assign the duration of the dry period, IDURD, to array FPD(ND, Y, MO) for recovery, or if it cannot be recovered, the dry hours are added to MDH, (Missing Dry Hours).

The routine for 'Last Period Dry' is essentially identical except as noted in a previous paragraph: it is the last period in Month 3 that is not recoverable, rather than the first period of Month 1.

4.2.7 Recovery of Incomplete Periods

In the previous section, we have described how storms and dry periods that occur at the beginning and end of each station-month may be periods that can be paired with their respective previous or continuing portion. All the pertinent parameters have been retained in arrays identifiable by station sequence number, year number, and month. For convenience, the following abbreviations will be used to identify the respective periods:

FPW	First period wet
FPD	First period dry
LPW	Last period wet
LPD	Last period dry

Should the program be run with only a single month's data, array index NN will be less than 2. Such a value will cause the program to skip the end-period recovery section. This will reduce run time. Normally the flag, NOWET is set to 1, signifying that recovery of both wet and dry end periods is desired. If NOWET = 0 (changed in EDITOR), the program recovers dry periods only. Data may consist of reports from a very dry region, and the very rare wet end period may not justify the extra run time required to examine each station-year for possible beginning and ending wet periods. The procedures dealing with storm parameters are considerably more time consuming

and complex than those dealing with dry periods. The recovery of wet periods will be discussed first.

Wet periods that span months fall into five cases or types. These types cannot always be identified at the assignment stage, so are identified and treated in the recovery process. Recall that NDHR is the number of dry hours allowed within a storm. The five cases and a brief description of each follows:

CASE 1: The number of dry hours separating LPW and FPW is greater than NDHR. Process as two separate storms and assign the intervening dry period to an array for later recovery.

CASE 2: The number of dry hours separating LPW and FPW is less than NDHR. Either the last hour of the LPW is wet or the first hour of the FPW is wet, but not both. Because the last (or first) hour is wet, there is one event rate yet to be calculated in this case because when it was assigned to the array it was not yet known whether the situation would be a CASE 2 or CASE 4.

CASE 3: Either the LPW or the FPW is actually followed or preceded by a FPD or LPD. Dry hours less than or equal to NDHR that formed the end or beginning of the LPW or FPW are assigned to an array for addition later to the proper FPD or LPD.

CASE 4: Both LPW and FPW are continuous wet periods. The number of events in the combined periods will be 1 less than that shown by the assigned arrays. A new event rate must be calculated for the event formed by the coupling of LPW and FPW.

CASE 5: Quite similar to CASE 2 in that the period following the LPW or the period preceding the FPW was dry. However, the last hour of the LPW or the first hour of the FPW is always wet. Earlier in the program this situation caused the calculation of the event rate to be postponed. The event rate calculation is made at this point in the program.

The end-period recovery routine is contained in loop DO 600, which examines each station for each year of data for any LPW or FPW periods. If

MMF(KYR) indicates there were no months having recoverable data for the year in question, control skips to the next year or station. But if the value of MMF(KYR) is less than 3, there is a possibility of recoverable wet periods. An inner loop, DO 680 performs the necessary steps to identify periods that can be paired, combines the matching parameters after the proper case has been determined, and puts the arrayed data into non-array arguments. Sub-routine STORM is then called to process the period. Storms formed by pairing are also tested for maxima of duration and amount.

The first test within loop DO 680 determines whether the season for the current year is complete or not by examining MMF(KYR). KYR in this loop is denoted by II. If the season-year under examination is complete, there will be two passes through the loop. If there is only one set of consecutive months for the season being examined, the flag J0 is set to 2 and only 1 pass through the loop will occur. In the arrays, station-sequence number is N; year number is either Indices IX or IY; month is either MX or MY. If the season is WINTER and if it is complete, or if December and January are present, the first pair of coupled periods involve two different years. IX and IY must be adjusted for this situation, and a series of decisions at the beginning of loop 680 sets the values for IX and IY and transfers control to the appropriate set of consecutive months; i.e., MX and MY equal M1 and M2 for pairing of the first months of a season, but equal M2 and M3 for the pairing of periods from the last months of a season.

Once the proper values for IX, IY, MX, MY are assigned, program steps follow that determine the Case type from the arrays to be paired. The first test sums the appropriate LPW and FPW. If the sum is zero, then there were no wet beginning and ending periods; i.e., those particular last and first periods were dry and the pairing of LPD and FPD will take place in the Dry Period Recovery routine. If the sum is greater than zero, at least one of the periods was wet. The program then proceeds to determine which leg was the wet one (or whether they were both wet) by testing the difference between LF and FF. If both were wet, a sum, KDO, of the dry hours at the end of the LPW and at the beginning of the FPW is formed. The value of KOD determines the following cases:

<u>KDD</u>	<u>Meaning</u>
> NDHR	Two storms separated by a dry period. CASE 1.
< NDHR but > 0	A continuing wet period with dry hours at the month break. CASE 2 or 5.
= 0	Precipitation continues through the month break. CASE 4.

If only one leg is wet as determined by the difference, LF-FF being not equal to zero, control skips over the KDD determination and, using flag KL or KF, determines whether the last or first hour was wet. If either is wet, treatment is assigned to CASE 2 or 5 routine. If neither is wet, a CASE 3 situation is indicated, and control skips to that part of the recovery routine.

The pairing of wet periods and the processing of the storms thus formed is quite similar in all cases. Differences are due to the number and position of any dry hours that occur in the paired periods. If the sum of consecutive dry hours is less than, or equal to NDHR, then those hours are included within the storm. If the sum of such hours is greater than NDHR, the hours are assigned to arrays which will be used in the Dry Period Recovery section. When the storm segments have been combined from the appropriate arrays, the values are put into nondimensioned arguments for Subroutine STORM, which is then called for processing the storm.

The recovery of paired dry periods LPD and FPD takes place in DO Loop 183. Since duration is the only dry period parameter considered, the process is considerably shorter than for the storm periods. The basic procedure is similar, however, and the following steps are taken:

1. Test MMF(KYR) for season completeness. The MMF code determines which, if any, end periods can be processed.
2. Test for WINTER season. If WINTER, make the appropriate adjustment for year break in values of IX and IY.
3. Depending on value of MMF(KYR), process both periods if MMF = 0, or only one period if MMF is greater than zero.
4. Assign the arrays containing LPD and FPD to nondimensioned arguments for Subroutine DRYPRD, test for maximum duration, then call the subroutine to process the dry period.

Descriptions of Subroutine MXIMA, DRYPRD and STORM are found in Section 4.3.

4.2.8 Normal Termination

Once the recovery and processing of the month spanning wet and dry periods is complete, program WETDRY proceeds to the analysis section. This section produces lists of sums, averages, and extremes, followed by the frequency distribution tables of dry period duration and storm characteristics. This output is described in Section 4.5.

4.3 SUBROUTINES USED IN PROGRAM WETDRY

4.3.1 Subroutine MXIMA

As each hourly precipitation amount is processed, it is compared to the previous maximum encountered. Each new value of storm duration, IDURR; calculated event rate, IRATEV; storm precipitation amount, ISTAM; and duration of dry period, IDURD; is also compared with previous high values, and is established as new maxima if old values are exceeded. The final maximum values are printed out in Output Table 1.

4.3.2 Subroutine DRYPRD

Each time a dry period terminates as the hourly data from the input file are being processed, or each time a dry period is recovered from end periods being paired in the recovery routine, the dry period is processed by a call to Subroutine DRYPRD. Subroutine DRYPRD also keeps accumulating sums of the number of dry periods in the assigned class interval, ISUMD(J), and of the number of dry hours in that class, IDHR(J). In addition, the grand sums of the number of dry periods, NMDP, and of dry hours in the data, ITDHRS, are incremented by the appropriate amount. The dry period duration counter, IDURD, is then cleared in preparation for the next dry period.

4.3.3 Subroutine STORM

Each time a storm period ends, Subroutine STORM is called to process the period. This subroutine performs the following actions on the storm data:

- Accumulates a total sum of all the precipitation events in the data, NEVENT.

- Accumulates a total sum of all the event rates calculated, TOTRAT.
- Accumulates a total sum of all the storms processed, SSUM.
- Accumulates a total sum of all storm precipitation amounts, JGRSUM.
- Assigns the storm to its proper frequency class L.
- Accumulates a sum of all storms assigned to class L, NSTM(L).
- Accumulates a sum of all the precipitation occurring in class L storms, TSTAM(L).
- Accumulates a sum of all the events occurring in storms of class L, NEV(L).
- Accumulates a sum of all the wet hours in storms of class L, ITWHR(L).
- Accumulates a sum of all the hours in storms of class L, ITOUR(L).
- Accumulates a sum of all the pseudo-wet hours in storms of class L, ISSDH(L).
- Clears the storm and event counters in preparation for the next wet hour when events or storms have ended.

4.4 INPUT TO WETDRY

4.4.1 Program Control Input

There are four lines of user input, near the beginning of the program, that provide file names and variable values which control program operation. The program request for input, and a description of the responses follow:

1. 'NAME OF INPUT DATA FILE' Response: The program is asking for the name of the hourly precipitation data file that has been created by program NCCTAP. This file must have been checked and edited by the user to eliminate by change, correction, or substitution, all values of -9 or -99 that may have appeared in the file when it was initially created from the NCDC data.
2. 'NAME OF OUTPUT DATA FILE' Response: The user inputs the name of the file to which the output data is to be written. After the program has run, the user makes the appropriate keyboard command to have the output file printed.

3. 'ENTER VALUES FOR NO. OF DRYHOURS AND NO. OF STATIONS' Response: NDHR is the variable name for the continuous number of dry hours the user will allow to occur within a continuing storm. In storm analyses it is usually desirable that each precipitation event not be considered a total storm. Frequently, precipitation periods may be separated by dry periods of only 1 or 2 hours duration. If these dry hours are to be considered part of a single storm, the user must limit their length to be in harmony with the data, and the desired analyses. For the north-east United States in SUMMER and AUTUMN, one dry hour may be an acceptable in-storm dry period. It may be acceptable to allow 2 to 6 dry hours within WINTER and SPRING storms.

NX is the number of stations that will occur in the input file. This number must equal the number of elements, LL, in the data statement, DATA(NS(LL)).

4. 'ENTER FIRST AND LAST DATA YEARS AND KYR CODES FOR EACH YEAR' Response: The number of the first year in the data, NFYR, is always 1. The number of the last year in the data, NLYR, is determined chronologically from the first year, even if there is a break in the continuity of years for which there are data. For example, if the input data file has data for 1977, 1978, 1980, and 1981, NFYR = 1, representing 1977, and NLYR = 5, representing 1981. The KYR code, which is explained below, makes it possible to inform program WETDRY that there will be no data for 1979, but it must be included as year 4, nevertheless.

Within the program, normalized year numbers are calculated by subtracting a 'base year' from the value of year (YR), as read from the input file. This base year is built into our current version of the program, and is the last calendar year (last two digits only) preceding the first data year. For example, the PNL data base is made up of months from 1977(77), 1978(78), 1979(79), and 1980(80). The base year then, is defined as 1976(76). Subtracting the base year from the above data years, will thus assign year numbers 1, 2, 3 and 4 to the PNL data. If the program is to be used in situations where data years are quite

variable, it is a simple matter to make EDIT changes in the program to include the base year among the user input parameters.

In addition to the input of NFYR and NLYR, the user must type in a KYR number code, which informs the program of the completeness status of each of the season-years in the data (see 4.2.6). The storage and recovery of month-end and month-beginning periods is controlled by the completeness of the season for any data-year. If the season is incomplete, (or entirely missing), then it becomes necessary to indicate which month(s), or year(s), are missing. The user manually inputs a code number for each season-year within the period NFYR-NLYR, at the same time that the entries are made for NFYR and NLYR. The rules for determining the value of the code numbers, MMF(KYR), are listed in Table 5.

TABLE 5. Rules for Determining Value of Season Completeness Code, MMF(KYR)

<u>Status of Season</u>	<u>MMF(KYR)</u>
All 3 months available	0
Month 1 missing	1
Month 3 missing	2
Month 2 missing; or Months 1 & 3 missing; or Months 1 & 2 missing; or Months 2 & 3 missing	3
Entire season missing	9

For example:

<u>Available Data</u>	<u>Season</u>	<u>MMF(KYR) CODE</u>
Mar 78 Apr 78 May 78	SPRING	0
Jan 79 Feb 79	WINTER	1
Dec 77 Jan 78	WINTER	2
Aug 80	SUMMER	3

The user input then, for the command, 'ENTER FIRST and LAST DATA YEARS AND KYR CODES FOR MISSING SEASON-MONTHS PER YEAR', is composed of two numbers separated by a space, for NFYR and NLYR, followed by KYR code numbers separated by spaces, one number for each season of data.

An example of complete responses to Entry #4 are shown below. Consider an AUTUMN data file composed of the following monthly data:

<u>Season</u>			<u>Year No.</u>	<u>MMF(KYR)CODE</u>
Sep 78	Oct 78	Nov 78	1	0 (3 month season complete)
Sep 79	Oct 79		2	2 (month #3 is missing)
Sep 80		Nov 80	3	3 (month #2 is missing)

The user reply to the input request would be: 1 3 0 2 3, where 1 and 3 are values for NFYR and NLYR, and values for MMF(KYR), KYR = 1, 3, are 0 2 3.

As another example, a WINTER file might contain the following months:

<u>Season</u>			<u>Year No.</u>	<u>MMF(KYR)CODE</u>
	Jan 78	Feb 78	1	1 (month 1 missing)
Dec 78	Jan 79	Feb 79	2	0 (season complete)
	no data		3	9 (entire season missing)
Dec 80	Jan 81	Feb 81	4	0 (season complete)

The input entry for the above situation would be: 1 4 1 0 9 0.

The code numbers for MMF(KYR) refer to the year corresponding to the first month in a season, regardless whether that month has input data or not. Confusion may arise with season WINTER. There, December will be of one year, while January and/or February will be for the subsequent year. To restate the rule for coding MMF(KYR) for WINTER: MMF(KYR) is coded to correspond to the year representing December, regardless of whether there is data for December. For the other three seasons, MMF(KYR) represents the year in which March, June or September occur. Since there is no 'year break' in these seasons, coding is self-explanatory.

4.4.2 Hourly Precipitation Data File

The hourly precipitation data file has been prepared by program NCCTAP and then checked for anomalous data by visual inspection. Proper changes have been made manually via EDITOR, and the individual monthly files have been combined to form a seasonal file for the region of interest. The name of this data file is entered from the keyboard, or through a command file, when the program asks for NAME OF INPUT DATA FILE. Since this data file may

be a large one, it may be desirable to copy it to tape if there will be lengthy intervals between runs of WETDRY.

4.5 OUTPUT FROM WETDRY

4.5.1 Output Table 1: Average Values and Maxima

Output Table 1 (see Appendix B) is a 'one liner', that contains the following information:

- Last State, Station, Year, and Month encountered in the data file.
- Average storm precipitation rate (inches per hour).
- Average storm duration, and average dry period duration.
- Total number of storms, and total number of dry periods processed.
- Grand total of regional precipitation from processed storms (inches).
- Grand sums of wet hours, of dry hours, and of pseudo-wet hours.
- Grand sum of all event rates in the processed storms (inches/hour).
- Grand sum of all events in processed storms.
- The average event rate for all events from processed storms (inches/hour).

4.5.2 List of Sums and Checks

Immediately following the Table 1 output, is a list of maximum values of the following storm and dry period characteristics:

- Maximum hourly precipitation amount.
- Maximum storm duration.
- Maximum event rate.
- Maximum storm amount.
- Maximum dry period duration.

Next, a list containing sums and counts of various parameters that constitute an internal audit of program operation, is printed. These counts provide Quality Assurance checks of the reliability of the program operation, and also are a valuable aid in diagnosing problems resulting from program changes that may temporarily produce unexpected output. These checks include 1) sums of the total regional precipitation, determined by three different

procedures within the program, and 2) the grand sum of hours in the data, compared with a sum composed of the hours assigned to various categories. Disagreements in these comparisons indicate flaws in the program operation, in the data, or both, and must be reconciled before analysis runs are accepted as valid.

The last list on the page containing Table 1 is a summary of actions occurring within the routines that recover the month-end and -beginning dry and wet periods. They include:

1. The number of dry hours, MDH, in first and last periods that are excluded from the analyses.
2. The number of dry hours, NRDH, recovered from paired first and last periods.
3. The distribution, by Case type, of the number of recovered storms.
4. The number of recovered dry periods.

