USER'S GUIDE FOR U.S. GEOLOGICAL SURVEY RAINFALL-RUNOFF MODELS--

REVISION OF OPEN-FILE REPORT 74-33

U.S. GEOLOGICAL SURVEY

Open-File Report 77-884

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PREFACE

A user's guide for U.S. Geological Survey rainfall-runoff models and associated data files was prepared in 1974 by Charles W. Boning. Since distribution of the guide in 1974, the system for storing and retrieving data in the computer files has changed and other rainfall-runoff models have been developed. The previous data base consisted of both a short-term (5- to 15-year records) and a long-term (60- to 70-year records) data file.

The short-term file contained unit rainfall and discharge and daily rainfall and evaporation data which were used to calibrate the models. The long-term file contained the same type of data, except for unit discharge; these data were collected at sites different from those for the short-term file. The long-term data were used to synthesize unit discharges. The new data base consists of the Daily and Unit Values Files. Each of these files contain short and long-term data.

New and revised computer programs have been developed to store and retrieve data in the files. Several programs that edit data, calibrate rainfall-runoff models, and synthesize peak discharges have been modified. Some programs, previously used for rainfall-runoff modeling are obsolete and were deleted from the computer program library.

This revised user's guide describes use of the new data files and programs for U.S. Geological Survey rainfall-runoff models.

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ABSTRACT

Modified versions of the rainfall-runoff model described by Dawdy, Lichty, and Bergmann (1972) are used in the U.S. Geological Survey as a means of synthesizing flood discharges for small drainage areas. Synthesized flood discharges derived through use of long-term (60-70 year) rainfall and evaporation data, provide a more representative time base than do short-term (5-15 year) discharge records obtained by conventional stream gaging techniques.

The rainfall, discharge, and evaporation data for use with rainfall-runoff models are stored in the Unit and Daily Values Files. Any of these data which were collected during the current or immediately preceding water year are stored on direct access, online disk files. Older data are stored in sequential files on magnetic tapes. Both the disks and tapes contain short-term data collected by the U.S. Geological Survey for calibration of models and long-term data for use in synthesis of long-term flood records.

Information in this report provides guidelines for the assembly, storage, and retrieval of data needed to use these models, and also provides description and documentation of computer programs for model calibration and flood-record synthesis.

INTRODUCTION

This guide describes computer programs and data files of the Geological Survey that are related to modeling of the rainfall-runoff process on small streams.

Rainfall-runoff models frequently are used by Geological Survey hydrologists to extend short-term (5-15 years) records of small stream floods. Runoff events for ungaged time periods are synthesized from the model using long-term (60-70 years) rainfall and evaporation records. The model employs digital computer solutions of mathematical relations to approximate the hydrologic processes of infiltration, soil moisture storage, and surface runoff routing. Constants and limits in the mathematical relations are determined to calibrate the model for a specific drainage basin from analyses of concurrent data on rainfall, evaporation, and runoff rates.

The basic form of the model for synthesis of flood records in small rural watersheds was developed during the 1960's, by Dawdy, Lichty, and Bergmann (1972). The computer program for this basic model has been modified to include internal optimization of model parameters, changes in methods of routing flows, and consideration of uniformly distributed impervious areas. The program for calibration of the rainfall-runoff model for a natural basin with one rain gage has been documented by Carrigan (1973). R. W. Lichty (written communication, 1974) expanded the capability of this program to model urban areas with up to five rain gages.

A large mass of data has been collected for use with the rainfall-runoff models. Much of the data were obtained by the Geological Survey through cooperatively financed programs with various Federal agencies, and the Federal Highway Administration in particular, with the highway or transportation agencies in most States, and with numerous municipal and local governmental agencies. Data on rainfall and runoff have been recorded systematically at nearly 2,000 sites in time increments ranging from daily to as short as 5-minutes during storms. In addition, long-term rainfall and evaporation data observed by other agencies have been assembled and processed for use in model synthesis.

Processing, storing, retrieving, and utilizing this large mass of data can be efficient only with modern computer facilities. Disk and tape files of data have been created in a central file system. The data can be made available upon request from the District Chief, Water Resources Division, U.S. Geological Survey, at addresses given at the end of this report.

Data from the files and related programs may be obtained in card-image form. All programs are written in PL/I language; although some programs are also available in Fortran language.

Inquiries on the availability of computer programs and the costs of obtaining such information should be addressed to:

Chief Hydrologist
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U.S. Geological Survey
National Center, MS 409
Reston, Virginia 22092

This user's guide contains instructions for use of the data files and computer programs for the various models. Unless otherwise noted, it is the users responsibility to prepare computer job decks for execution of programs.

Pages in this manual are numbered by section so that revisions and additions to the guide can be readily incorporated.

The next two sections respectively describe the organization and general procedures for storing and retrieving data and abstracts of computer-program cataloged procedures used for storing, retrieving, and editing data and for model calibration and flood-record synthesis.

A cataloged procedure is the means used with IBM computers by which the necessity of repetitiously writing job control instructions for a program, or nested programs, are avoided. Use of the cataloged procedure simplifies preparation of job decks and lessens card punching errors.

Subsequent sections give details for use of the individual cataloged procedures for programs that store, retrieve and edit data, calibrate models, and synthesize flood records. Each section describes the function of the procedure, the cards needed to invoke or to use a procedure (input instructions) the output and diagnostic error messages of the program, and an example of the utilization of a procedure (including input cards and output prints and cards).