4.5.3 Output Table 2: Frequency Distribution of Dry Periods

Output Table 2 displays the frequency distribution of dry periods by class intervals of 20 hours. This class interval is arbitrary. It may be made smaller or larger by EDIT changes of the appropriate DATA statement elements of IDPX(KK), and the corresponding dimensions for IDPX.

Column 1 of the output table lists the sequential number of the frequency class. The second column defines the class interval by hours, column 3 is the frequency for each class, and column 4 is the percent frequency of each class. Column 5 represents a 3-point running average percent frequency for each class.

4.5.4 Output Table 3: Frequency Distribution of Storm Periods

This table provides the frequency of storms by a class interval of 1 hour. Other storm and event statistics are shown for each of the class intervals as well. Table 6 lists the information printed in Output Table 3, and a brief description of the variables.

The six column totals in Output Table 3 are used as checks of data utilization, and possible program idiosyncracies. Following Table 3, is a

short list of sums and calculated values. These too, provide checks on certain of the sums and averages calculated by different procedures. A final line shows the number of dry hours allowed to occur within a storm.

TABLE 6. Description of Output Table 3

<u>Column Heading</u>	<u>Description</u>
STORM LENGTH	The frequency class. Also, the storm duration in hours.
CUMPCT(J)	The cumulative percent of the number of storms in each class.
NSTM(J)	The number of storms in each class.
TSTAM(J)	The total precipitation from all storms in each class.
AVPPS(J)	Average precipitation amount in each storm of class J.
FRTOT(J)	The fraction of the total regional precipitation from storms in class J.
AV3PT(J)	A 3-point smoothed average of FRTOT.
NEV(J)	The total number of events in each storm class.
AVEVS(J)	The average number of events in storms of class J.
CUMFR(J)	The cumulative fraction of total regional precipitation from each storm class. Expressed as a percentage.
ITWHR(J)	The total number of wet hours in all storms of class J.
GAVHR(J)	The average number of hours in all events from storms of class J.
AVPPE(J)	The average hourly precipitation rate for each event occurring in storms of class J.
AVSTRT(J)	The average hourly precipitation rate for storms of class J.

4.6 DIAGNOSTIC MESSAGES FROM WETDRY

4.6.1 Non-Critical Messages

To check the accuracy of changes made manually in the hourly precipitation data file, the sum of the 24 hourly precipitation values, IP(K), for each day of record, is compared with the daily sum of precipitation, IPD. If there is disagreement, the following message is printed out: INCONSISTENT PRECIP SUM AT (state #, station #, month, day, year)

Should an hourly precipitation value of -99 (missing data) slip through the manual editing process, WETDRY will indicate the occurrence with: -99 ENCOUNTERED AT (state #, station #) ON (month, day, year) HR

The above statements do not signal termination of the program, but do identify data records which need to be corrected.

4.6.2 Messages Accompanying Abnormal Program Termination

Errors, or certain anomalies in the data, and excessive counts or cycles of some operations in a program run, will cause termination of the run, and a diagnostic statement indicating the nature of the problem. The diagnostic statements and their meaning are listed below:

1. 'NEG VALUE OF (DA-1) AT'.

If the variable read for day, DA, is zero, the program stops, and the location of the erroneous value is given (state, station, month, day, year). The data file must be corrected before trying the run again.

2. '(DA-LDA) = 0. LDA = 'value' 'AT' (month, day, year, state, station number).

If the day number should be duplicated for a station-month, the program will stop with the location of the occurrence given. The data file must be corrected.

3. 'ABNORMAL VALUE OF IDURR. IDURR =' (value).

The program is set to stop if a storm exceeds "nnn" hours. Any desired limit, nnn, can be set through EDITOR.

4. 'AFTER () PASSES NUM (OR LNUM) FAILED TO FIND A MATCH AT DD 212, 241, 222, OR 231. STOP'

The four loops indicated are the ones which locate the station sequence number when assigning LPW, FPW, LPD or FPD to arrays. If a station number other than that shown in the DATA list is encountered, the program terminates, and the questionable station numbers are printed out. Check the data file for duplicated or spurious station numbers. Correct if necessary.

5. 'ERROR ENCOUNTERED IN READ, OR M COUNT EXCEEDED AT (). M = '.

If unrecognizable data are encountered as a record is being read, control is passed to this statement, and the location is printed out. M is a counter for controlling the number of passes through the READ statement. The limiting values for M and MAXM are assigned through EDITOR (see 4.2.4).

6. 'TOO MANY DAYS WITH MISSING DAILY TOTALS. STOP'.

A daily sum of precipitation IPD, is read with each record. If the number of missing daily sums exceeds 100, (the user can change the limit through EDIT) the program terminates.

5.0 REFERENCES

The MAP3S/RAINE Research Community. 1982. "The MAP3S/RAINE Precipitation Chemistry Network: Statistical Overview for the Period 1976-1980." Atmos. Environ. 16:1603-1631.

Scott, B. C. 1982. "Predictions of In-Cloud Conversion Rates of SO_2 to SO_4 ". Atmos. Environ. 16:1735-1752.

U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Environmental Data Service. National Climatic Data Center (NCDC). 1960. TD-9657 Hourly Precipitation. Available from the National Climatic Data Center, Asheville, North Carolina.

APPENDIX A

PROGRAM LISTINGS

```

C PROGRAM NCCTAP, VAX VERSION, JANUARY 1984.
C ***** THIS PROGRAM READS ORIGINAL CODED STATION-FILE HOURLY PRECIP-
C ITATION DATA, PERFORMS PRELIMINARY ERROR CHECKING, DECODES
C THE DATA, WRITES IT TO DISK FILE AND PRINTS A COPY OF WHAT
C HAS BEEN WRITTEN TO FILE.
C
C THE PROGRAM MAY STOP IN ONE OF THREE WAYS ---
C 1) AFTER FINISHING THE PROCESSING OF THE LAST STATE DESIRED
C 2) AFTER REACHING THE END OF AVAILABLE DATA (ENDS IN NEXTAP)
C 3) IF THE NUMBER OF BAD RECORDS EXCEEDS 200 (ENDS IN READ3)
C
C A YEAR'S WORTH OF ORIGINAL DATA FROM THE ENTIRE U. S. MAY BE
C WRITTEN ON AS MANY AS FIVE TAPE VOLUMES. TO FACILITATE
C HANDLING OF THIS MUCH DATA, EACH VOLUME SHOULD HAVE BEEN
C WRITTEN AS A SEPARATE FILE. WHEN READING THE CONSECUTIVE
C FILES, EACH TIME AN END-OF-FILE IS FOUND, READING BEGINS WITH
C THE NEXT FILE (THE NEXT VOLUME). THE TAPES SHOULD BE STAGED
C ON CONSECUTIVE UNITS, THE FIRST OF WHICH WILL BE SPECIFIED
C AS LU IN THE INPUT.
C
C EXTERNAL ERR
C COMMON/ERROR/KB
C IPR= A 3 CHARACTER CODED PCPN AMOUNT
C LPR = A 13 CHARACTER VRBL TO COMPARE WITH IPR TO CONVERT A MINUS
C A BLANK OR A PLUS FROM THE ORIGINAL TAPE TO CODES FOR
C MISSING DATA, TRACE TO ZERO OR TO AMOUNT OF PCPN
C LPR= TEN DIGITS, A MINUS, A BLANK, AND A PLUS
C IP= HOURLY PCPN AMOUNT IN INCHES X 100
C NSTT= A 2 DIGIT STATE NUMBER (RANGES FROM 01 TO 50)
C IPRD= A 4 CHARACTER CODED 24 HOUR PCPN TOTAL
C NSTN= THE REQUESTED NUMBER OF STATIONS FOR DATA IN ANY STATE
C
C DIMENSION IPR(24,3),LPR(14),IP(24),II(3),NSTT(50)
C DIMENSION IPRD(4),IDAT(366),IPK(366,6)
C DIMENSION IRAY(6)
C DIMENSION NSTN(50,50)
C CHARACTER*80 INFILE
C DATA (LPR(I),I=1,13)/1H0,1H1,1H2,1H3,1H4,1H5,1H6,1H7,1H8,1H9,1H-,
C 11H,1H+/
C ***** INITIALIZE IRAY FOR SYSTEMC
C SYSTEMC IS A SYSTEM ROUTINE USED FOR USER-DIRECTED ERROR PRO-
C CESSING. (IN THIS CASE, IT IS CALLED IF THERE IS 'ILLEGAL
C DATA IN FIELD' IN THE RECORD BEING READ.) THE RECORD IS
C PRINTED OUT AND EXECUTION CONTINUES WITH THE RECORD BEING
C TREATED AS MISSING DATA.
C THE CYBER SYSTEMC SUBROUTINE AND IPAY{} STATEMENTS HAVE BEEN COMMENTED
C IRAY(1)=0
C IRAY(2)=1
C IRAY(3)=1
C IRAY(4)=100
C IRAY(5)=LOC(ERR)
C IRAY(6)=20
C CALL SYSTEMC(78,IRAY)
C ***** INITIALIZATION
C KB = BAD RECORD FLAG (SET BY SYSTEMC CALL TO ERR)
C NTD = NUMBER OF TOTAL DAYS PER STATION
C NUM = CURRENT STATION NUMBER
C NSTATE = NUMBER OF THE STATE JUST READ
C IFLAG = FLAG WHICH IS SET TO 1 IF 'ACCUMULATED' HOURLY

```

```

      NDPS=0
      NST=MSTATE*10000+NUMB
30 IF(MSTATE.GT.NST(NS)) GO TO 80
C      IF READ A NEW STATE, THEN PROCESS THE OLD STATE
C ***** IF STATION READ IS NOT DESIRED STATION READ ANOTHER RECORD
      IF(IJK.EQ.1) GO TO 65
      IF(NUM.NE.NUMB) GO TO 70
C      IF READ A NEW STATION, THEN PROCESS THE OLD ONE
      NDPS=NDPS+1
      NTD=NTD+1
      ISUM=0
      MI=0
C
C ***** PROCESS THE DAY'S DATA
      DO 50 I=1,24
      IF(IPR(I,1).NE.LPR(12)) GO TO 37
      IP(I)=-99
      MI=1
      GO TO 50
37 IF(IPR(I,1).NE.LPR(11)) GO TO 39
      IP(I)=0
      GO TO 50
39 IF(IPR(I,2).NE.LPR(11)) GO TO 41
      FOR ACCUMULATED AMOUNTS, THE FIRST ACTUAL DATA WILL REPRESENT THE
C      ACCUMULATION FOR MORE THAN ONE HOUR. THIS WILL BE INDICATED
C      BY A NEGATIVE TOTAL.
      IFLAG=1
      IP(I)=-9
      MI=1
      GO TO 50
41 DO 47 J=1,2
      DO 43 K=1,10
      IF(IPR(I,J).EQ.LPR(K)) GO TO 45
43 CONTINUE
45 II(J)=K-1
47 CONTINUE
      IP(I)=IPR(I,3)+II(2)*10+II(1)*100
      ISUM=ISUM+IP(I)
      IF(IFLAG.NE.1) GO TO 50
      IFLAG=0
50 CONTINUE
C
C ***** DECODE THE DAILY PRECIPITATION TOTAL.
      CALL UNPK4(IPRD,LPR,IPD)
      IF(MI.NE.0) GO TO 55
      IF (ISUM.EQ.IPD) GO TO 55
      PRINT 51
51 FORMAT(' INCONSISTANT PRECIP SUM')
      PRINT 58,MSTATE,NUMB,IMD,IDA,IYR,(IP(I),I=1,24),IPD
      IF (IPD.LT.0) PRINT 52
52 FORMAT('          DAILY TOTAL MISSING, HOURLY VALUES CONSIDERED VA
1LID')
      IF (IPD.LT.0) GO TO 55
      DO 53 I=1,24
53 IP(I)=-99
      PRINT 54
54 FORMAT('          THESE DATA WILL BE CONSIDERED MISSING')

```

```

C          VALUE IS EXPECTED
C          NSPS = NUMBER OF STATIONS PER STATE
C          NDPS = NUMBER OF PRECIP DAYS PER STATION
      KB=0
      NTD=0
      NUM=0
      MSTATE=0
      IFLAG=0
      NSPS=0
      NDPS=0
C ***** INPUT DATA ---
C          NSTA = NUMBER OF STATES
C          KPR = PRINT CONTROL (0=NO,1=YES)
C          LU FIRST INPUT TAPE UNIT NUMBER
C          LLU = LAST INPUT TAPE UNIT NUMBER
C          NSTT = ARRAY OF STATE NUMBERS OF STATES WHOSE DATA IS TO BE
C                  OBTAINED
C ***** NSTN = ARRAY OF STATION NUMBERS WHOSE DATA IS TO BE READ
      TYPE 2345
2345  FORMAT(' Name of input file ? ',3)
      ACCEPT 2346, INFILE
2346  FORMAT(A)
      OPEN( UNIT=7, NAME='DATA48.DAT', FORM='FORMATTED',
1      TYPE='OLD', READONLY )
      OPEN( UNIT=2, NAME=INFILE, FORM='FORMATTED',
1      TYPE='OLD', READONLY )
      OPEN( UNIT=3, NAME='DATA3.DAT', FORM='FORMATTED',
1      TYPE='NEW' )
      READ(7,5) NSTA,KPR,LU,LLU
5  FORMAT(4I5)
      PRINT 6,NSTA,KPR,LU,LLU
6  FORMAT(1X,4I5)
      DO 9 I=1,NSTA
      READ(7,7) NSTT(I),NSD,(NSTN(I,J),J=1,NSD)
7  FORMAT(I2,I3,15I5/16I5/16I5)
      PRINT8, NSTT(I),NSD,(NSTN(I,J),J=1,NSD)
8  FORMAT(1X,I2,2X,I3,2X,15I5/1X,9X,15I5/1X,9X,15I5)
9  CONTINUE
10 CONTINUE
C
C ***** LOOP THROUGH EACH DESIRED STATE
      DO 100 NS = 1,NSTA
      FIND NEXT STATE
12  MDIFF=MSTATE-NSTT(NS)
      IF(MDIFF)14,20,17
14  CALL READ3(MSTATE,NUMB,IYR,IMO,IDA,IPR,IPRD,NSTN,LU,LLU,IJK,NSTT,
2  NS)
      GO TO 12
C
C ***** STATE READ IS BEYOND DESIRED STATE
17  PRINT 18,NSTT(NS)
18  FORMAT(' MISSING STATE IN SOURCE DATA, STATE NO.',I3)
      GO TO 100
C
C ***** INITIALIZE FOR NEW STATE
20  NUM=NUMB
      NSPS=NSPS+1

```

```

55 IF (KPR,EQ,0) GO TO 60
   WRITE(3,56) MSTATE,NUMB,IMO,IDA,IYR,(IP(I),I=1,24),IPD
56   FORMAT(I2,I4,3I2,24I3,I4)
   PRINT 58,MSTATE,NUMB,IMO,IDA,IYR,(IP(I),I=1,24),IPD
58   FORMAT(1X,I2,3X,I4,3X,I2,3X,I2,2X,I2,3X,25I4)
60   IDATE = IYR*10000+IMO*100+IDA
   IDAT(NDPS)=IDATE
C ***** READ THE NEXT DAY'S DATA (TWO RECORDS)
65   CALL READ3(MSTATE,NUMB,IYR,IMO,IDA,IPR,IPRD,NSTN,LU,LLU,IJK,NSTT,
   2 NS)
   GO TO 30
C
C
C ***** END-OF-STATION PROCESSING FOLLOWS
70   PRINT 75,NUM,NDPS,NUMB
75   FORMAT(1X,'STATION ',I6,'HAD ',I4,'PCPN DAYS, NEXT NUMB=',I6)
   NUM=NUMB
   NSPS=NSPS+1
   IF (NSPS,GT,50) GO TO 78
   NDPS=0
   NST=MSTATE*10000+NUMB
   GO TO 30
C
C
C ***** END-OF-STATE PROCESSING FOLLOWS
78   PRINT 85, MSTATE
85   FORMAT(1X,'NSPS EXCEEDED 50 STATIONS FOR STATE ',I4)
80   PRINT 75,NUM,NDPS,NUMB
   NSPS=0
   NTD=0
100 CONTINUE
   STOP
   END

```

```

      SUBROUTINE READ3(MSTATE,NUMB,IYR,IMO,IDA,IPR,IPRD,NSTN,LU,LLU,IJK,
2 NSTT,NS)
C ***** THIS SUBROUTINE READS THE NEXT DAY'S DATA (TWO RECORDS)
      COMMON/ERROR/KR
      DIMENSION IPR(24,3),IPRD(4),NSTN(25,50),NSTT(50)
      DATA NBAD/0/
      NF=1
      NL=12
C **** FLAG CARD IJK SET TO ZERO.
      IJK=0
C ***** IN LOOP, I = CARD TO BE READ, NC = CARD NUMBER READ FROM CARD
      DO 70 I = 1,2
20  READ(LU,25,FND=30,ERR=80) MSTATE,NUMB,IYR,IMO,IDA,NC,((IPR(K,J)),J=
21,3),K=NF,NL), (IPRD(J),J=1,4)
25  FORMAT(I2,I4,3I2,I1,I2(2A1,I1),2(A1,I1))
      IF(MSTATE.LT.NSTT(NS)) GO TO 75
40  CONTINUE
      IF(I.EQ.2) GO TO 50
C ***** LOOP THROUGH STATIONS UNTIL DESIRED STATION IS FOUND
      DO 45 JJ=1,50
      IF(NSTN(NS,JJ).EQ.NUMB) GO TO 50
45  CONTINUE
C **** WHEN STATION READ IS NOT WANTED STATION IJK IS SET TO 1
      IJK=1
C *** READ SECOND RECORD SO A CARD 1 RECORD WILL BE READ UPON RETURN
      NF=NF+12
      NL=NL+12
      READ(LU,25,END=30,ERR=80) MSTATE,NUMB,IYR,IMO,IDA,NC,((IPR(K,J)),J=
21,3),K=NF,NL), (IPRD(J),J=1,4)
C  IF A NEW STATE AND STATION ARE READ AND NEW STATION IS "GOOD" PROCESS DAY 1
      NP1=NS+1
      IF(MSTATE.EQ.NSTT(NP1).AND.NUMB.EQ.NSTN(NP1,1)) IJK=0
      RETURN
50  IF (NC.NE.I) GO TO 80
      IF (KR.EQ.0) GO TO 60
      NBAD=NBAD+1
      IF(NBAD.GT.10) GO TO 100
      CALL MISS(IPR,IPRD,I)
      KR=0
60  NF=NF+12
      NL=NL+12
70  CONTINUE
75  RETURN
C
80  PRINT 90,I,NC,MSTATE,NUMB,IYR,IMO,IDA
90  FORMAT(' READ NO.',I3,' CARD ',J2,' STATION ',I2,I4,' DATE ',
1 3I2,' DATA FOR THIS DATE CONSIDERED MISSING')
      NBAD=NBAD+1
      IF(NBAD.GT.10) GO TO 100
      CALL MISS(IPR,IPRD,1)
      CALL MISS(IPR,IPRD,2)
      RETURN
C
30  CALL NEXTAP(LU,LLU)
      IF (LU.LE.LLU) GO TO 20
C **** THE EOF ON THE LAST FILE HAS BEEN REACHED.
C      SET MSTATE HIGHER THAN ANY POSSIBLE STATE NUMBER AND RETURN.

```

```

      SUBROUTINE NEXTAP(LU,LLU)
C ***** THIS SUBROUTINE INCREMENTS THE UNIT NUMBER (LU) OF THE FILE
C          FROM WHICH DATA IS BEING READ. BECAUSE THERE ARE SOMETIMES
C          EOF'S AT THE BEGINNING OF A TAPE, TWO EOF'S ARE REQUIRED TO
C          INCREMENT LU
      DATA KFST/1/
      KFST=-KFST
      IF(KFST.LT.0) RETURN
      LU=LU+1
      IF(LU.LE.LLU) RETURN
      PRINT 10,LLU
10  FORMAT(' REACHED EOF ON TAPE',I2)
      RETURN
      END

```

```

      SUBROUTINE UNPK4(IPRW,LPR,IP)
C ***** UNPK4 DECODES THE DAILY TOTAL PRECIP (IPRW). THE 1ST OR 3RD
C      CHARACTERS MAY NOT BE DIGITS, AND ARE THEREFORE IN ALPHA-
C      NUMERIC FORMAT. UNPK4 DECODES THEM, AND EITHER COMBINES
C      THE FOUR DIGITS OF IPRW INTO ONE INTEGER IP, OR SETS IP
C      ACCORDING TO THE CODED DIGITS.
      DIMENSION IPRW(4),LPR(14),II(3)
      DO 70 J=1,3,2
      DO 10 K=1,12
      IF(IPRW(J).EQ.LPR(K)) GO TO 15
10  CONTINUE
15  IF (J.EQ.3) GO TO 31
C ***** DECODE THE FIRST CHARACTER
      IF(K.LE.10) GO TO 25
      KY=K-10
      IF (KM.EQ.2) GO TO 23
      IP=0
C      CHARACTER WAS "-" MEANING 'TRACE', VALUE OF IP IS ZERO
      RETURN
23  IP=-99
C      CHARACTER WAS BLANK, VALUE IS MISSING
      RETURN
25  II(J)=K-1
C      CHARACTER IS A DIGIT
      GO TO 70
C ***** DECODE THIRD CHARACTER
31  IF(K.LE.10) GO TO 25
      IF(K.EQ.11) GO TO 33
      PRINT 32,(IPRW(I),I=1,4)
32  FORMAT('0 ONE OF THE CHARACTERS IN THE FOLLOWING WORD IS UNACCEPTA
10LE ',4A1)
33  IP=-9
C      CHARACTER IS "-", VALUE REPRESENTS ACCUMULATED DATA
      RETURN
70  CONTINUE
C ***** COMBINE DIGITS INTO VALUE FOR IP
      IP=IPRW(4)+II(3)*10+IPRW(2)*100+II(1)*1000
      RETURN
      END

```



```
      SUBROUTINE ERN
C ***** THIS SUBROUTINE IS CALLED BY THE SYSTEM ERROR ROUTINE SYSTEMC.
C          IT SETS FLAG KB TO 1.
      COMMON/ERROR/KB
      KB=1
      RETURN
      END
```

```

      SUBROUTINE MISS(IPR,IPRD,LT)
C ***** IF BAD DATA IS ENCOUNTERED, IT IS TRANSFORMED BY MISS TO BE
C      TREATED AS MISSING
      DIMENSION IPR(24,3),IPRD(4)
      DATA LPR/' '/
      IF (LT.EQ.2) GO TO 40
20 DO 30 I=1,12
30 IPR(I,1)=LPR
      GO TO 60
40 DO 50 I=13,24
50 IPR(I,1)=LPR
60 IPRD(1)=LPR
      RETURN
      END

```

```

C PROGRAM WETDRY, VERSION 7A, J.M. THORP/622R/BNW APRIL 1984
C PROGRAM WETDRY, PROGRAM TO PROCESS WET AND DRY PERIODS FROM HRLY PCPN DATA
C FROM FILES MADE BY PROGRAM NCCTAP FROM NCC ID-9657 FOREIGN TAPES. THE
C PROGRAM PROCESSES THE DATA IN THE FORM OF FREQUENCY TABLES OF AVERAGE
C STORM AND DRY PERIOD PROPERTIES. W07A IS AN EXTENSION OF PROGRAM W05
C (11/83) A VERSION OF WETDRY WHICH RECOVERS BRIDGED MONTH
C END WET AND DRY PERIODS AND MAKES ALLOWANCES FOR INCOMPLETE SEASONS.
C THIS VERSION REQUIRES 4 USER INPUT STATEMENTS.

C ** THE NEXT TWO STATEMENTS ARE NOT USED IN THIS VERSION OF WETDRY

C DIMENSION THE FOLLOWING VARIABLES ACCORDING TO THE MAX NUMBER OF REQUESTED
C STATIONS PER STATE IN THE HPD FILE.

C INTEGER IPTOT(15),NSTN(15),IDSTAT(15)
C REAL PAVG(15),DRYAVG(15),RAINAV(15),EVTNTRT(15)
C **
C DIMENSION THE FOLLOWING VARIABLES ACCORDING TO THE NUMBER OF CLASSES IN
C +THE STORM FREQUENCY TABLE
C INTEGER NSTM(300),NEV(300),ITWHR(300),ITOUR(300),ISSPH(300)
C REAL TSTAM(300),RATSUM(300),AVPPS(300),FRTOT(300),AV3PT(300),
C +AVEVS(300),CUMFR(300),GAVHR(300),AVPPE(300),AVSTRT(300)
C REAL BASE(301),PCT(300),CUMPCT(300),BPCT(301)

C DIMENSION THE FOLLOWING VARIABLES ACCORDING TO THE NUMBER OF CLASSES IN THE
C +DRY PERIOD FREQUENCY TABLE.
C INTEGER IDPX(42),ISUMD(42),IDHR(42)
C REAL PCTD(42),AVG3(42)

C DIMENSION THE FOLLOWING VARIABLES ACCORDING TO THE NUMBER OF EVENTS PER STORM
C INTEGER IDET(20),IEV(20)
C REAL RATEV(20)

C DIMENSION THE FOLLOWING VARIABLES PER INDIVIDUAL REQUIREMENT.
C INTEGER MDAYS(13), IP(24)
C INTEGER SSUM,DA,YR,FMO,FYR,LMO,LYR,GSIPD,MXRTXM,SUMEV,FP
C INTEGER Y,YY,FY,LT,HRCHK,LOSTDH,KYR,NFTR,NLYR
C INTEGER MUNYR( 24),MON(25),IYR(25),MMF(5)
C INTEGER SMHP
C REAL GAVSTRT,GAVEVRT,SSTMRT

C *** THE FOLLOWING VARIABLES ARE RELATED TO THE PROCESSING OF FIRST
C AND LAST PERIODS. NS=NO. OF STATIONS; FPD(STA,NO,YEAR,MONTH) ETC.
C INTEGER NS(90),FPD(90,5,12),LPD(90,5,12),FPW(90,5,12),
C +LPW(90,5,12)

C *** THE FOLLOWING VARIABLES ARE RELATED TO THE PROCESSING OF FIRST
C AND LAST WET PERIODS. THIS SECTION COULD BE DROPPED
C IF BRIDGED WET PERIODS ARE NOT IMPORTANT.
C INTEGER KF(90,5,12),NFWH(90,5,12),NFP(90,5,12),NXV(90,5,12)
C INTEGER ISTAMF(90,5,12),IDHF(90,5,12),NwTF(90,5,12),KFD(90,5,12)
C INTEGER KL(90,5,12),NLWH(90,5,12),NLP(90,5,12),NXVL(90,5,12)
C INTEGER ISTAML(90,5,12),IDHL(90,5,12),NwTL(90,5,12),KLD(90,5,12)
C INTEGER KKF,KD,FPSTM,NW,LW,KKL,LPSTM,MX,MY,LF,FF,KOD,FH,NOWET
C INTEGER CASE1,CASE2,CASE3,CASE4,P24,NHOP,HR1
C REAL EVR(20),XRATF(90,5,12),XRATL(90,5,12)
C REAL RR

```

C *****

```
CHARACTER*80 FILE,FILE1
DATA(MDAYS(MM),MM=1,13)/32,29,32,31,32,31,32,32,31,32,31,32,30/
DATA (IDPX(KK),KK=1,42) /0,20,40,60,80,100,120,140,160,180,200,
+220,240,260,280,300,320,340,360,380,400,420,440,460,480,500,520,
+540,560,580,600,620,640,660,680,700,720,740,760,780,800,820,840,860,880,900,920,940,960,980,1000/
```

C ***DATA STATEMENT FOR SELECTING ACTUAL STATION NUMBER

```
DATA(NS(LL),LL=1,89)/806,3456,9595,0237,
+1166,1549,1577,5751,6711,7382,8179,2738,3037,4259,8187,1060,2367,
+1855,4746,4954,1175,6905,0465,0470,0736,0770,9923,0164,2103,2846,
+3333,3936,4641,5178,5712,7366,2248,5435,7455,1683,5639,0311,6026,
+8883,0042,0687,1012,5801,5803,5811,7167,8383,3630,0058,1561,1657,
+1786,2075,4865,8357,9406,0106,2682,3699,6889,6916,6993,6997,9705,
+9728,0896,6698,1094,6402,1061,5120,6139,7201,7285,8849,8906,0582,
+1570,2718,4393,6859,3269,4961,5479/
```

C SET THE CONDITIONS FOR MAX CYCLES (MAXM) ALLOWED BEFORE TERMINATING THE
C RUN ABNORMALLY. AS A GUIDE SET MAXM= NO.STATIONS*NO.MONTHS*15
MAXM=15000

C*****USER INPUT=NAME OF DATA INPUT FILE AND DATA OUTPUT FILE*****

```
WRITE(6,3000)
3000 FORMAT(' NAME OF INPUT DATA FILE ? ')
READ(5,3001) FILE
3001 FORMAT(A80)
OPEN(UNIT=9,NAME=FILE,TYPE='OLD',READONLY)
WRITE(6,3002)
3002 FORMAT(' NAME OF OUTPUT DATA FILE ? ')
READ(5,3003) FILE1
3003 FORMAT(A80)
OPEN(UNIT=4,NAME=FILE1,TYPE='NEW')
```

C SET THE NUMBER OF DRY HOURS TO BE ALLOWED IN A STORM AS NOHR.

C SET THE MAX NUMBER OF STATIONS IN THE DATA BASE AS NX.

C*****USER INPUT*****

```
WRITE(6,3005)
3005 FORMAT(' ENTER VALUES FOR NO. OF DRY HOURS AND NO. OF STATIONS')
READ(5,*) NOHR,NX
TYPE *, ' NOHR AND NX= ',NOHR,NX
```

C ** MISSING SEASON=MONTH CODES, MMF(KYR): 0=M1,M2,M3 AVAILABLE;

C 1=M1 MISG.;2=M3 MISG.;3=M2 OR M1&M2 OR M2&M3 MISG.(i.e. NO RECOVERABLE
C PERIODS)

C*****USER INPUT*****

```
WRITE(6,3007)
3007 FORMAT(' ENTER FIRST AND LAST DATA YEARS AND KYR CODES FOR MISSING  
+ SEASON=MONTHS PER YEAR')
READ(5,*) NFYR,NLYR,(MMF(KYR),KYR=NFYR,NLYR)
TYPE *, ' F&L YRS & KYR CODES= ',NFYR,NLYR,(MMF(KYR),KYR=NFYR,NLYR)

WRITE(4,3011) NFYR,NLYR,(MMF(KYR),KYR=NFYR,NLYR)
```

```

3011 FORMAT(1H1," FIRST AND LAST YEARS IN DATA FILE ARE ",2I3,/,
+1H," MISSING "SEASON=MONTH=YP" CODES FOLLOW:",/,
+1H," MMF(KYR=1)= ",I3,/,
+1H," MMF(KYR=2)= ",I3,/,
+1H," MMF(KYR=3)= ",I3,/,
+1H," MMF(KYR=4)= ",I3,/,
+1H," MMF(KYR=5)= ",I3,/)

C TO ACTIVATE RECOVERY-OF-BRIDGED-PERIOD ROUTINE SET NRC=1.
C TO SKIP RECOVERY ROUTINE SET NRC=0.
  NRC=1

C SET THE DESIRED BASES FOR THE MAXIMA
C
  MXIP=0
  MXDR=0
  MXRTXM=0
  MXDRY=0
  MXTOT=0

C
C INITIALIZE THE COUNTERS
C
  IGRSUM=0
  JGRSUM=0
  JPTOT=0
  GSIPD=0
  LNDYR=0
  LDA=0
  SSUM=0
  NUMDP=0
  N=1
  NEVENT=0
  NFD=0
  NSTA=0
  NN=0
  M=0
  SUMLEV=0
  IPD99=0
  ITHRS=0
  ITRHRS=0
  ITDHRS=0
  IDRY=0
  IV=0
  IVSUM=0
  IPEV=0
  SRATSUM=0.
  RATOT=0.
  TOTRAT=0.
  SUMAVP=0.
  NUMMET=0
  IATHRS=0
  ISTAM=0
  DA=0
  MDH=0
  VATH=0
  MP=0
  IDH=0