Use of data files and computer programs for storage and retrieval of data, for calibration of models, and for synthesis of flood records is highly dependent on the hardware and software of the computer system presently operated by the Geological Survey. (See Supplementary Data for details of computer-system requirements.) Two data files, the Unit and Daily Values Files which are used with the rainfall-runoff models, are part of the National Water Data Storage and Retrieval System (Watstore). The system and its use are described in detail by Hutchison (1975, 1976).

Only short-term rainfall and runoff data may be obtained from the Geological Survey. Long-term rainfall data are available only from the agency furnishing the data, principally the National Climatic Center, National Oceanic and Atmospheric Administration, Asheville, N.C.

Acknowledgments

J. M. Bergmann, U.S. Geological Survey, developed many of the programs which would interface the Unit and Daily Values Files with retrieval, updating, editing, and model programs which are previously associated with the former file system described by Boning (1974).

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DATA FILES

Description of Data

Calibration of rainfall-runoff models requires four types of data (stored in tape and disk files): unit rainfall, unit discharge, daily rainfall and daily evaporation. Unit data for discharge and rainfall are recorded at time intervals of 30 seconds, 1, 5, 10, 15, 30, or 60 minutes. Unit data are defined only for the duration of storm events which produce significant floods during a year.

For synthesis of flood records, long-term observed daily rainfall and evaporation and unit rainfall data are required. The period of available record for long-term evaporation data is generally much less than that for rainfall data. The evaporation record is extended by synthesis. Synthetic evaporation records are not permanently stored in the files.

The long-term and unit rainfall data were principally provided by and are available from the National Climatic Center, Asheville, North Carolina. The long-term evaporation data were provided by and are available from the National Climatic Center and other supplying agencies. The long-term unit rainfall data usually consist of about five storms per year, defined at 5-minute time intervals.

A list of long-term data currently in the computer files will be found in Supplementary Data.

Computer Files

The unit rainfall and discharge and daily rainfall data may be entered in the files by direct translation of 16-channel paper tapes on which such information is commonly recorded. All data also may be entered in the files via punched cards or card-image input. The standard formats for card input are described in section 4.

The unit rainfall and discharge data are stored in the Unit Values File and daily rainfall and evaporation data in the Daily Values File. The data are divided into file records. Each record in the Daily Values File contains data for one water year. Each record in the Unit Values File contains data for one day (maximum capacity 2,880 unit values). The records in each file are stored in ascending order of the record-access key. The record-access key contains in order, state code, agency code, station identifier, cross-section locator, sampling depth, STORET parameter code, date, and statistic code.(See Hutchison, 1975, Appendix.) The date for daily records is the water year (Oct. 1 - Sept. 30) and for unit records is the calendar year, month, and day. The parameter (STORET) identifies the type of data (discharge, rainfall, evaporation). The statistic code indicates the basis of recording the data (instantaneous, cumulative).

Data only may be stored in and retrieved from a file provided the station has been properly identified in the Station Header File. (See Chap. III, Vol. 1, WATSTORE User's Guide, Hutchison, 1975, for description of the Station Header File.)

Initially, the data are stored on the Current Daily Values and Unit Values online disk files. Data management utilizes the index sequential access method of storage. Historical data are removed from the current files at six-month intervals and merged into the historical files on magnetic tapes. Data on the historical tapes are sequentially stored in ascending order by the key.

Initiation of an update of data (additions, changes, deletions), regardless of whether data are on the current or historical file, takes place on the current files. Updating of data in the current files is instantaneous. When data are retrieved from the historical file tapes, the current file is scanned for updating information; if an update to this historical data is necessary, the updated data are inserted into the retrieved historical data. Updated data temporarily overlays previously stored entries in the historical file for the current job execution.

At the 6-month maintenance interval when current record data are transferred to the historical file, the updated data are merged into the historical file.

Steps in entering, retrieving, editing, and merging data, and in utilizing the data are schematically shown in figure 2-1.

The volume-serial numbers of historical file tapes for each data type may be determined by use of the cataloged procedure MESSAGE (See Chap. 2, vol. 1 WATSTORE User's Guide, Hutchison, 1975).

Methods of Data Input

Three methods of entering data into the computer files are available: translation of 16-channel digital recorder paper tapes (section 3), standard format cards, and "Carter" format cards (section 4).

The method of identifying data in files for the rainfall-runoff model is a 15-digit number, a parameter code, and a statistic code. The previous file system used an 8-digit number in the computer files and on input data cards (designated "Carter" cards).

The capability of converting the 8-digit number to the 15-digit number and inputting the data properly into the files is available. This capability is important to users whose data have been previously punched on cards using the "Carter" format.

A separate cataloged procedure is used for each method of input.

Data Retrieval

All cataloged procedures associated with the rainfall-runoff models contain a processing step calling program H268 (Section 8) which retrieves data only from the current online disk files.