```

```

      MDH2=0
      NRDH=0
      LFPDH=0
      HRCHE=0
      LOSTDH=0
      CASE1=0
      CASE2=0
      CASE3=0
      CASE4=0
      NRDP=0

      TPCT=0.
      ITDP=0
      DO 2 J=1,42
      ISIMO(J)=0
      IOHR(J)=0
2      CONTINUE
      DO 4 J=1,300
      NSTM(J)=0
      TSTAM(J)=0.
      MEV(J)=0
      ITWHR(J)=0
      FATSUM(J)=0.
      ITDUR(J)=0
      ISSDH(J)=0
      CUMFQ(J)=0.
      CUMPCT(J)=0.
4      CONTINUE
5      JDAY=1
      IDURD=0
      IDURR=0
      IFD=0
      IFR=0
      LP=0
      FP=0
      LDA=0
      PZ4=0
      HRI=0

C
C IF FIRST DAY OF NEW STATION-MONTH WAS READ ON LAST CYCLE, PROCESS IT
C BEFORE READING THE NEXT PCPN DAY.
C IF(DA,EQ,1) GO TO 18
C THE FIRST DAY OF A MONTH ALWAYS HAS A RECORD WHETHER IT HAD PCPN OR NOT.
C AFTER THE FIRST DAY, ONLY DAYS WITH PCPN HAVE A RECORD.
C
C *****READ A 24 HOUR RECORD
C
8      READ(9,10,END=12,ERR=350) MSTATE,NUM,MO,DA,YR,(IP(K),K=1,24),IPD
10     FORMAT(I2,I4,3I2,24I3,I4)
C      WRITE(4,2001)MSTATE,NUM,MO,DA,YR,(IP(K),K=1,24),IPD
C 2001 FORMAT(1H ,I2,I4,3I2,24I3,I4)
C ** THE FOLLOWING LOOP CAN BE ACTIVATED FOR THE FIRST RUN ON A NEW DATA
C FILE TO MAKE SURE THE SUM OF HOURLY PCPN = THE DAILY TOTAL.

C      DO 2010 I=1,24
C      SMHP=SMHP+IP(I)
C 2010 CONTINUE
C      IF(SMHP.NE,IPD) WRITE(4,2012) SMHP,IPD,MSTATE,NUM,MO,DA,YR

```

```

C 2012 FORMAT(1H , ' INCONSISTENT PRECIP SUM, SMHP, IPD= ', 2I4, ' AT ',
C      +13, 15, 3I3)
C      SMHP=0

      GO TO 13
12  LSTATE=MSTATE
    MSTATE=99
    LMO=MO
    LYR=YR
C ** SET UPPER INDEX, LY, FOR 'LAST PERIOD' PROC. LOOPS @ 179.
    LY=LYR-76
C IF END OF DATA GO TO 325 AND COUNT ANY DRY DAYS TO END OF MONTH.
    GO TO 325
C THE FOLLOWING STATEMENT IS USED TO THROW OUT STATIONS NOT WANTED.
C IF (NUM=4763) 13, 8, 13
C IF HOURLY DATUM IS MISSING (-99), NOTE IT AND READ NEXT RECORD.
13  IF(IPD.EQ.-99) GO TO 9
    GO TO 19
9   WRITE(6,11) MSTATE, NUM, MO, DA, YR
11  FORMAT(1H , T5, 'IPD=-99 AT ', I2, I4, 2X, 3I2)
    IPD99=IPD99+1
    IF(IPD99.GT.100) GO TO 385
    GO TO 8
C IF FEB HAS 29 DAYS, TEMPORARILY SET MO=13
19  IF(MO=2) 16, 14, 16
14  IF(((YR/4)*4).EQ.YR) MO=13
16  M=M+1
    GSTPD=GSTPD+IPD
    IF(M=1) 17, 17, 18
17  FMO=MO
    FYR=YR
C ** SET LOWER INDEX, FY, FOR 'LAST PERIOD' PROCESSING LOOPS @ 179.
    FY=FYR-76

C *** BEGINNING AND END OF MONTH STORMS OR DRY PERIODS ARE ASSIGNED
C TO AN ARRAY IN ORDER TO ADD THEM TO THE APPROPRIATE CATEGORY
C AFTER ALL THE DATA IS READ.
C *** SET THE THREE M'S ACCORDING TO THE SEASON BEING PROCESSED.
C *** FOR ANY SEASONAL DATA THERE WILL BE ONLY ONE SET OF M'S.
C *** IF DATA IS NOT TREATED SEASONALLY THERE WILL BE NO NEED TO
C ASSIGN M'S.
    GO TO(502, 502, 504, 504, 504, 506, 506, 506, 508, 508, 508, 502)FMO
502  M1=12
    M2=1
    M3=2
    NSF=1
    GO TO 510
504  M1=3
    M2=4
    M3=5
    GO TO 510
506  M1=6
    M2=7
    M3=8
    GO TO 510
508  M1=9
    M2=10

```

```

      M3=11
510  CONTINUE
18   IF(DA=1) 250,21,24
21   IF(JDAY,NE,1) GO TO 24
      NSTA=NSTA+1
      NDMO=MDAYS(MO)
24   IF(MO,EQ,13) MO=2
C   PUT A LIMIT ON NO. OF RECORDS TO HALT A RUNAWAY. 15*NO.STA,*NO. OF MONTHS.
      IF(M,GT,MAXM) GO TO 350
      IF(MSTATE,GT,90) GO TO 325
      IF(DA=1) 250,302,304
302  NSM=NUM
      MSTATE=MSTATE

      MOYR=MO+100+YR
      IF(MOYR=LMOYR) 306,304,306
306  IF(JDAY,NE,1) GO TO 304
C   NN KEEPS TRACK OF WHICH MONTH/YEAR DATA SET(S) ARE USED.
      NN=NN+1
      MUN(NN)=MU
      IYR(NN)=YR
      Y=YR-76

C   IF LAST PCPN DAY IS NOT LAST DAY OF MONTH, COUNT DRY HOURS AT 325.
C   IF DRY DAYS OCCUR BETWEEN PCPN DAYS, COUNT DRY HOURS AT 315.
C   *** WHEN STATION-MONTH HAS NO PCPN DA=1 WILL BE READ FOR TWO STATIONS
C   IN SUCCESSION. GO TO 325 AND COUNT A MONTH OF DRY HOURS.
304  IF(DA=LOA) 325,326,315
326  IF(NUM,EQ,LNUM) GO TO 254
C   ** COUNT THE DRY HOURS TO THE END OF THIS STATION MONTH.
325  JDAY=JDAY+1
      IF(JDAY,GT,NDMO) GO TO 135
      IDURD=IDURD+24
      ITHRS=ITHRS+24
      GO TO 325
315  JDAY=JDAY+1
      IF(JDAY,GT,NDMO) GO TO 135
      IF(DA=JDAY) 330,320,320
C   ** COUNT THE DRY HOURS TO THE NEXT PRECIPITATION DAY.
320  IDURD=IDURD+24
      IF(IDURR,EQ,0) GO TO 328
      IF(IFLAG,EQ,0) GO TO 327
C
C   PROCESS THE PCPN EVENT JUST ENDED
C
      NUMNET=NUMNET+IWETHR
      INET(IV)=IWETHR
      IEV(TV)=IPEV
      RATEV(IV)=FLOAT(IEV(IV))/(FLOAT(IWET(IV))*100.)
      RATOT=RATOT+RATEV(IV)

      IRATEV=IEV(IV)*100/IWET(TV)
      IF(IRATEV=MXRTXM) 323,322,322
322  CALL MXIMA(MXRTXM,IRATEV,LOCRA1,LOCRA2,MSTATE,NUM,MO,DA,YR)
323  CONTINUE
      IWETHR=0

```



```

      IPEV=0
      IFLAG=0
C
C  PROCESS THE LAST STORM
C
327  IF(IDURR=MXDR) 343,341,341
341  CALL MXIMA(MXDR,IDURR,LOCOR1,LOCOR2,MSTATE,NUM,MO,DA,YR)
343  CONTINUE
      IF(ISTAM=MXTOT) 347,345,345
345  CALL MXIMA(MXTOT,ISTAM,LOCTT1,LOCTT2,MSTATE,NUM,MO,DA,YR)
347  CONTINUE
      IF(IDURR.LT.0.OR.IDURR.GT.300) GO TO 258

      IF(IDURR.GE.60) WRITE(4,4020) IDURR,MSTATE,NUM,MO,DA,YR
4020  FORMAT(1H,' IDURR= ',I4,' AT ',5I4)

      CALL STORM(NEVENT,IV,N,RATOT,TOTRAT,IVSUM,IDURR,ISTAM,
+NUMWET,L,MSTM,TSTAM,SSUM,JGRSUM,NEV,IWTHR,RATSUM,ITDUR,ISSDH,
+IDH)
328  ITHRS=ITHRS+24
      GO TO 315
C
C  PROCESS HOURLY DATA
C
330  DO 130 K=1,24
      IF(IP(K).EQ.-99) GO TO 110
      ITHRS=ITHRS+1
      IF(K.NE.1) GO TO 62
      IF(DA.NE.1) GO TO 62

      NFD=NFD+1
C      WRITE(4,4035)MSTATE,NUM,MO,DA,YR,(IP(N),N=1,24),IPD,NFD
C 4035  FORMAT(1H0,I2,I4,3I2,24I3,I4,2X,I5)

      IF(IP(1).GT.0) HR1=IP(1)
      FP=1
      FH=1
62  IF(IP(K)=0) 60,65,70
C  PROCESS A DRY HOUR FROM THIS PCPN DAY IF IP(K)=0
65  IDURD=IDURD+1
      IF(IFR.EQ.0) GO TO 100
      IF(IDURR.EQ.0) GO TO 130
      IF(IWTHR.EQ.0) GO TO 47
C
C  IF PCPN EVENT HAS ENDED PROCESS IT AND INDEX IT FOR SUMMARIZATION
C  NUMWET= NO. OF WET HRS IN THIS STORM. IV=EVENT NO. IWET=NO. OF WET HRS IN
C  +THIS EVENT. IEV=PCPN AMT IN THIS EVENT. RATEV=PCPN RATE (IN/HR) IN THIS EVNT
C  RATOT=SUM OF EVENT RATES IN THIS STORM.
C
66  NUMWET=NUMWET+IWETHR
      IWET(IV)=IWETHR
      IEV(IV)=IPEV
      IF(FP.EQ.1) GO TO 46
      RATEV(IV)=FLOAT(IEV(IV))/(FLOAT(IWET(IV))*100.)
      IRATEV=IEV(IV)*100/IWET(IV)
      IF(IRATEV=MXRTXM) 69,67,67
67  CALL MXIMA(MXRTXM,IRATEV,LOCRA1,LOCRA2,MSTATE,NUM,MO,DA,YR)

```

```

69  CONTINUE
    RATOT=RATOT+RATEV(IV)

46  I#ETHR#0
    IPEV#0
    IFLAG#0
    IF(IDURN.EQ.0) GO TO 130
C   IF SOME DRY HOURS ARE TO BE CONSIDERED PART OF A STORM, TEST THE
C   CURRENT DRY HOURS, IDURD, AGAINST THAT NUMBER, NDHR.
47  IF(IDURD.LE.NDHR) GO TO 130
    IF(FP.EQ.0) GO TO 48

C*****
C   IF CURRENT STORM IS FIRST PERIOD OF MONTH ASSIGN ITS PARAMETERS TO
C   ARRAYS FOR LATER RECOVERY.
C
C   TEMPORARY STMT. WRITE OUT THE MISG DRY HOURS FROM LAST AND
C   FIRST PERIODS OF EACH STATION, LFPDH.
C   **   IF FIRST PERIOD IS WET, THE DRY HOURS IN THE PRD WILL BE
C   PRINTED OUT HERE.

    DO 1000 I=1,NX
      IF(NUM#NS(I)) 1000,1005,1000
1000  CONTINUE
      GO TO 275
1005  NA=I
C   ** IF MO#M1 NO PAIRING IS POSSIBLE FOR FIRST PERIODS.
      IF(MO.EQ.M1) GO TO 1040
C   ** IF SEASON IS WINTER THE SINGLE MMF CODE CANNOT REPRESENT 2 YEARS. SET YY.
      IF(M1.NE.12) GO TO 1010
C   IF(MMF(Y).EQ.1) GO TO 1010
      IF(MO.GT.2) GO TO 1010
      YY=Y-1
      IF(MMF(YY).EQ.0) GO TO 1017
      IF(MMF(YY)#2) 1015,1017,1040
1010  IF(MMF(Y).EQ.0) GO TO 1017
      IF(MMF(Y)#2) 1015,1017,1040
1015  IF(MO.EQ.M2) GO TO 1040
1017  FPW(NA,Y,MO)=IDURR

1019  RATOT#0.
      IF(IDURR.GT.24) WRITE(4,1027) IDURR,NA,Y,MO
1027  FORMAT(1H0,' FIRST PERIOD STORM HAD IDURR= ',I3,' HRS AT ',
+      3I4)

1020  IF(MR1.EQ.0) GO TO 1030
      KF(NA,Y,MO)#1
      NFWR(NA,Y,MO)=INET(1)
      NFP(NA,Y,MO)=IEV(1)
      KKF#1
1030  KFD(NA,Y,MO)=KD
      NXV(NA,Y,MO)=IV
      IF(KKF.EQ.1) GO TO 1045
      DO 1035 J=1,IV
        EVR(J)=FLOAT(IEV(J))/(FLOAT(INET(J))*100.)
        RATOT=RATOT+EVR(J)

```

```

1035     CONTINUE
        GO TO 1055
1045     IF(IV.LE.1) GO TO 1057
        DO 1046 J=2,IV
            EVR(J)=FLOAT(IEV(J))/(FLOAT(IWET(J))*100.)
            RATOT=RATOT+EVR(J)

1046     CONTINUE

1055     XRATF(NW,Y,MO)=RATOT
1057     FPSTM=FPSTM+1
        ISTAMF(NW,Y,MO)=ISTAM

C       WRITE(4,4021) NW,Y,MO,IDURR,ISTAMF(NW,Y,MO)
C 4021  FORMAT(1H,' FPW(',I2,',',I2,',',I2,',') FOR RECOVERY. IDURR= ',I4,
C      +', ISTAMF(NW,Y,MO)= ',I4)
        IDHF(NW,Y,MO)=IDH
        NUMWET(NW,Y,MO)=NUMWET
        GO TO 1050
1040     CONTINUE

C
        LFPDH=IDH
        MWH=MWH+NUMWET
        MDH=MDH+IDH

C       WRITE(4,4050) MDH,IDH
C 4050  FORMAT(1H,' T10,' MDH= ',I6,', INCR. BY IDH @ 4050 =',I4)

        MP=MP+ISTAM
        JPTOT=JPTOT+ISTAM

C       WRITE(4,4023) NW,Y,MO,NUMWET,IDH,ISTAM
C 4023  FORMAT(1H,' FPW(',I2,',',I2,',',I2,',') NO RECOVERY. NUMWET= ',
C      +I4,', IDH= ',I3,', ISTAM= ',I4)

        IDRY=IDRY-IDH
        ITRHRS=ITRHRS+NUMWET

1050     DO 1044 J=1,IV
        IWET(J)=0
        IEV(J)=0
        EVR(J)=0.
        RATEV(J)=0.
1044     CONTINUE
        IDURR=0
        IDH=0
        NUMWET=0
        IV=0
        ISTAM=0
        RATOT=0.
        FP=0
        KD=0

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```

      KKF=0
      IWETHR=0
      IPEV=0
      IFLAG=0
      FH=0
      GO TO 130
C*****
C
C  PROCESS THE LAST STORM
C
48  IF(IDURR=MXDR) 53,51,51
51  CALL MXIMA(MXDR,IDURR,LOCOR1,LOCOR2,MSTATE,NUM,MO,DA,YR)
53  CONTINUE
      IF(ISTAM=MXTOT) 57,55,55
55  CALL MXIMA(MXTOT,ISTAM,LOCTT1,LOCTT2,MSTATE,NUM,MO,DA,YR)
57  CONTINUE
      IF(IDURR.LT.0.OR.IDURR.GT.300) GO TO 258

      IF(IDURR.GE.60) WRITE(4,4020) IDURR,MSTATE,NUM,MO,DA,YR

      CALL STORM(NEVENT,IV,N,RATOT,TOTRAT,IVSUM,IDURR,ISTAM,
+NUMWET,L,NSTH,TSTAM,SSUM,JGRSUM,NEV,ITWHR,RATSUM,ITOUR,ISSDH,
+IDH)
      GO TO 130
C
C  IF IP(K) WAS GREATER THAN 0, PROCESS A WET HOUR.
C
60  WRITE(4,4060) IP(K),MSTATE,NUM,MO,DA,YR
4060 FORMAT(1H , ' NEGATIVE IP(K)= ',I3,' AT ',SI4)

      IR(K)=0
70  ITRHRS=ITRHRS+1
      IF(IP(K)=MXIP) 72,71,71
71  MIP=IP(K)
      CALL MXIMA(MXIP,MIP,LOCAM1,LOCAM2,MSTATE,NUM,MO,DA,YR)
72  CONTINUE
      IFLAG=1
      IDURR=IDURR+1
      IWETHR=IWETHR+1
      IF(IWETHR.EQ.1) IV=IV+1
      IF(IDURD.EQ.0) GO TO 78
      IF(IDURD=NDHR) 75,75,78
C  ADD PSEUDO WET HOURS AS ALLOWED BY NDHR.
75  IDURR=IDURR+IDURD
      IDRY=IDRY+IDURD
      IDH=IDH+IDURD

      IF(FH.GT.0) KD=IDURD
      IDURD=0
78  JPTOT=JPTOT+IP(K)
C  IPTOT(N)=IPTOT(N)+IP(K)
      ISTAM=ISTAM+IP(K)
      IPEV=IPEV+IR(K)
      FH=0
      IF(IFD.EQ.0) GO TO 100

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```

      IF(IDURD,EQ,0) GO TO 130
C
      IF(FP,EQ,0) GO TO 79
C*****

C **      IF THE FIRST PERIOD IS DRY ASSIGN IDURD TO AN ARRAY FOR LATER
C          RECOVERY.

          DN 241 I=1,NX
          IF(NUM=NS(I)) 241,246,241
241      CONTINUE
          GO TO 275
246      ND=I
          IF(MO,EQ,M1) GO TO 248
C ** IF SEASON IS WINTER THE SINGLE MMF CODE CANNOT REPRESENT 2 YEARS. SET YY.
          IF(M1,NE,12) GO TO 242
C          IF(MMF(Y),EQ,1) GO TO 242
          IF(MO,GT,2) GO TO 242
          YY=Y-1
          IF(MMF(YY),EQ,0) GO TO 247
          IF(MMF(YY)=2) 243,247,248
242      IF(MMF(Y),EQ,0) GO TO 247
          IF(MMF(Y)=2) 243,247,248
243      IF(MO,EQ,M2) GO TO 248

247      FPD(ND,Y,MO)=IDURD

C      WRITE(4,4024) ND,Y,MO,IDURD
C 4024 FORMAT(1H,' FPD(',I2,',',I2,',',I2,') FOR RECOVERY.IDURD= ',I4)

          IDURD=0
          GO TO 249
248      MDH=MDH+IDURD

C      WRITE(4,4052) ND,Y,MO,IDURD
C 4052 FORMAT(1H,' FPD(',I2,',',I2,',',I2,') NO RECOVERY. LOST DRY
C      + HOURS= ',I4)

          IDURD=0
249      FP=0
          KD=0
          FH=0
          GO TO 130
C*****

79      IF(IDURD=MXDRY) 82,87,80
80      CALL MXIMA(MXDRY,IDURD,LCDRY1,LCDRY2,MSTATE,NUM,MO,DA,YR)
82      CONTINUE
          IF(IDURD,GT,2500) IDURD=2500

C
C FIND PROPER CLASS FOR DRY PERIOD AND PROCESS IT.
C
          CALL DRYPRD(IDURD,KK,ISUMD,NUMDP,IOHR,ITDHR)
          KD=0
          FH=0
100      IFD=1

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      IFR=1
      GO TO 130
110  WRITE(6,120) MSTATE,NUM,MO,DA,YR,K
120  FORMAT(1H,'-99 ENCOUNTERED AT ',I2,I4,' ON ',3I2,' HR ',I2)
130  CONTINUE
C
C  SET "LAST PERIOD" FLAGS
C
      LDA=0A
      LNUM=NUM
      LASTATE=MSTATE
      LM=MO
      LAYR=YR
      IF(LDA.EQ.(NDMM-1)) GO TO 131
      LP=1
      LMDYR=MO*100+YR
      GO TO 8
131  IF(IP(24)=0) 110,127,126
126  P24=1
127  IF(IDURD.GT.NDMM) GO TO 132
      LP=2
      LMDYR=MO*100+YR
      GO TO 8
132  LP=1
      LMDYR=MO*100+YR
      GO TO 8
135  CONTINUE
      IF(LP.EQ.2) GO TO 134
      IF(IFLAG.EQ.0) GO TO 137
C
C  PROCESS THE LAST PCPN EVENT.
C
134  IF(IFLAG.EQ.0) GO TO 129
      NUMWET=NUMWET+INWETHR
      IWET(IV)=INWETHR
      IEV(IV)=IPEV
      RATEV(IV)=FLOAT(IEV(IV))/(FLOAT(IWET(IV))*100.)
      RATOT=RATOT+RATEV(IV)

      IRATEV=IEV(IV)*100/IWET(IV)
129  IF(LP.LT.2) GO TO 138

C*****
C  IF LAST MONTHLY PERIOD IS WET PUT THE DATA INTO ARRAYS FOR POSSIBLE
C  LATER RECOVERY.

      DO 2000 I=1,NX
      IF(LNUM=NS(I)) 2000,2005,2000
2000  CONTINUE
      GO TO 275

2005  INURR=IDURR+IDURD
      LN=I
      IF(LM.EQ.M3) GO TO 2040
C ** IF SEASON IS WINTER THE SINGLE MMF CODE CANNOT REPRESENT 2 YEARS. SET YY.

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      IF(M1.NE.12) GO TO 2008
C      IF(MMF(Y).EQ.1) GO TO 2008
      IF(LM.GT.2) GO TO 2008
      YY=Y+1
      IF(MMF(YY).EQ.0) GO TO 2017
      IF(MMF(YY)=2) 2015,2020,2040
2008      IF(MMF(Y).EQ.0) GO TO 2017
      IF(MMF(Y)=2) 2015,2020,2040
2015      IF(LM.EQ.M2) GO TO 2017
      GO TO 2040
2020      IF(LM.EQ.M2) GO TO 2040
2017      LPW(LW,Y,LM)=IDURR
      RATOT=0.
      IF(P24.EQ.0) GO TO 2030

C  SET FLAGS FOR POSSIBLE CASE IV
      KKL(LW,Y,LM)=1
      NLWH(LW,Y,LM)=INWTHR
      NLP(LW,Y,LM)=IPEV
      KKL=1

2030      KLD(LW,Y,LM)=IDURD
      VXL(LW,Y,LM)=IV
      IF(KKL.EQ.1) GO TO 2045
C  WHEN NOT CASE IV CALCULATE EVENT RATES AND ACCUMULATE THEM.
      DO 2042 J=1,IV
      EVR(J)=FLOAT(IEV(J))/(FLOAT(INET(J))*100.)
      RATOT=RATOT+EVR(J)

2042      CONTINUE
      GO TO 2055
2045      IF(IV.LE.1) GO TO 2057

      DO 2046 J=1,(IV-1)
      EVR(J)=FLOAT(IEV(J))/(FLOAT(INET(J))*100.)
      RATOT=RATOT+EVR(J)

2046      CONTINUE

2055      XRATL(LW,Y,LM)=RATOT
2057      LPSTM=LPSTM+1
      ISTAML(LW,Y,LM)=ISTAM

C      WRITE(4,4025) LW,Y,LM,IDURR,ISTAML(LW,Y,LM)
C 4025  FORMAT(1H,' LPW(',I2,',',I2,',',I2,',') FOR RECOVERY. IDURR= ',I4,
C      +',. ISTAML(LW,Y,LM)= ',I4)

      IDHL(LW,Y,LM)=IDH
      NWTL(LW,Y,LM)=NUMWET
      GO TO 2060
2040      CONTINUE

C **IF LAST PERIOD IS A STORM AND ENDS WITH DRY HOURS .LE. NDHR, THESE
C  HOURS COME THROUGH IN IDURD ONLY. BUT ANY DRY HOURS <NDHR THAT

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C   OCCURRED WITHIN THE STORM HAVE BEEN PUT INTO IDH AND IDRY.  THUS
C   IDH IS INCREASED BY IDURD.  BUT IDRY SHOULD BE REDUCED BY THE IDH
C   WITHIN THE STORM ONLY.

      MWH=MKH+NUMWET
      IDH=IDH+IDURD
      MDH=MDH+IDH

C   WRITE(4,4050) MDH,IDH

      MDH2=MDH2+IDH
      MP=MP+ISTAM
      JPTOT=JPTOT-ISTAM

C   WRITE(4,4027) LW,Y,LM,NUMWET,IDH,ISTAM
C 4027 FORMAT(1H,' LPK(',I2,',',I2,',',I2,',') NO RECOVERY. NUMWET= ',
C          +I4,', IDH= ',I3,', ISTAM= ',I4)

      IDRY=IDRY-(IDH-IDURD)
      ITRHRS=ITRHRS+NUMWET
      LFPDH=IDH

2060   DO 2033 J=1,IV
      IWET(J)=0
      IEV(J)=0
      EVR(J)=0.
      RATEV(J)=0.
2033   CONTINUE
C

      IDURD=0
      IDURR=0
      IDH=0
      RATOT=0.
      IRATEV=0
      NUMWET=0
      IV=0
      ISTAM=0
      IWETHR=0
      IPEV=0
      IFLAG=0
      KKL=0
      LP=0
      GO TO 155
C*****

138   CONTINUE
      IF(IRATEV=MXRTXM) 139,136,136
136   CALL MXIMA(MXRTXM,IRATEV,LOCRA1,LOCRA2,MSTATE,NUM,MO,DA,YR)
139   IWETHR=0
      IPEV=0
      IFLAG=0
137   IF(IDURR=0) 258,150,140
C
C   PROCESS THE LAST STORM.
C
140   IF(IDURR=MXDR) 144,142,142

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142 CALL MXIMA(MXDR,IDURR,LOCDR1,LOCDR2,MSTATE,NUM,MO,DA,YR)
144 CONTINUE
    IF(ISTAM=MXTOT) 148,146,146
146 CALL MXIMA(MXTOT,ISTAM,LOCTT1,LOCTT2,MSTATE,NUM,MO,DA,YR)
148 CONTINUE
    IF(IDURR.LT.0.OR.IDURR.GT.300) GO TO 258

    IF(IDURR.GE.60) WRITE(4,4020) IDURR,MSTATE,NUM,MO,DA,YR

    CALL STORM(NEVENT,IV,N,RATOT,TOTRAT,IVSUM,IDURR,ISTAM,
+NUM,ET,L,NSTM,ISTAM,SSUM,JGRSUM,NEV,ITWHR,RATSUM,ITDUR,ISSDH,
+IDH)
    IF(IDURD.EQ.0) GO TO 155
150 IF(LP.LT.1) GO TO 156

C*****
C ** IF LAST PERIOD IS DRY ASSIGN IDURD TO ARRAY FOR LATER RECOVERY.

    DO 231 I=1,NX
    IF(LNUM=NS(I)) 231,233,231
231 CONTINUE
    GO TO 275
233 LD=I
    IF(LM,EQ,M3) GO TO 238
C ** IF SEASON IS WINTER THE SINGLE MMF CODE CANNOT REPRESENT 2 YEARS. SET YY.
    IF(M1.NE.12) GO TO 232
C    IF(MMF(Y).EQ.1) GO TO 232
    IF(LM.GT.2) GO TO 232
    YY=Y-1
    IF(MMF(YY).EQ.0) GO TO 235
    IF(MMF(YY)=2) 234,236,238

232 IF(MMF(Y).EQ.0) GO TO 235
    IF(MMF(Y)=2) 234,236,238
234 IF(LM,EQ,M2) GO TO 235
    GO TO 238
236 IF(LM,EQ,M2) GO TO 238
235 LPD(LD,Y,LM)=IDURD

C    WRITE(4,4026) LD,Y,LM,IDURD
C 4026 FORMAT(1H,' LPD(',I2,',',I2,',',I2,',') FOR RECOVERY,IDURD= ',I4)

    IDURD=0
    GO TO 239
238 MDH=MDH+IDURD

C    WRITE(4,4054) LD,Y,LM,IDURD
C 4054 FORMAT(1H,' LPD(',I2,',',I2,',',I2,',') NO RECOVERY, LOST DRY
C    + HOURS= ',I4)

    IDURD=0
239 LP=0
    GO TO 155
C*****
C

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C PROCESS THE LAST DRY PERIOD IF NOT ALREADY DONE.
C
156 IF(IDURD-MXDRY) 154,154,152
152 CALL MXTMA(MXDRY,IDURD,LCORY1,LCORY2,MSTATE,NUM,MO,DA,YR)
154 CONTINUE
    IF(IDURD.GT.2500) IDURD=2500
    CALL DRYPRO(IDURD,KK,ISUMD,NUMDP,IDHR,ITDHR5)
C IF INPUT DATA HAS ALL BEEN READ, GO TO 160.
155 IF(MSTATE.GT.90) GO TO 160
    IF(IDURD.EQ.0) GO TO 5
C CALCULATE THE AVERAGES AND SUMS
160 CONTINUE

C ***** FOR SEASONAL ANALYSIS COMBINE EXCLUDED LAST AND FIRST PERIODS
C OF CONSECUTIVE MONTHS. SET NX = TO NO. OF STATIONS IN DATA.
C ***** IF THERE ARE NOT 2 CONSECUTIVE MONTHS OF DATA IN THE FILE
C SKIP TO 185. DO NOT ATTEMPT TO PROCESS BRIDGED PERIODS.

    IF(NN.LT.2) GO TO 185
    IF(NRC.EQ.0) GO TO 185

C *** AFTER DATA HAS ALL BEEN READ IF ANY FIRST AND LAST WET PERIODS ARE
C RECOVERABLE DO IT HERE.
    DO 600 N=1,NX
        DO 600 II=NFYR,NLYR
C JO CONTROLS WHETHER ONLY 1 CYCLE PASSES THROUGH DO 680
        JO=0
C CHECK FIRST FOR THE PERIODS AT THE END OF FIRST SEASONAL MONTH AND
C BEGINNING OF SECOND MONTH. IF EITHER OF THE PERIODS IS ZERO DO NOT
C PROCESS THE PERIOD AS A BRIDGED PERIOD. RATHER PROCESS WHICHEVER LEG
C HAD THE STORM. ANY DRY HOURS ENDING OR BEGINNING SUCH A LEG SHOULD GO
C ON THE CORRESPONDING DRY PERIOD. IF BOTH PERIODS ARE ZERO SKIP TO THE
C SECOND SET OF PERIODS AT M2 AND M3 (M = THE SEASONAL MONTH).

C IF A SEASON IS INCOMPLETE, BRIDGED PERIOD PROCESSING WILL
C BE FOR ONE PAIR AT MOST; PERHAPS NONE.

C IF MMF(KYR) CODE=3, THERE WILL BE NO RECOVERY. PASS TO NEXT YR OR STA.
    IF(MMF(II).GE.3) GO TO 600

    DO 680 JJ=1,2
        LF=0
        FF=0
        ADD=0
        KKL=0
        KKF=0

    IF(MMF(II)-1) 604,603,601
C IF MMF CODE=1, M1 IS MISG, PROCESS SECOND PAIR ONLY. START AT 603.
603 JU=JO+2
    IF(M1.NE.12) GO TO 611
    IX=II+1
    IY=II+1
    GO TO 609
611 IX=II
    IY=II
    GO TO 609

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C IF MMF CODE=2, M3 IS MISG, PROCESS FIRST PAIR ONLY, START AT 601.
601 JU=JO+2
C IF MMF CODE=0, SEASON IS COMPLETE. TREAT BOTH PAIRS, START AT 604.
604 IF(JJ.EQ.2) GO TO 605
C IF SEASON IS WINTER CODES 2 AND 0 INVOLVE DATA FOR 2 DIFFERENT
C YEARS. IX AND IY MUST BE ADJUSTED TO ACCOMMODATE THIS. FOR ALL
C OTHER SEASONS AND FOR CODE 1 IN WINTER IX=IY.
    IF(M1.NE.12) GO TO 606
    IX=II
    IY=II+1
    GO TO 607
606 IX=II
    IY=II

607 MX=M1
    MY=M2
    GO TO 610

605 IF(M1.NE.12) GO TO 608
    IX=II+1
    IY=II+1
    GO TO 609
608 IX=II
    IY=II
609 MX=M2
    MY=M3

C DETERMINE WHICH CASE THE SITUATION REPRESENTS.
610 IF(LPW(N,IX,MX)+FPW(N,IY,MY).EQ.0) GO TO 602
    IF(LPW(N,IX,MX).GT.0) LF=1
    IF(FPW(N,IY,MY).GT.0) FF=1

    IF(LF+FF) 620,630,620
630 KDD=KLD(N,IX,MX)+KFD(N,IY,MY)

C KDD EQUALS THE SUM OF DRY HOURS IN MIDDLE OF BRIDGED PERIOD.
C IF KDD .GT. NDHR IT IS CASE I (TWO STORMS SEPARATED BY A DRY PERIOD).
    IF(KDD.GT.NDHR) GO TO 650

C IF KDD=0 IT IS CASE IV. THE BRIDGED PERIOD IS SOLID WET.
    IF(KDD.EQ.0) GO TO 660

C IF KDD .GT. 0 BUT LT NDHR THE WET PERIOD IS BROKEN. CASE II OR V.
    IF(KDD.LE.NDHR) GO TO 635

620 IF(KL(N,IX,MX).GT.0.OR.KF(N,IY,MY).GT.0) GO TO 635
    IF(KLD(N,IX,MX).GT.0.OR.KFD(N,IY,MY).GT.0) GO TO 640
C*****
C PROCESS CASE II AND CASE V BRIDGED STORMS.
C*****
635 IDURR=LPW(N,IX,MX)+FPW(N,IY,MY)
    IF(IDURR=MXDR) 634,633,633
633 CALL MXIMA(MXDR,IDURR,LOCOR1,LOCOR2,MSTATE,NUM,MO,DA,YR)
634 IV=NXVL(N,IX,MX)+NXV(N,IY,MY)
    ISTAM=ISTAML(N,IX,MX)+ISTAMF(N,IY,MY)

    WRITE(4,4029) N,IX,MX,N,IY,MY,IDURR,ISTAM

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4029 FORMAT(1H, ' CASE 2/5 RECOVERED. LPW(' ,3I3,')'+FPW(' ,
+3I3,')= ' ,I4,' WITH ISTAM=' ,I4,/)

      IF(ISTAM=MXTOT) 632,631,631
631 CALL MXIMA(MXTOT,ISTAM,LOCTT1,LOCTT2,MSTATE,NUM,M0,DA,YR)
632 NUMWET=NUMTL(N,IX,MX)+NUMTF(N,IY,MY)
      IDH=IDHL(N,IX,MX)+IDHF(N,IY,MY)
C IF THERE WERE END DRY HOURS <NDHR THEY HAVE NOT BEEN ADDED.
      IDH=IDH+KLD(N,IX,MX)
      IDRY=IDRY+KLD(N,IX,MX)

C IN CASE II AND V STORMS IF LAST OR FIRST HOUR HAD PCPN
C (I.E. IF KL OR KF .NE. ZERO) THERE IS ONE EVENT RATE
C NOT TET CALCULATED.

      KKL=KL(N,IX,MX)
      KKF=KF(N,IY,MY)
      IF(KKL=KKF)636,637,638
636 RATOT=FLOAT(NFP(N,IY,MY))/(FLOAT(NFWH(N,IY,MY))*100.)
      GO TO 637
638 RATOT=FLOAT(NLP(N,IX,MX))/(FLOAT(NLWH(N,IX,MX))*100.)
637 RATOT=RATOT+XRATL(N,IX,MX)+XRATF(N,IY,MY)

C WRITE(4,4007) RATOT,IV,IDURR,N,IY,MY
C 4007 FORMAT(1H, ' AT 4007, CASE 2 OR 5, RATOT,IV,IDURR,N,YR,M0= ',
C +F5.3,5I5,/)

      CASE2=CASE2+1

      CALL STORM(NEVENT,IV,N,RATOT,TOTRAT,IVSUM,IDURR,ISTAM,NUMWET,L,
+NSTM,ISTAM,SSUM,JGRSUM,NEV,ITHR,RATSUM,ITDUR,ISSDH,IDH)
      GO TO 602
C*****
C PROCESS A CASE I BRIDGED STORM PERIOD.
C*****
650 CONTINUE
      LPW(N,IX,MX)=LPW(N,IX,MX)-KLD(N,IX,MX)
      IDHHR=LPW(N,IX,MX)
      IV=NXVL(N,IX,MX)
      ISTAM=ISTAML(N,IX,MX)

      WRITE(4,4031) N,IX,MX,LPW(N,IX,MX),ISTAML(N,IX,MX),
+N,IY,MY,FPW(N,IY,MY),ISTAMF(N,IY,MY),LPD(N,IX,MX),
+FPD(N,IY,MY)
4031 FORMAT(1H, ' CASE 1 RECOVERED. LPW(' ,3I3,')=' ,I4,' WITH ISTAML
+' ,I4,'.FPW(' ,3I3,')=' ,I4,' WITH ISTAMF=' ,I4,/'
+1H, ' CASE 1 LPD & FPD=' ,2I3,/)

      IF(ISTAM=MXTOT) 652,651,651
651 CALL MXIMA(MXTOT,ISTAM,LOCTT1,LOCTT2,MSTATE,NUM,M0,DA,YR)
652 NUMWET=NUMTL(N,IX,MX)
      IDH=IDHL(N,IX,MX)
      RATOT=XRATL(N,IX,MX)

C WRITE(4,4009) RATOT,IV,IDURR,N,IX,MX
C 4009 FORMAT(1H, ' AT 4009, CASE 1, RATOT,IV,IDURR,N,YR,M0= ',
C +F5.3,5I5,/)

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LPSTM=LPSTM-1
CASE1=CASE1+1

CALL STOR4(NEVENT,IV,N,RATOT,TOTRAT,IVSUM,IDURR,ISTAM,NUMWET,L,
+NSTM,ISTAM,SSUM,JGRSUM,NEV,ITWHR,RATSUM,ITDUR,ISSDH,IDH)

FPW(N,IY,MY)=FPW(N,IY,MY)-KFD(N,IY,MY)
IDURR=FPW(N,IY,MY)
IV=NXV(N,IY,MY)
ISTAM=ISTAMF(N,IY,MY)

IF(ISTAM=MXTOT) 657,655,655
655 CALL MXIMA(MXTOT,ISTAM,LOCTT1,LOCTT2,MSTATE,NUM,MO,DA,YR)
657 NUMWET=NXWF(N,IY,MY)
IDH=IDHF(N,IY,MY)-KFD(N,IY,MY)
IDRY=IDRY-KFD(N,IY,MY)
RATOT=XRATF(N,IY,MY)

C WRITE(4,4009) RATOT,IV,IDURR,N,IY,MY

FPSM=FPSTM-1
CASE1=CASE1+1
CALL STORM(NEVENT,IV,N,RATOT,TOTRAT,IVSUM,IDURR,ISTAM,NUMWET,L,
+NSTM,ISTAM,SSUM,JGRSUM,NEV,ITWHR,RATSUM,ITDUR,ISSDH,IDH)
C ASSIGN LAST AND FIRST DRY HRS <NDHR TO ARRAYS FOR PROCESS AT DO 183.
LPD(N,IX,MX)=KLD(N,IX,MX)
FPD(N,IY,MY)=KFD(N,IY,MY)

GO TO 602

640 CONTINUE
C*****
C PROCESS CASE III STORMS. FIRST SITUATION LPW=0;FPW>0.
C*****
IF(FPW(N,IY,MY).EQ.0) GO TO 645
FPW(N,IY,MY)=FPW(N,IY,MY)-KFD(N,IY,MY)
IDURR=FPW(N,IY,MY)
IV=NXV(N,IY,MY)
ISTAM=ISTAMF(N,IY,MY)

WRITE(4,4037) N,IY,MY,TOURR,ISTAM,KFD(N,IY,MY)
4037 FORMAT(1H,' CASE 3a RECOVERED. FPA(',3I3,')=',I4,
+' WITH ISTAM=',I4,'. DRY HOURS REASSIGNED,KFD=',I4,/)

IF(ISTAM=MXTOT) 642,641,641
641 CALL MXIMA(MXTOT,ISTAM,LOCTT1,LOCTT2,MSTATE,NUM,MO,DA,YR)
642 NUMWET=NXWF(N,IY,MY)
IDH=IDURR-NUMWET
IDRY=IDRY-KFD(N,IY,MY)
RATOT=XRATF(N,IY,MY)

C WRITE(4,4011) RATOT,IV,IDURR,N,IY,MY
C 4011 FORMAT(1H,' AT 4011, CASE 3, RATOT,IV,IDURR,N,YR,MO= ',
C +F5.3,5I5,/)

CASE3=CASE3+1