In the former system for storing and retrieving data, a negative one-inch daily rainfall (indicated by '-100') had to be entered into the daily

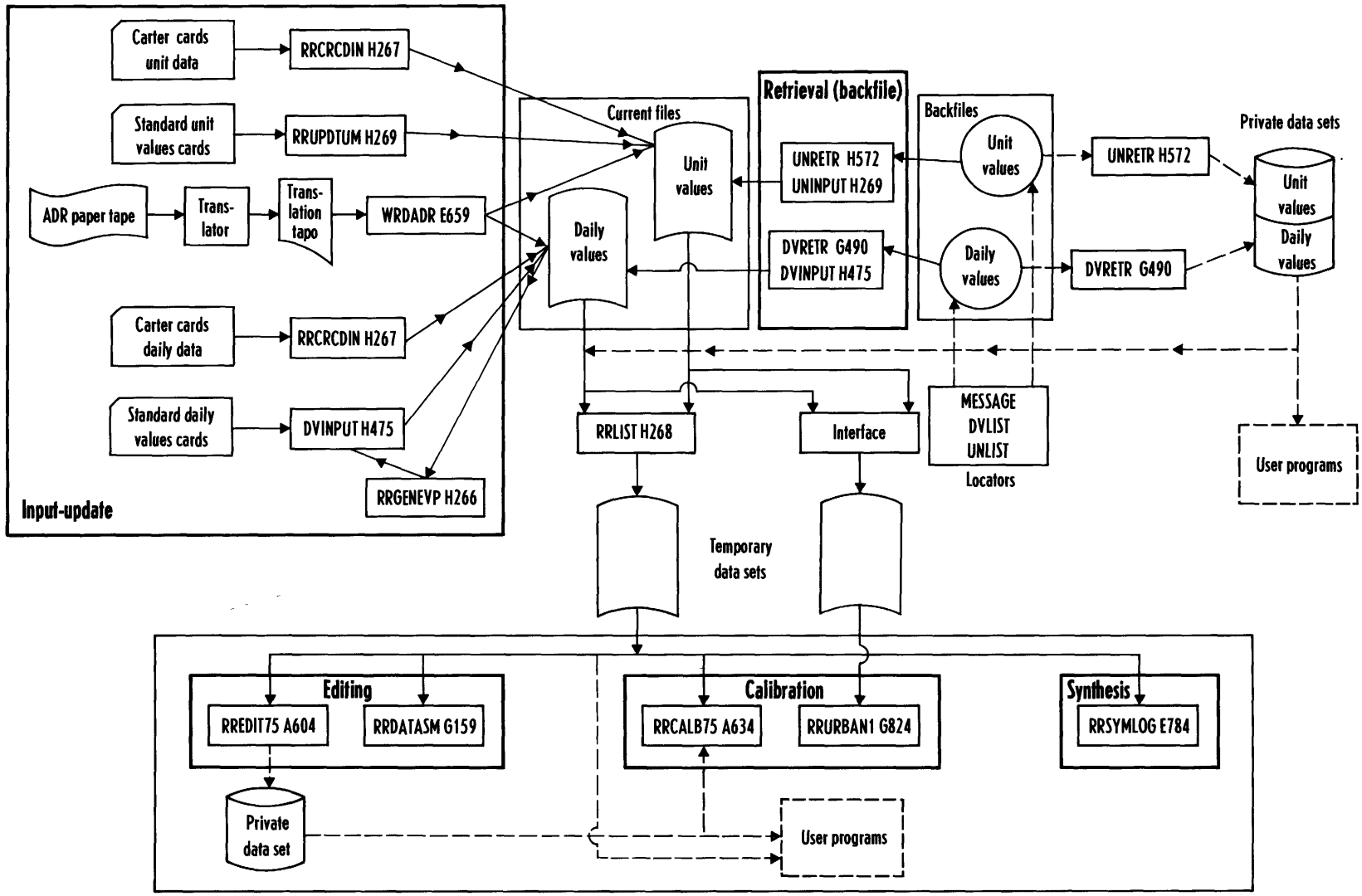

Figure 2-1. Flow chart for rainfall-runoff models programs system.

rainfall record for each day on which unit rainfall was recorded. This convention of using a '-100' storm indicator is no longer used in storing daily rainfall data. Use of this indicator is still a convenience in flagging days on which unit rainfall is defined in editing, calibrating, and synthesizing programs. Therefore, an interface program inserts the '-100' storm indicators into the daily rainfall array after retrieval from the current record disks. The user should not attempt to load the '-100' storm indicators in the Current or Historical Daily Values Files.

Data stored in the Unit and Daily Values Historical Files must be retrieved and stored on the current online disk files before they can be utilized by editing, calibrating, or synthesizing programs. These retrievals and loading on the current records disks are made using program G490, H475, H572 and H269 (Section 3).

Password Protection

Password-security protection exists for the Daily Values and Station Header Files. The Unit Values File is also password protected. The user is referred to the WATSTORE User's Guide for information on password protection.

Long-Term Data

Long-term rainfall data may be obtained from the National Climatic Center, Asheville, North Carolina (or other reliable sources). Steps taken in obtaining daily rainfall, identifying storms to be used in synthesis, and obtaining unit rainfall data follows:

1. Request available daily rainfall for the desired station from the National Climatic Center (NCC) at Asheville, North Carolina. The request should indicate that these data be on magnetic tape or on punched cards, and should be mailed to the Automatic Data Processing Unit, U.S. Geological Survey, 12201 Sunrise Valley Drive, National Center, Mail Stop 485, Reston, VA 22092, or to the user's terminal.

2. The data will be loaded into the Current Daily Values File by the Automatic Data Processing Unit or by the user at a terminal, using cataloged procedure RRCRCDIN.

3. Upon acknowledgment that daily rainfall has been loaded in the file, the user should edit the data using cataloged procedure RREDIT75 or RRDATASM.

4. The five storms that are most likely to produce the annual peak runoff should be identified using program G159 (section 10).

5. Request from NCC the unit rainfall for specific storm days, and enter these data into the Current Unit Values File in the same manner as for daily rainfall. The unit data should contain all rainfall, including interspersed periods of no rainfall that fell during the day.