```

```

      CALL STORM(NEVENT,IV,N,RATOT,TOTRAT,IVSUM,IDURR,ISTAM,NUMWET,L,
+NSTM,ISTAM,SSUM,JGRSUM,NEV,ITWHR,RATSUM,ITDUR,ISSDH,IDH)

      FPD(N,IY,MY)=KFD(N,IY,MY)

      GO TO 602
C*****
C  PROCESS CASE III WHEN LPW.GT.0;FPW=0
C*****
645  CONTINUE
      LPW(N,IX,MX)=LPW(N,IX,MX)-KLD(N,IX,MX)
      IDURR=LPW(N,IX,MX)
      IV=NXVL(N,IX,MX)
      ISTAM=ISTAML(N,IX,MX)

      WRITE(4,4039) N,IX,MX,IDURR,ISTAM,KLD(N,IX,MX)
4039  FORMAT(1H,' CASE 3b RECOVERED. LPW(',3I3,')=',I4,' WITH
+ISTAM=',I4,' DRY HOURS REASSIGNED,KLD=',I4,/)

      IF(ISTAM=MXTOT) 647,646,646
646  CALL MXIMA(MXTOT,ISTAM,LOCTT1,LOCTT2,MSTATE,NUM,MO,DA,YR)
647  NUMWET=NXTL(N,IX,MX)
      IDH=IDURR-NUMWET
      RATOT=XRATL(N,IX,MX)

C      WRITE(4,4011) RATOT,IV,IDURR,N,IX,MX

      CASE3=CASE3+1
      CALL STORM(NEVENT,IV,N,RATOT,TOTRAT,IVSUM,IDURR,ISTAM,NUMWET,L,
+NSTM,ISTAM,SSUM,JGRSUM,NEV,ITWHR,RATSUM,ITDUR,ISSDH,IDH)

      LPD(N,IX,MX)=KLD(N,IX,MX)

      IF(FPD(N,IY,MY).EQ.0) GO TO 648
648  GO TO 602

660  CONTINUE
C*****
C  PROCESS CASE IV, A SOLID WET PERIOD.
C*****
      IDURR=LPW(N,IX,MX)+FPW(N,IY,MY)
      IF(IDURR=MXOR) 664,662,662
662  CALL MXIMA(MXOR,IDURR,LOCDR1,LOCDR2,MSTATE,NUM,MO,DA,YR)
664  IV=NXVL(N,IX,MX)+NXV(N,IY,MY)+1
      ISTAM=ISTAML(N,IX,MX)+ISTAMF(N,IY,MY)

      WRITE(4,4041) N,IX,MX,N,IY,MY,IDURR,ISTAM
4041  FORMAT(1H,' CASE 4 RECOVERED. LPW(',3I3,')+FPW(',3I3,
+')=',I4,' WITH ISTAM=',I4,/)

      IF(ISTAM=MXTOT) 667,666,666
666  CALL MXIMA(MXTOT,ISTAM,LOCTT1,LOCTT2,MSTATE,NUM,MO,DA,YR)
667  NUMWET=NXTL(N,IX,MX)+NMTF(N,IY,MY)
      IDH=IDHL(N,IX,MX)+IDHF(N,IY,MY)
      LPH=NLP(N,IX,MX)+NFWH(N,IY,MY)
      LFP=NLP(N,IX,MX)+NFP(N,IY,MY)
      RR=FLUAT(LFP)/(FLUAT(LFH)*100.)