PROCEDURE ABSTRACTS

Brief abstracts of each cataloged procedure used with rainfall-runoff models are presented to indicate their general purpose and capabilities. Individual procedure documentation is given in subsequent sections of this guide to provide instructions for use of those cataloged procedures which are not in Volumes 1 and 5 of the WATSTORE User's Guide and for preparation of input data for their execution. Those cataloged procedures which are described in Volumes 1 and 5 of the WATSTORE User's Guide are not documented in this report.

Note that none of the programs will execute unless information for each station is in the Station Header File. (See Instruction for Station Header File, Vol. 1, Chap. 3, WATSTORE User's Guide, Hutchison, 1975).

In the following table, each cataloged procedure is named and its function listed; the program numbers contained in the cataloged procedure are given to facilitate user reference in subsequent sections of this report; and, references to documentation for cataloged procedures described in Volumes 1 and 5 of the WATSTORE User's Guide are specified.

Table 3-1.--List of cataloged procedures used with rainfall-runoff model data processing and editing, model calibration, and synthesis of flood-peak discharges

Cataloged procedure name	Function	Program numbers	WATSTORE reference number
WRDADR	Computation of unit rainfall and discharge	E659	5
DVINPUT	Input and update of data in daily values file	H475	1
UNINPUT	Input and update of data in unit values file	H269	5
UNOPER	Special file operations which change identifiers, parameters, dates, and record disposition	H568	5
RRCARDED	Editing of cards in Carter format	A556	-
RRCRCDIN	Input of data cards with Carter format	H267, H475, H269	-
RRGENEVP	Synthesis of daily evaporation	H266, H475	-

Table 3.---(cont.)

Cataloged procedure name	Function	Program numbers	WATSTORE reference number
DVRETR	Retrieval of daily values from current and historical files	G475, G490	1
UNRETR	Retrieval of unit values from current and historical files	G475, H572	5
RRLIST	Retrieval of unit and daily values from current disk files	H268	-
RREDIT75	Retrieval and editing of unit and daily values	H268, A604	-
RRDATASM	Summarization of unit and daily data to evaluate suitability for use in calibration and synthesis	H268, G159	-
RRIDSYN	Test for identical distribution of annual flood discharges	J503	
RRIDTEST	Test for identical distribution of rainfall characteristics	J504	-
RRCALB75	Calibration of rainfall-runoff model for natural basins	H268, A604, A634	-
RRURBAN1	Calibration of a rainfall-runoff model for urban basins	J149, G824	-
RRSIMLOG	Synthesis of peak discharges using a rainfall-runoff model calibrated from procedure RRCALB75 or RRURBAN1 and Pearson Type-III flood-frequency computation	H268, E784, E675	-

The abstracts are grouped into five categories of program function: input of new data, data retrieval, editing, tests for identical distributions, and models. Each abstract is identified by the cataloged procedure name.

Input of New Data

WRDADR.--With this procedure, gage heights and rainfalls which are digitally recorded on 16-channel paper tape are translated into unit discharge, unit rainfall, and daily rainfall data. These data are stored in the Current Unit and Daily Values Files. Unit value data cards may be punched if requested (daily values not punched).

This program is the primary processing program for entering data into Unit Values files. It is also used to process all continuous records for entry into the Daily Values File.

Details on using this procedure are found in Section A, Chapter 1, Volume 5, WATSTORE User's Guide (Hutchison, 1976).

In this cataloged procedure, program E659 contains a subprogram XPRIME to compute unit discharge and a subprogram XQWMON to compute unit and daily rainfalls. Special features in each subprogram must be implemented in order to enter data into the Unit Values File. (See details in Chap. A, Vol. 5, WATSTORE User's Guide; Hutchison, 1976).

The processing steps of examining the paper tapes, specifying corrections to the tapes, magnetic tape translation of the paper tapes, setting up the computer job, and listing instructions on the input cards are virtually the same for processing unit rainfall and discharge as for processing daily discharge records. The task of loading rainfall and discharge data into the files differs from processing daily discharge records in certain specific instructions entered on the input cards.

DVINPUT.--The principal application of the procedure with rainfall-runoff models is to update (add, change, or delete daily records) the Daily Values File. Anytime this procedure is invoked, the updated data is written on the Current Daily Values File. This new data will always override the data in the Daily values Historical File upon merger of the files and if a '3' is entered in column 2 of the M card (Chap. 4, Vol. 1, WATSTORE User's Guide, Hutchison, 1975).

Several types of deletions may be done: Individual days, water years, specified periods (less or greater than a water year) on current and/or historical file.

The procedure is used to load retrieved records from the historical file onto the current file.

Instructions on input and update operations for this cataloged procedure are in Chapter 4, Volume 1 of the WATSTORE User's Guide (Hutchison, 1975, especially pages A14 and A59-A76).

UNINPUT.--Data for the unit values files may be added, changed, or deleted by using this cataloged procedure. The data are entered on the Current Unit Values File; any data on this file will override magnitudes in the historical file upon merger of the files and if a '3' is entered in column 2 of the M card.

Instructions on input and update operations for this cataloged procedure are in Chapter 3, Volume 5 of the WATSTORE User's Guide (Hutchison, 1976).

UNOPER.--Through use of this cataloged procedure, changes can be made to codes such as the agency, State, parameter, and statistic, and to the station

identifier. Another special operation is the facility of changing the recording interval for unit values. The procedure is used to delete records from the Unit Values Current and Historical Files.

All special file operations are described in Volume 5, WATSTORE User's Guide (Hutchison, 1976).

RRCARDED.--Up to three of the four types of Carter format cards can be edited at one time by the program. Diagnostic messages indicate continuity of card type, of dates, and of card sequencing, matching dates for unit rainfall and discharge, and invalid or potentially invalid data entries for rainfall and discharge. See Section 5.

RRCRCDIN.--Cards containing unit rainfall, unit discharge, daily rainfall, or daily evaporation data, punched in the Carter format are entered into the Current Unit Values and Daily Values Files. See Section 6.

RRGENEVP.--Daily evaporation is synthesized for the period prior to available evaporation records for use in the runoff synthesis program (cataloged procedure RRSIMLOG). Daily evaporation synthesized for one water year is used for every year of missing record. The synthetic evaporation data are entered into the Current Daily Values File. The data cannot be transferred to the historical files. Output from the program includes a listing of synthetic daily evaporation for the one year and an optional plot of the data. See Section 7.

Data Retrieval

Initially, all data will reside on online disks in the Current Unit and Daily Values Files. About every 3 to 6 months data with dates prior to the current and immediately past water years will be transferred to tapes for the Unit and Daily Values Historical Files. Methods to obtain inventories of data stored on historical files may be obtained by contacting the Automatic Data Section, U.S. Geological Survey, National Center, Mail Stop 437, 12201 Sunrise Valley Drive, Reston, VA 22092.

In order to utilize the data for any purpose, the unit values and the daily values on the historical files must be respectively copied onto the Current Unit and Daily Values (online disk) Files. In the process of copying from the tape files, these data will be merged with the data already in the Current Unit and Daily Values Files.

DVRETR.--Cataloged procedure DVRETR is the daily values retrieval system used in the National Water Data Storage and Retrieval System - WATSTORE (Hutchison 1975, Vol. 1, Chap. 4, p. 93-139). The data may be retrieved in the form of a printout, punch cards, or on magnetic tape or disk. The principal retrievals for use with the rainfall-runoff models and associated programs will be the standard daily values record format on magnetic disk.

The procedure provides the only means of retrieving and merging into one data set on the Current Daily Values File records that are located in both the current and historical files.

UNRETR.--This procedure contains the principal method of retrieval of unit values used in the National Water Data Storage and Retrieval System (WATSTORE). Unit values, rainfall and discharge, may be retrieved in the form of a printout, punch cards, and in the standard unit values record format on magnetic disk. It is the only means of retrieving and merging records that are located in both current and historical files and entering them into the data set on the Current Unit Values File.

Records which are retrieved from the historical files are written in the standard unit values record format in a temporary data set. If program H269 (procedure UNINPUT) is subsequently executed as the next step in the job, this temporary data set will be written into the Current Unit Values File.

This prinicipal purpose of this procedure for rainfall-runoff analysis is to create a complete data set (current and historical files records) on the current online disk files. Retrievals cannot be made unless the records have been identified in the Station Header File.

See Volume 5, WATSTORE User's Guide (Hutchison, 1976), for instructions in the use of this cataloged procedure.

RRLIST.--This procedure is used to retrieve data from both the Current Unit and Daily Values Files; output of the program includes a printout of data retrieved, creation of a temporary disk file to pass data to subsequent user programs, and punches data on cards in the Carter format. See Section 8.

The cataloged procedure for this program is limited in use to list, pass, and (or) punch the data. Program H268, the only program in the procedure is imbedded in other cataloged procedures (RREDIT75, RRDATASM, RRCALB75, RRSIMLOG) to retrieve data and create a temporary disk file of these data for use as input to other programs in these cataloged procedures. A temporary index sequential file needed by the other programs in these cataloged procedures is created by an interface program (not described in this user guide), which follows program H268. The use of program H268 in these cataloged procedures is indicated by the data definition card: //H268.SYSIN DD *.

An additional program J149 retrieves from both the Current Unit and Daily Values Files like program H268, except that card images with instream delimiters are created, and these data are subsequently used by program G824, cataloged procedure RRURBAN1. The use of program J149 in this procedure is indicated by the data definition card: //J149.SYSIN DD */

If the user wished to create a special purpose data set in a user library on tape or disk, the Automatic Data Section, U.S. Geological Survey, National Center, Mail Stop 437, 12201 Sunrise Valley Drive, Reston, VA 22092, should be contacted.

Editing

RREDIT75.--Several options for editing and retrieving data are available in this procedure:

1. Dates of data in the Current Unit and Daily Values Files are compared to insure all storm periods have been identified. Dates of the storm periods and dates of missing data in either file are listed in the printed output.

2. A user file of selected data may be created.

3. A tape suitable for a Calcomp plot of unit rainfall and/or discharge versus time may be obtained.

4. Unit and (or) daily data for selected time periods may be listed.

5. Punched cards in Carter format may be obtained for selected data.

6. The daily and storm rainfall and runoff are listed to evaluate the suitability of including the data in model calibration.

See Section 9.

RRDATASM.--Unit and daily data (rainfall, runoff, evaporation) are summarized to evaluate suitability for use in calibration or synthesis. Options include the following:

1. Compute monthly and annual rainfall and (or) evaporation with optional punched card output.

2. Indicates daily rainfall for which unit data are available with magnitudes which are unusually high.

3. Defines the number of peaks in a storm and determines the beginning and ending times, duration, and total rainfall and runoff of each storm.