```

```

      RATOT=RR+XRATL(N,IX,MX)+XRATF(N,IY,MY)
C      WRITE(4,4013) RATOT,IV,IDURR,N,IY,MY
C 4013 FORMAT(1H," AT 4013, CASE 4, RATOT,IV,IDURR,N,YR,MO= ",
C      +F5.3,515,/)

      CASE4=CASE4+1
      CALL STORM(NEVENT,IV,N,RATOT,TOTRAT,IVSUM,IDURR,ISTAM,NUMMET,L,
      +NSTM,ISTAM,SSUM,JGRSUM,NEV,ITWHR,RATSUM,ITDUR,ISSDH,IDH)
      GO TO 602

C IF ONLY ONE PAIR CAN BE PROCESSED, (JD=2) JUMP OUT OF LOOP 660.

602 IF(JO.GE.2) GO TO 600
680 CONTINUE

600 CONTINUE

C *** RECOVER BRIDGED DRY PERIODS FROM SEGMENTS ASSIGNED TO ARRAYS.

163 DO 183 N=1,NX
      DO 179 IX=NFYR,NLYR
        IF(MMF(IX).GE.3) GO TO 179
        IF(MMF(IX)=1) 162,167,162
162      IY=IX
        IF(M1.EQ.12) IY=IX+1

164      IDURD=LPD(N,IX,M1)+FPD(N,IY,M2)
        IF(IDURD.EQ.0) GO TO 165
        IF(IDURD.LE.MXDRY) GO TO 166
        CALL MXIMA(MXDRY,IDURD,LCDRY1,LCDRY2,55,N,M2,01,IY)
166      NRDH=NRDH+IDURD
        CALL DRYPRD(IDURD,KK,ISUMD,NUMDP,IDHR,ITDHR)
        NRDP=NRDP+1

165      IF(MMF(IX).EQ.2) GO TO 179
        GO TO 169
167      IY=IX
        IF(M1.EQ.12) IY=IX+1
169      IDURD=LPD(N,IY,M2)+FPD(N,IY,M3)
        IF(IDURD.EQ.0) GO TO 179
        IF(IDURD.LE.MXDRY) GO TO 168
        CALL MXIMA(MXDRY,IDURD,LCDRY1,LCDRY2,66,N,M3,01,IY)
168      NRDH=NRDH+IDURD
        CALL DRYPRD(IDURD,KK,ISUMD,NUMDP,IDHR,ITDHR)
        NRDP=NRDP+1

179      CONTINUE
183      CONTINUE
C
C ***** DO TABLE 1-TOTALS AND AVERAGES FROM STORMS AND DRY PERIODS.
C
185 HCHCK=ITDHR+ITRHR+IDRY+MDH+MWH
      IGRSUM=JPTOT
      GRSUMP=FLOAT(JPTOT)/100.
      GAVSTRT=FLOAT(IGRSUM)/(FLOAT(ITRHR+IDRY)*100.)
      GAVEVHT=FLOAT(IGRSUM)/(FLOAT(ITRHR)*100.)

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```

AVSTDR=FLOAT(ITRHR5+IDRY)/FLOAT(SSUM)
AVDPDR=FLOAT(ITDHR5)/FLOAT(NUNDP)
C   AVEVRT=TOTRAT/FLUAT(NEVENT)
WRITE(4,177)
177 FORMAT(1H1,T62,"TABLE 1",//)
WRITE(4,191)
DO 187 L=1,NN
WRITE(4,195) MON(L),YR(L)
187 CONTINUE
WRITE(4,180)
180 FORMAT(1H ,T24,"AVG",T32,"AVG",T40,"AVG",T112,"AVG",/1H ,T24,
+ "STM",T32,"STM",T40,"DRY",T48,"NUM",T56,"NUM",T72,"SUM",
+ T80,"SUM",T87,"PSEUDO",T95,"SUM",T112,"EVENT",/1H ,
+ T3,"LAST",T17,"LAST",T24,"RATE",T32,"DUR",T40,"PRD",T48,
+ "OF",T56,"DRY",T63,"TOTAL",T72,"WET",T80,"DRY",T89,"WET",T95,
+ "EVNT",T104,"NUM",T112,"RATE",/1H ,T2,"STATE STATION YR/40",T24,
+ "IN./HR",T32,"HRS",T40,"HRS",T48,"STMS",T56,"PRDS",T63,"PCPN",
+ T72,"HRS",T80,"HRS",T89,"HRS",T95,"RATES",T104,"EVNTS",T112,
+ "IN/HR")
WRITE(4,190) LSTATE,NUM,YR,MO,GAVSTRT,AVSTDR,AVDPDR,SSUM,NUNDP,
+ GRSUMP,ITRHR5,ITDHR5,IDRY,TOTRAT,NEVENT,GAVEVRT
190 FORMAT(1H0,T3,I2,T9,I4,T16,I2,1X,I2,T24,F5.3,T31,F4.1,T39,F5.1,
+ T46,I6,T55,I6,T62,F8.2,T71,I7,T79,I8,T88,I5,T95,F7.2,T104,I6,
+ T112,F5.3)
XAMT=FLOAT(MXIP)/100.
XRATE=FLOAT(MXRTX)/10000.
XTOT=FLOAT(MXTOT)/100.
C   WRITE EXTREMES AND GRAND SUMS
WRITE(4,192) NDHR,XAMT,LOCAM1,LOCAM2,MXDR,LOCOR1,
+ LOCOR2,XRATE,LOCRA1,LOCRA2,XTOT,LOCTT1,LOCTT2,MXDRY,LCORY1,LCORY2,
+ ITDHR5,ITRHR5,IDRY,MDH,MWH,MRCHK,ITHRS,GSIPD,MP,IGRSUM,JGRSUM,
+ NSTA
192 FORMAT(1H0,"* INCLUDES DRY PERIODS OF .LE. ",I2," HRS DURATION",//
+ 1H0,"MAX HRLY AMT= ",F5.2," INCHES AT ",2(I6,1X)/
+ 1H , "MAX STORM DURATION= ",I3," HOURS AT ",2(I6,1X)/
+ 1H , "MAX EVENT RATE= ",F5.2," INCHES/HR AT ",2(I6,1X)/
+ 1H , "MAX STORM AMOUNT= ",F5.2," INCHES AT ",2(I6,1X)/
+ 1H , "MAX DRY PERIOD DURATION= ",I4," HOURS AT ",2(I6,1X)///
+ 1H , " SUM OF USABLE DRY HOURS(ITDHR5)= ",I8,/,
+ 1H , " SUM OF USABLE WET HOURS (ITRHR5)= ",I8,/,
+ 1H , " SUM OF USABLE PSEUDO WET HOURS (IDRY)= ",I8,/,
+ 1H , " TOTAL F & L DRY PRD HOURS NOT RECOVERED (MDH)= ",I8,/,
+ 1H , " TOTAL FIRST AND LAST WET PERIOD HOURS EXCLUDED(MWH)= ",I8,/,
+ 1H , " SUM OF ABOVE HOURS (MRCHK)= ",I8,/,
+ 1H , " TOTAL HOURS IN DATA (ITHRS)= ",I8,/,
+ 1H , " GRAND SUM OF STATION=MONTH PCPN AMT IN ALL DATA (GSIPD)= ",I8,/,
+ 1H , " TOTAL PCPN AMT EXCLD BY FIRST AND LAST PRDS (MP)= ",I8,/,
+ 1H , " GRAND SUM OF HRLY PCPN AMTS, IGRSUM= ",I8,/,
+ 1H , " GRAND SUM OF STORM AMOUNTS, JGRSUM= ",I8,/,
+ 1H , " NUMBER OF STATION=MONTHS PROCESSED (NSTA)= ",I5,/)
WRITE(4,194) MDH,MDH2,NRDH,CASE1,CASE2,CASE3,CASE4,NRDP
194 FORMAT(1H0,
+ " TOTAL FIRST AND LAST DRY PERIOD HOURS EXCLUDED(MDH)= ",I6,/,
+ 1H , " TOTAL F & L NON-BRIDGED DRY PRD HRS EXCLUDED(MDH2)= ",I6,/,
+ 1H , " TOTAL F & L BRIDGED DRY PRD HRS RECOVERED(NRDH)= ",I6,/,
+ 1H , " TOTAL CASE 1 STORMS RECOVERED= ",I6,/)

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+1H , ' TOTAL CASE 2 STORMS RECOVERED=          ',16, /
+1H , ' TOTAL CASE 3 STORMS RECOVERED=          ',16, /
+1H , ' TOTAL CASE 4 STORMS RECOVERED=          ',16, /
+1H , ' TOTAL DRY PERIODS RECOVERED=            ',16, /
+)
C
C ***** DO A FREQUENCY DISTRIBUTION TABLE OF DRY PERIOD DURATION. TABLE 2
C
      WRITE(4,196)
196  FORMAT(1H1,T62,'TABLE 2',//)
      WRITE(4,191)
191  FORMAT(1H ,T26,'HOURLY PCPN DATA FROM THE FOLLOWING MONTH=YR(S)',
+ ' WERE USED IN THIS TABLE',//1H ,T60,'MONTH/YR')
      DO 193 L=1,NN
      WRITE(4,195) MON(L),IYR(L)
195  FORMAT(1H ,T62,I2,'/',I2)
193  CONTINUE
      WRITE(4,197)
197  FORMAT(1H0,T46,'FREQUENCY DISTRIBUTION OF DRY PERIODS',/
+1H0,T11,'DRY PERIOD',T24,'NUMBER',T47,'SMOOTHED',/
+1H ,T3,'CLASS',T13,'CLASS',T26,'OF',T36,'PERCENT',T47,
+ ' AVERAGE',/1H ,T2,'NUMBER',T12,'(HOURS)',T24,'PERIODS',
+T35,'FREQUENCY',T47,'PERCENT',//)
      MD=(4XDRY/20)+3
      IF(MD.GT.42)MD=42
      DO 202 J=2,(MD)
      I=(J-1)
      PCTD(J)=FLOAT(ISUMD(J))*100./FLOAT(NUMDP)
      TPCT=TPCT+PCTD(J)
      ITDP=ITDP+ISUMD(J)
      IF(J.LE.3) GO TO 204
      AVG3(J)=(PCTD(J-2)+PCTD(J-1)+PCTD(J))/3.
204  WRITE(4,206) I,(IDPX(I)+1),IDPX(J),ISUMD(J),PCTD(J),AVG3(J)
206  FORMAT(1H ,T4,I2,T10,I5,'-',I4,T23,I5,T37,F5.2,T48,F5.2)
202  CONTINUE
      WRITE(4,204) ITDP,TPCT
204  FORMAT(1H0,T3,'TOTALS',T23,I6,T36,F6.2)
      GO TO 270
C
C *** ERRORS CAUSED BY BAD INPUT DATA ARE IDENTIFIED HERE, AND
C PROGRAM IS STOPPED.
C
250  WRITE(6,252) MD,DA,YR
252  FORMAT(1H ,T5,'NEG VALUE OF (DA=1) AT ',3I2)
      GO TO 400
254  WRITE(6,256) LDA,MD,DA,YR,MSTATE,NUM
256  FORMAT(1H ,T5,'(DA=LDA) CAME OUT ZERO. LDA= ',I2,' AT ',3I2,
+1X,I2,1X,I4)
      GO TO 400
258  WRITE(6,260) IDURR,MD,DA,YR,MSTATE,NUM,M
260  FORMAT(1H ,T5,'ABNORMAL VALUE OF IDURR. IDURR = ',I4,' AT ',
+3I2,1X,I2,1X,I4,' M= ',I8)
      GO TO 400
275  WRITE(4,277) I,NUM,LNUM,MD,DA,YR,MSTATE,M
277  FORMAT(1H ,T5,'AFTER I= ',I2,'PASSES NUM(OR LNUM)= ',2I5,
+ 'AT MD,DA,YR,MSTATE ',4I3,' (M= ',I8,')',
+ ' FAILED TO FIND A MATCH AT DO 212,241,222 OR 231. STOP')

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      GO TO 400
350  WRITE(6,280) HSTATE,NUM,MO,DA,YR,M
280  FORMAT(1H0,T5,"ERROR ENCOUNTERED IN READ OR M COUNT EXCEEDED AT ",
+I2,I4,1X,3I2,5X,"M= ",I8)
      GO TO 400
385  WRITE(6,287) IPD99
287  FORMAT(1H," IPD99= ",I3," TOO MANY HRS W/MISG DATA. STOP.")
      GO TO 400

270  CONTINUE
C
C ***** DO FREQUENCY TABLE FOR STORM DURATION STATISTICS. TABLE 3.
C
      WRITE(4,T55)
355  FORMAT(1H1,T62,"TABLE 3",//)
      SFX1=0.
      WRITE(4,191)
      DO 362 L=1,NN
      WRITE(4,195) MON(L),IYR(L)
362  CONTINUE
      WRITE(4,281)
281  FORMAT(1H0,T53,"STORM AND EVENT STATISTICS",/1H ,T52,
+ "(UNITS: INCHES, INCHES/HOUR)",//)
      WRITE(4,364)
364  FORMAT(1H0,T3,"STORM",T11,"CUM",T18,"NUM",T24,"TOT PCPN ",
+ " AVERAGE FRACTION SMOOTHED",T64,"TOTAL NO AVG NO OF ",
+ "FRACTION TOTAL NET GR.AV.NO AVG PCPN",T124,
+ "AVG PCPN",/1H ,T2,"LENGTH",
+T11,"PCT",T19,"OF",T24,"ALL STMS PCPN PER OF TOTAL 3-PT ",
+ "AVG",T65,"EVENTS EVNTS PER OF NMLIZD HRS IN",T103,
+ "HOURS IN RATE PER",T124,
+ "RATE PER",/1H ,T2,"(HOURS)",T18,"STMS",T24,
+ "IN CLASS STORM PCPN",T64,"IN CLASS STORM ",
+ "TOT PCPN EVNT CLSS EA. EVNT EVENT",T124,"STORM",
+ /1H ,T17,"(NSTM)",
+T25,"(TSTM) (AVPPS) (FRTOT) (AV3PT)",T66,"(NEV)",T74,
+ "(AVEVS) (CUMFR)",T94,"(ITWHR) (GAVHR) (AVPPE)",
+T124,"(AVSTRT)",/)
C  CALCULATE AND WRITE OUT VALUES FOR EACH CLASS IN THE FREQUENCY TABLE.
      MW=MXDR+3

C *** THE FOLLOWING STATEMENT IS A CHECK AGAINST HUGE LOOPS. COMMENTED
C OUT FOR REGIONS THAT EXPERIENCE LONG PERIODS OF PRECIPITATION.
C IF(MW.GT.200) MW=200

      DO 365 J=1,MW
      IF(NSTM(J).EQ.0) GO TO 367
C  CALCULATE AVG PCPN PER STORM FOR THIS CLASS.
      AVPPS(J)=TSTM(J)/FLOAT(NSTM(J))
      IF(NSTM(J).GE.1) NCT=NCT+1
C  CALCULATE THE AVG HRLY PCPN RATE PER EVENT, AND THE SUM OF THE RATES.
C ***TEST
      IF(NEV(J).LT.1) GO TO 363

      AVPPE(J)=TSTM(J)/FLOAT(ITWHR(J))
      AVSTRT(J)=TSTM(J)/FLOAT(NSTM(J)*(J))

```

```

      SSTMRT=SSTMRT+AVSTRT(J)
C      SRATSUM=SRATSUM+RATSUM(J)
C      CALCULATE THE GRAND AVG NO. OF HRS IN EACH EVENT IN CLASS J.
      GAVHR(J)=FLOAT(ITWHR(J))/FLOAT(NEV(J))
C      CALCULATE THE AVG NO. OF EVENTS PER STORM.
      AVEVS(J)=FLOAT(NEV(J))/FLOAT(NSTM(J))
367 IF(J=2) 369,369,371
369 AV3PT(J)=0.
C      CALCULATE THE FRACTION OF GRAND TOTAL PCPN FOR EACH CLASS.
371 FRTOT(J)=TSTAM(J)/(FLOAT(IGRSUM)/100.)
      IF(J.LE.2) GO TO 373
      AV3PT(J)=(FRTOT(J-2)+FRTOT(J-1)+FRTOT(J))/3.
373 SUMAVP=SUMAVP+AVPPE(J)
      SUMEV=SUMEV+NEV(J)
C      CALCULATE GR. SUM OF (NO. EVNTS X AV. PCPN RATE PER EVNT) OVER ALL CLASSES
      SFIXI=SFIXI+FLOAT(NEV(J))*AVPPE(J)
C      CALCULATE THE CUMULATIVE FRACTION OF TOTAL PCPN AT EACH CLASS.
      BASE(1)=0.
      CUMFR(J)=BASE(J)+FRTOT(J)
      BASE(J+1)=CUMFR(J)
      IZ=J-1
      PCT(J)=FLOAT(NSTM(J))/FLOAT(SSUM)
      BPCT(1)=0.
      CUMPCT(J)=BPCT(J)+PCT(J)

C ***TEST
      GO TO 368
363 WRITE(4,366) J,NEV(J),RATSUM(J)
366 FORMAT(1H," AT CLASS J= ",I3," NEV(J) AND RATSUM(J)= ",
+IS,F8.3)
C *****

368 BPCT(J+1)=CUMPCT(J)
      WRITE(4,375) J,CUMPCT(J),NSTM(J),TSTAM(J),AVPPS(J),FRTOT(J),
+AV3PT(J),IZ,NEV(J),AVEVS(J),CUMFR(J),ITWHR(J),GAVHR(J),AVPPE(J),
+AVSTRT(J)
375 FORMAT(1H,"I3,I3,I9,"(F4.2,"),T17,I5,T25,F7.2,I35,F5.2,
+T44,F5.3,T53,F5.3,"(I3,"),T66,I4,T75,F5.1,T85,F5.3,T95,
+I5,T104,F5.1,T113,F5.3,T121,F8.3)
365 CONTINUE
      EAVRT=SUMAVP/FLOAT(NCT)
      TPCPN=FLOAT(IGRSUM)/100.
      AMEAN=SFIXI/FLOAT(SUMEV)
      WRITE(4,377) SSUM,TPCPN,NEVENT,ITRHR, SUMAVP,SSTMRT
377 FORMAT(1H,"I3,"TOTALS",T16,I6,3X,F7.2,T64,I6,T94,I6,T111,F7.3,
+T120,F9.3,
+1H,"I18,"SSUM",T27,"TPCPN",T66,"NEVENT",T94,"ITRHR",//)
      WRITE(4,379) NCT,SUMAVP,EAVRT,SSTMRT,SUMEV
379 FORMAT(1H,"I5,"NUM OF CLASSES WITH STORMS (NCT)= ",T48,I3,/1H,"
+T5,"SUM AVG PCPN RATE PER EVNT (SUMAVP)= ",T48,F7.3,/1H,"T5,
+T50,F5.3,/1H,"T5,
+T50,F5.3,/1H,"T5,
+T47,F6.3,/1H,"T5,
+T43,I8)
      WRITE(4,383) NDHR
383 FORMAT(1H,"I5,"STORMS INCLUDE DRY PERIODS OF ",I2," HRS OR LESS")
      GO TO 400
400 STOP

```

```
SUBROUTINE MXIMA (MX,MVAR,LOC1,LOC2,MSTATE,NUM,MO,DA,YR)
INTEGER DA,YR
MX=MVAR
LOC1=MSTATE*10000+NUM
LOC2=MO*10000+DA*100+YR
RETURN
END
```

```

      SUBROUTINE DRYPRD(IDUHD,J,ISUMD,NUMDP,IDHR,ITDHRS)
C   A SUBROUTINE TO PROCESS THE DRY PERIOD JUST ENDED.
      INTEGER IDURD,KK,NUMDP,ITDHRS
      INTEGER IDPX(42),ISUMD(42),IDHR(42)
      DATA (IDPX(KK),KK=1,42) /0,20,40,60,80,100,120,140,160,180,200,
+220,240,260,280,300,320,340,360,380,400,420,440,460,480,500,520,
+540,560,580,600,620,640,660,680,700,720,740,760,780,800,2500/
      DO 100 J=1,42
        IF(IDURD-IDPX(J)) 80,80,100
      80  ISUMD(J)=ISUMD(J)+1
        IDHR(J)=IDHR(J)+IDURD
        NUMDP=NUMDP+1
        ITDHRS=ITDHRS+IDURD
C   WRITE 90 FOR A LISTING OF EACH DRY PERIOD AS IT OCCURS.
C       WRITE(4,90) IDURD
C  90  FORMAT(1H,T3,'IDURD= ',14)
C   INITIALIZE DRY PERIOD COUNTER FOR NEXT DRY PERIOD.
      IDURD=0
      GO TO 110
    100 CONTINUE
    110 RETURN
      END