4. Computes the maximum annual rainfall for selected durations and optionally creates punched cards in a format for use in computation of Pearson type III frequency curve by program E675 (Isherwood and others, 1976).

5. Identifies the five highest storm 1- or 2-day rainfalls in a year which exceed a selected (or default) threshold.

See Section 10.

Tests for Identical Distributions

The Cramer-von Mises test (Conover, 1971) for identical distributions is used in the following two procedures. Output from either procedure will indicate whether the hypothesis of identical distribution of two records is not acceptable at the one or five percent level of significance.

RRIDSYN.--Tests whether the synthetic annual flood discharges generated from two or more long-term rainfall and evaporation records for the same streamflow site are identically distributed. See Section 11.

RRIDTEST.--Records of annual precipitation or evaporation or of maximum annual precipitation for selected duration (5 min. ..., 1 hour, ...) observed at different sites are tested for identical distribution. See Section 12.

Models

RRCALB75.--The procedure is used to calibrate a rainfall-runoff model for natural basins, or urban basins considered to have a uniform distribution of impervious areas. Only one rainfall record is used for input data. The magnitudes of up to 10 parameters are determined through an optimizing procedure. Options are available to base the calibration on the maximum peak or on multiple peaks occurring within each storm, on separation of estimated base flow discharge, and on exclusion of selected floods. The routing of rainfall excess is accomplished using a triangularly shaped translation hydrograph and a linear reservoir storage.

A line printer plot of the time distribution of total and excess unit rainfall and observed and computed unit discharges may be optionally obtained. See Section 13.

RRURBAN1.--The procedure (program G824) is used to calibrate an urban model, which is an extension of the natural basin model, program A634. Multirain gage data are acceptable as input and, it is specially designed to accommodate spatially heterogeneous impervious areas. The basin is divided into areas associated with each rain gage. A translation hydrograph must be determined for each of these areas with the distribution of pervious and impervious areas separately described. In the calibration, magnitudes of up to nine parameters are determined through an optimizing procedure. Options available in the natural basin procedure for selection of peaks, base flow separations, and storm events are also included in this procedure. See Section 14.

RRSIMLOG.--The parameters obtained through the calibration program A634 or G824 are used with long-term rainfall and evaporation data to generate synthetic peak discharges. The peak discharges synthesized for each storm within a year and the ranked annual peak discharges are listed by the program; the annual peak discharges are passed in the procedure to program E675, for Pearson Type-III flood-frequency computation (Isherwood and others, 1976). See Section 15.

CARD FORMATS FOR UNIT AND DAILY VALUES DATA

Two systems of card formats for unit rainfall, unit discharge, daily rainfall, and daily evaporation may be used as input to the Unit and Daily Values Files and retrieved from these files. One system of formating is consistently referred to as the "Carter format"; this format was used for input and retrieval of data from the former Rainfall-Runoff Model Files. The other system of format is consistently referred to as the "ADP format." The ADP format is the standard by which cards should be punched. The Carter format is being maintained so that previously prepared card decks of rainfall-runoff data may be entered into the files and card decks can be reproduced for use with 'stand-alone' programs. Do not use the Carter format for unit data recorded at less than 5-minute intervals; use the ADP format.

In each system of formats, there is one type of format for unit values and another type for daily values.

Carter Format

Unit rainfall and unit discharge

Column	Description
1-8	8-digit station identifier.
9-10	Last 2 digits of calendar year.
11-12	Calendar month.
13-14	Day of month.
15-16	Recording interval in minutes.
17-18	Card number, i.e., for 5-minute data, card 1 will contain data for first hour of the day, card 2 for second hour, etc. For 15-minute data, card 1 will contain data for first 3 hours of the day, etc.
19-78	Twelve 5-column data fields.
79	Century code. If data prior to 1881, an '8' must be entered, otherwise, leave blank.
80	'1', unit rainfall data; '2', unit discharge data. If the data for all twelve fields (cols. 19-78) are missing or zero, then the card need not be punched.

Column	Description
80 continued.	However, the card number for this omitted card must be taken into account when numbering other cards for the day.

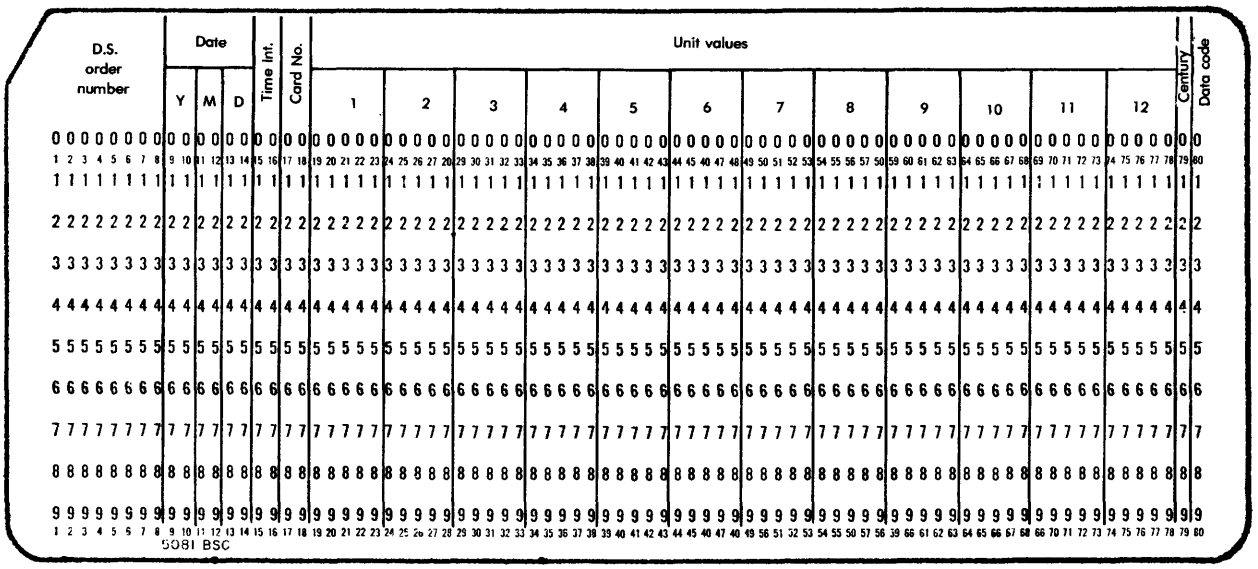

Figure 4-1.--Carter format for unit value of rainfall and disharge

Daily rainfall and daily evaporation

Column	Description
1-8	8-digit station identifier.
9-10	Last 2 digits of calendar year.
11-12	Calendar month.
13	Card number: '1', first 16 days of month, '2', remaining days of month.
14-77	Sixteen 4-column data fields.
78	Blank.
79	Century code. If data prior to 1881, an '8' must be entered, otherwise leave blank.
80	'3', daily rainfall data; '4', daily evaporation data.

Zero values should be punched if error messages in editing the card deck (program A556, RRCARDED, Section 5) are to be avoided.

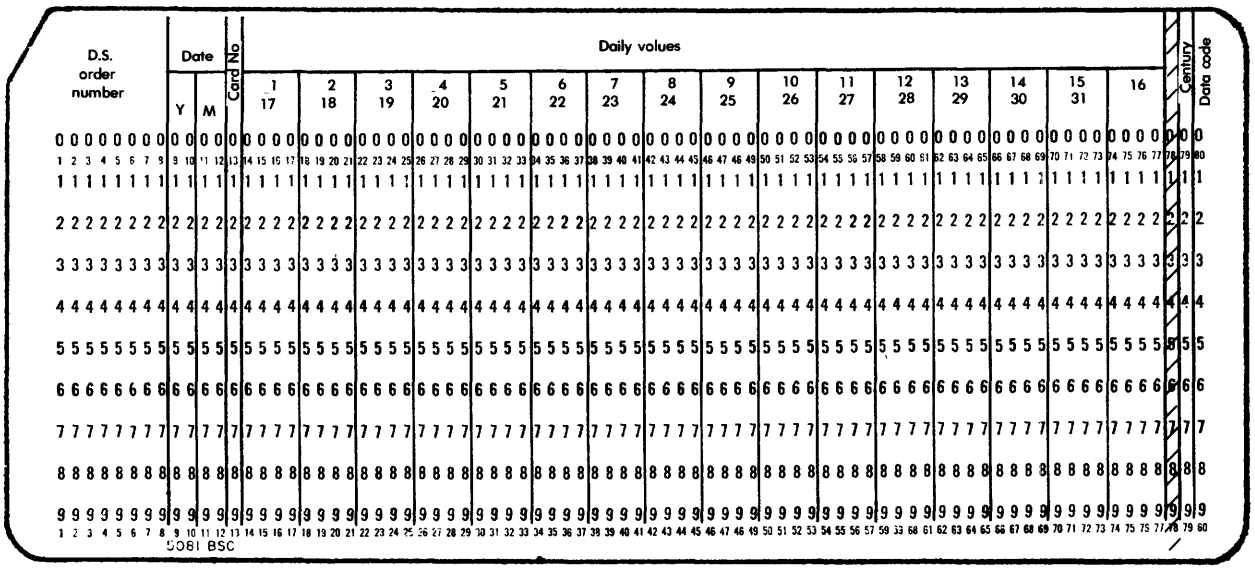

Figure 4-2.--Carter format for daily values of rainfall and evaporation

ADP Format

Unit values

a. Code card

Column	Description
1	Card type '2'.
2-16	15-digit station identifier.
17-28	Blank.
29-33	Parameter code '00045', unit rainfall '00060', unit discharge.
34-38	Statistic code '00006', unit rainfall '00011', unit discharge.
39-79	Blank.
80	'1' signifies updated records will be printed; otherwise leave blank.