```

```

      SUBROUTINE STORM(NEVENT,IV,N,RATOT,TOTRAT,IVSUM,IDURR,ISTAM,
+NUMWET,L,NSTM,TSTAM,SSUM,JGRSUM,NEV,ITWHR,RATSUM,ITDUR,ISSDH,IDH)

C   A SUBROUTINE TO PROCESS A STORM AFTER IT HAS ENDED.

      INTEGER NEV(300),ITWHR(300),ITDUR(300),ISSDH(300),NSTM(300)
      INTEGER IDH,IDURR,ISTAM,IV,IVSUM,JGRSUM,L,NUMWET,SSUM,NEVENT,N

      REAL TSTAM(300),RATSUM(300)
      REAL RATOT,TOTRAT

      NEVENT=NEVENT+IV
      TOTRAT=TOTRAT+RATOT

C   WRITE(4,4015) TOTRAT
C 4015 FORMAT(1H ,TS,"TOTRAT= ",F7.2)

      IVSUM=IVSUM+IV
      SSUM=SSUM+1
      JGRSUM=JGRSUM+ISTAM
C   SUMRAT(N) IS A SPECIFIC STATION VARIABLE FOR USE IN A DO LOOP.
C   INDIVIDUAL STATIONS, I.E. (N), ARE NOT BEING PROCESSED IN THIS VERSION.
C   SUMRAT(N)=SUMRAT(N)+RATOT
C   WRITE 349 IS FOR TROUBLE SHOOTING PURPOSES.

C   WRITE(4,349) IDURR,ISTAM,NUMWET,IDH
C 349  FORMAT(1H ," IDURR,ISTAM,NUMWET,IDH= ",4I4)

      L=IDURR
      NSTM(L)=NSTM(L)+1
      TSTAM(L)=TSTAM(L)+(FLOAT(ISTAM)/100.)
      NEV(L)=NEV(L)+IV
      ITWHR(L)=ITWHR(L)+NUMWET
      RATSUM(L)=RATSUM(L)+RATOT
      ITDUR(L)=ITDUR(L)+IDURR
      ISSDH(L)=ISSDH(L)+IDH
C   INITIALIZE THE STORM VARIABLES FOR THE NEXT STORM.
      ISTAM=0
      IV=0
      NUMWET=0
      RATOT=0.
      IDURR=0
      IDH=0
      L=0
      RETURN
      END

```


APPENDIX B

EXAMPLES OF OUTPUT

TABLE 1

HOURLY PCPN DATA FROM THE FOLLOWING MONTH-YR(S) WERE USED IN THIS TABLE

															MONTH/YR
															1/78
															2/78
															12/78
															1/79
															2/79
															12/79
															1/80
LAST STATE	LAST STATION	LAST YR/MO	AVG STP RATE IN./HR	AVG STP DWR HRS*	AVG DRY PRD HRS	NUM OF STMS	NUM DRY PRDS	TOTAL PCPN	SUM WET HRS	SUM DRY HRS	PSEUDO WET HRS	SUM EVNT RATES	NUM EVNTS	AVG EVENT RATE IN/HR	
47	5479	80 1	0.038	5.4	38.2	9493	9296	1952.95	48229	355547	2952	305.60	12445	0.040	

* INCLUDES DRY PERIODS OF .LF. 1 HRS DURATION

MAX HRLY AMT= 1.00 INCHES AT 111166 120378
 MAX STORM DURATION= 64 HOURS AT 275639 11078
 MAX EVENT RATE= 0.39 INCHES/HR AT 406402 120878
 MAX STORM AMOUNT= 6.32 INCHES AT 275639 11078
 MAX DRY PERIOD DURATION= 523 HOURS AT 550024 10104

SUM OF USABLE DRY HOURS (TIDHRS)= 355547
 SUM OF USABLE WET HOURS (TWRHRS)= 48229
 SUM OF USABLE PSEUDO WET HOURS (TDY)= 2952
 TOTAL F & L DRY PRD HOURS NOT RECOVERED (MDH)= 33606
 TOTAL FIRST AND LAST WET PERIOD HOURS EXCLUDED(MWH)= 306
 SUM OF ABOVE HOURS (HRCCHK)= 440640
 TOTAL HOURS IN DATA (TTHRS)= 440640
 GRAND SUM OF STATION-MON PCPN AMT IN ALL DATA (GSIPD)= 196037
 TOTAL PCPN AMT EXCLD BY FIRST AND LAST PRDS (MP)= 742
 GRAND SUM OF HRLY PCPN AMTS, JGPRSUM= 195295
 GRAND SUM OF STORM AMOUNTS, JGPRSUM= 195295
 NUMBER OF STATION-MONTHS PROCESSED (NSTA)= 609

TOTAL FIRST AND LAST DRY PERIOD HOURS EXCLUDED(MDH)= 33606
 TOTAL F & L NON-BRIDGED DRY PRD HRS EXCLUDED(MDH2)= 13
 TOTAL F & L BRIDGED DRY PRD HRS RECOVERED(MRHH)= 44376
 TOTAL CASE 1 STORMS RECOVERED= 0
 TOTAL CASE 2 STORMS RECOVERED= 27
 TOTAL CASE 3 STORMS RECOVERED= 15
 TOTAL CASE 4 STORMS RECOVERED= 29
 TOTAL DRY PERIODS RECOVERED= 314

TABLE 2

HOURLY PCPN DATA FROM THE FOLLOWING MONTH-YR(S) WERE USED IN THIS TABLE

MONTH/YR
 1/78
 2/78
 12/78
 1/79
 2/79
 12/79
 1/80

FREQUENCY DISTRIBUTION OF DRY PERIODS

CLASS NUMBER	DRY PERIOD CLASS (HOURS)	NUMBER OF PERIODS	PERCENT FREQUENCY	SMOOTHED AVERAGE PERCENT
1	1- 20	5517	59.35	0.00
2	21- 40	514	5.76	0.00
3	41- 60	788	8.48	25.53
4	61- 80	677	7.28	8.17
5	81- 100	458	4.93	6.90
6	101- 120	278	2.99	5.07
7	121- 140	167	1.80	3.24
8	141- 160	206	2.22	2.33
9	161- 180	119	1.28	1.76
10	181- 200	54	0.58	1.36
11	201- 220	44	0.47	0.78
12	221- 240	33	0.35	0.47
13	241- 260	56	0.60	0.48
14	261- 280	32	0.34	0.43
15	281- 300	21	0.23	0.39
16	301- 320	11	0.12	0.23
17	321- 340	1	0.01	0.12
18	341- 360	3	0.03	0.05
19	361- 380	1	0.01	0.02
20	381- 400	3	0.03	0.03
21	401- 420	5	0.05	0.03
22	421- 440	4	0.04	0.04
23	441- 460	0	0.00	0.03
24	461- 480	0	0.00	0.01
25	481- 500	2	0.02	0.01
26	501- 520	1	0.01	0.01
27	521- 540	1	0.01	0.01
28	541- 560	0	0.00	0.01
TOTALS		9296	100.00	

TABLE 3

MONTHLY PCPN DATA FROM THE FOLLOWING MONTH-YEAR WERE USED IN THIS TABLE

MONTH/YR

1/78

2/78

12/78

1/79

2/79

12/79

1/80

STORM AND EVENT STATISTICS
(UNITS: INCHES, INCHES/HOUR)

STORM LENGTH (HOURS)	CUM PCT	NUM OF STAS (NSTN)	TOT PCPN ALL STNS IN CLASS (TSTAM)	AVERAGE PCPN PER STORM (AVPPS)	FRACTION OF TOTAL PCPN (FRTOT)	SMOOTHED 3-PT AVG (AV3PT)	TOTAL NO EVENTS IN CLASS (NEV)	AVG NO OF EVNTS PER STORM (AVEVS)	FRACTION OF NMLI2D TOT PCPN (CUMFR)	TOTAL WET HRS IN EVNT CLSS (ITWHR)	GR.AV.NO HOURS IN EA. EVNT (GAVHR)	AVG PCPN RATE PER EVENT (AVPPE)	AVG PCPN RATE PER STORM (AVSTRT)
1	(0.32)	3071	40.05	0.01	0.021	0.000(0)	3071	1.0	0.021	3071	1.0	0.013	0.013
2	(0.44)	1146	40.95	0.04	0.021	0.000(1)	1146	1.0	0.041	2292	2.0	0.018	0.018
3	(0.55)	985	59.86	0.06	0.031	0.024(2)	1293	1.3	0.072	2647	2.0	0.023	0.020
4	(0.62)	880	65.57	0.10	0.034	0.028(3)	880	1.3	0.106	2520	2.9	0.026	0.024
5	(0.67)	508	65.81	0.13	0.034	0.033(4)	739	1.5	0.139	2309	3.1	0.029	0.026
6	(0.72)	457	87.87	0.19	0.045	0.037(5)	669	1.5	0.184	2530	3.8	0.035	0.032
7	(0.76)	409	86.54	0.21	0.044	0.041(6)	668	1.6	0.229	2604	3.9	0.033	0.030
8	(0.80)	374	84.07	0.28	0.043	0.044(7)	465	1.5	0.272	2271	4.9	0.037	0.035
9	(0.82)	265	89.76	0.34	0.046	0.044(8)	432	1.6	0.318	2218	5.1	0.040	0.038
10	(0.85)	229	84.78	0.37	0.043	0.044(9)	397	1.7	0.361	2122	5.3	0.040	0.037
11	(0.87)	198	93.79	0.47	0.048	0.046(10)	337	1.7	0.409	2039	6.1	0.046	0.043
12	(0.89)	185	93.33	0.50	0.048	0.046(11)	329	1.8	0.457	2076	6.3	0.045	0.042
13	(0.91)	155	99.68	0.64	0.051	0.049(12)	265	1.7	0.508	1905	7.2	0.052	0.049
14	(0.92)	126	83.32	0.66	0.043	0.047(13)	223	1.8	0.551	1667	7.5	0.050	0.047
15	(0.93)	100	69.61	0.70	0.036	0.043(14)	178	1.8	0.586	1422	8.0	0.049	0.046
16	(0.94)	80	67.21	0.84	0.034	0.038(15)	154	1.9	0.621	1206	7.8	0.056	0.053
17	(0.95)	75	65.31	0.87	0.033	0.034(16)	137	1.8	0.654	1213	8.9	0.054	0.051
18	(0.95)	55	49.35	0.90	0.025	0.031(17)	102	1.9	0.679	943	9.2	0.052	0.050
19	(0.96)	67	72.13	1.08	0.037	0.032(18)	116	1.7	0.716	1224	10.6	0.059	0.057
20	(0.96)	42	47.30	1.13	0.024	0.029(19)	77	1.8	0.741	805	10.5	0.059	0.056
21	(0.97)	44	57.89	1.32	0.030	0.030(20)	71	1.6	0.770	897	12.6	0.065	0.063
22	(0.97)	34	41.67	1.23	0.021	0.025(21)	61	1.8	0.792	721	11.8	0.058	0.056
23	(0.97)	34	46.76	1.38	0.024	0.025(22)	66	1.9	0.815	750	11.4	0.062	0.060
24	(0.98)	33	47.03	1.43	0.024	0.023(23)	61	1.8	0.840	764	12.5	0.062	0.059
25	(0.98)	33	41.76	1.27	0.021	0.023(24)	79	2.4	0.861	779	9.9	0.054	0.051
26	(0.98)	31	50.91	1.64	0.026	0.024(25)	61	2.0	0.887	776	12.7	0.066	0.063
27	(0.99)	19	29.67	1.51	0.015	0.021(26)	45	2.4	0.902	487	10.8	0.059	0.056
28	(0.99)	21	27.66	1.32	0.014	0.018(27)	44	2.1	0.916	565	12.8	0.049	0.047
29	(0.99)	19	27.57	1.45	0.014	0.014(28)	49	2.6	0.930	521	10.6	0.053	0.050
30	(0.99)	22	32.82	1.49	0.017	0.015(29)	46	2.1	0.947	636	13.8	0.052	0.050
31	(0.99)	13	17.84	1.37	0.009	0.013(30)	26	2.0	0.956	390	15.0	0.046	0.044
32	(1.00)	7	8.57	1.22	0.004	0.010(31)	21	3.0	0.960	210	10.0	0.041	0.038
33	(1.00)	7	7.54	1.06	0.004	0.006(32)	18	2.6	0.964	220	12.2	0.034	0.033
34	(1.00)	7	9.81	1.40	0.005	0.004(33)	16	2.3	0.969	229	14.3	0.043	0.041
35	(1.00)	7	10.34	1.48	0.005	0.005(34)	24	3.4	0.974	228	9.5	0.045	0.042
36	(1.00)	6	13.98	1.75	0.007	0.006(35)	18	2.3	0.982	278	15.4	0.050	0.049
37	(1.00)	3	3.90	1.30	0.002	0.005(36)	10	3.3	0.984	104	10.4	0.038	0.035

38	(1.00)	2	5.15	2.58	0.003	0.004(37)	5	2.5	0.986	73	14.6	0.071	0.068
39	(1.00)	3	6.23	2.08	0.003	0.003(38)	8	2.7	0.989	112	14.0	0.056	0.053
40	(1.00)	0	0.00	0.00	0.000	0.002(39)	0	0.0	0.989	0	0.0	0.000	0.000
41	(1.00)	0	0.00	0.00	0.000	0.001(40)	0	0.0	0.989	0	0.0	0.000	0.000
42	(1.00)	1	3.43	3.43	0.002	0.001(41)	3	3.0	0.991	40	13.3	0.086	0.082
43	(1.00)	2	2.59	1.29	0.001	0.001(42)	11	5.5	0.993	77	7.0	0.034	0.030
44	(1.00)	2	3.40	1.70	0.002	0.002(43)	8	4.0	0.994	82	10.3	0.041	0.039
45	(1.00)	0	0.00	0.00	0.000	0.001(44)	0	0.0	0.994	0	0.0	0.000	0.000
46	(1.00)	1	0.80	0.80	0.000	0.001(45)	2	2.0	0.995	45	22.5	0.018	0.017
47	(1.00)	0	0.00	0.00	0.000	0.000(46)	0	0.0	0.995	0	0.0	0.000	0.000
48	(1.00)	1	1.55	1.55	0.001	0.000(47)	8	8.0	0.995	41	5.1	0.038	0.032
49	(1.00)	0	0.00	0.00	0.000	0.000(48)	0	0.0	0.995	0	0.0	0.000	0.000
50	(1.00)	0	0.00	0.00	0.000	0.000(49)	0	0.0	0.995	0	0.0	0.000	0.000
51	(1.00)	0	0.00	0.00	0.000	0.000(50)	0	0.0	0.995	0	0.0	0.000	0.000
52	(1.00)	0	0.00	0.00	0.000	0.000(51)	0	0.0	0.995	0	0.0	0.000	0.000
53	(1.00)	0	0.00	0.00	0.000	0.000(52)	0	0.0	0.995	0	0.0	0.000	0.000
54	(1.00)	0	0.00	0.00	0.000	0.000(53)	0	0.0	0.995	0	0.0	0.000	0.000
55	(1.00)	0	0.00	0.00	0.000	0.000(54)	0	0.0	0.995	0	0.0	0.000	0.000
56	(1.00)	0	0.00	0.00	0.000	0.000(55)	0	0.0	0.995	0	0.0	0.000	0.000
57	(1.00)	0	0.00	0.00	0.000	0.000(56)	0	0.0	0.995	0	0.0	0.000	0.000
58	(1.00)	0	0.00	0.00	0.000	0.000(57)	0	0.0	0.995	0	0.0	0.000	0.000
59	(1.00)	0	0.00	0.00	0.000	0.000(58)	0	0.0	0.995	0	0.0	0.000	0.000
60	(1.00)	1	2.47	2.47	0.001	0.000(59)	3	3.0	0.997	58	19.3	0.043	0.041
61	(1.00)	0	0.00	0.00	0.000	0.000(60)	0	0.0	0.997	0	0.0	0.000	0.000
62	(1.00)	0	0.00	0.00	0.000	0.000(61)	0	0.0	0.997	0	0.0	0.000	0.000
63	(1.00)	0	0.00	0.00	0.000	0.000(62)	0	0.0	0.997	0	0.0	0.000	0.000
64	(1.00)	1	6.32	6.32	0.003	0.001(63)	3	3.0	1.000	62	20.7	0.102	0.099
65	(1.00)	0	0.00	0.00	0.000	0.001(64)	0	0.0	1.000	0	0.0	0.000	0.000
66	(1.00)	0	0.00	0.00	0.000	0.001(65)	0	0.0	1.000	0	0.0	0.000	0.000
67	(1.00)	0	0.00	0.00	0.000	0.000(66)	0	0.0	1.000	0	0.0	0.000	0.000
TOTALS		9493	1952.95				12445			48229		2.177	2.065
		SSUM	TPCPN				NEVENT			ITRRHS			

NUM OF CLASSES WITH STORMS (NCT)= 46
 SUM AVG PCPN RATE PER EVNT (SUMAVP)= 2.177
 SUMAVP/NCT = EST AV RATE (EAVRT)= 0.047
 SUM AVG PCPN RATE PER STORM (SSTMPT)= 2.065
 NUM OF EVENTS IN ALL CLASSES (SUMEV)= 12445

STORMS INCLUDE DRY PERIODS OF 1 HRS OR LESS

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