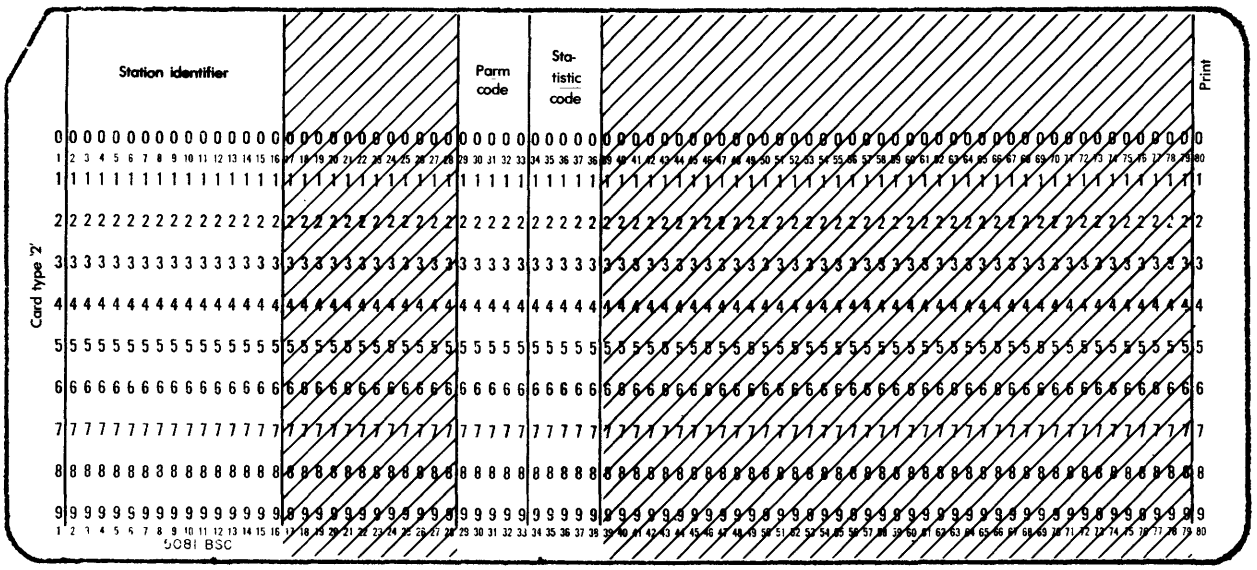

Figure 4-3.--ADP format for card type 2, defining parameter and statistics codes for station

b. Unit values card(s)

Column	Description
1	Card type 'B'.
2-16	15-digit station identifier.
17-20	Calendar year.
21-22	Calendar month.
23-24	Day of month.
	Time of observation in day
25-26	Hour (24-hour system)
27-28	Minute
29-30	Second.
	'DEL' in columns 25-26 will delete entire record for the day in Current Unit Values File, if '999999' is entered in cols. 39-45 and in Historical File if '999998' is entered in cols. 39-45.

Column	Description
31-35	Reading per day (right justified). Must be evenly divisible into 2880.
36-38	Blank.
39-80	Six 7-column fields. A value of '999999' in any field will delete data for that unit time interval from Current Unit Values File. A value of '999998' will delete from Unit Values Historical File.

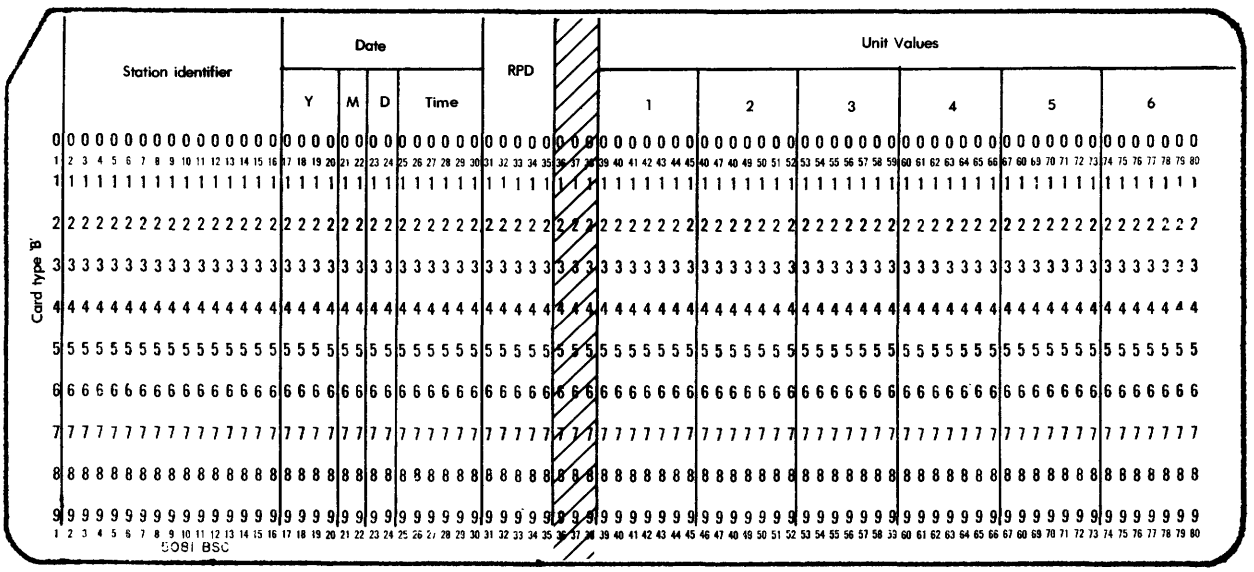

Figure 4-4.--ADP format for card type B, which is used for unit values

Daily values

a. Code card

Column	Description
1	Card type '2'.
2-16	15-digit station identifier.
17-28	Blank.
29-33	Parameter code '00045', daily rainfall '00050', daily evaporation.

Column	Description
34-38	Statistic code '00006', daily rainfall and evaporation.
39-80	Blank.

Refer to figure 4-3 for ADP format for card type 2, which is used for daily values.

b. Daily values card(s)

Column	Description
1	Card type '3'.
2-16	15-digit station identifier.
17-20	Calendar year.
21-22	Calendar month.
23-24	Card number: '1' - Days 1-8 '2' - Days 9-16 '3' - Days 17-24 '4' - Days 25-31.
25-80	Eight 7 - column fields (whole numbers right justified, decimal point punched for others). A value of '999999' will delete data for day from Current Daily Values File. A value of '999998' will delete from Daily Values Historical File.

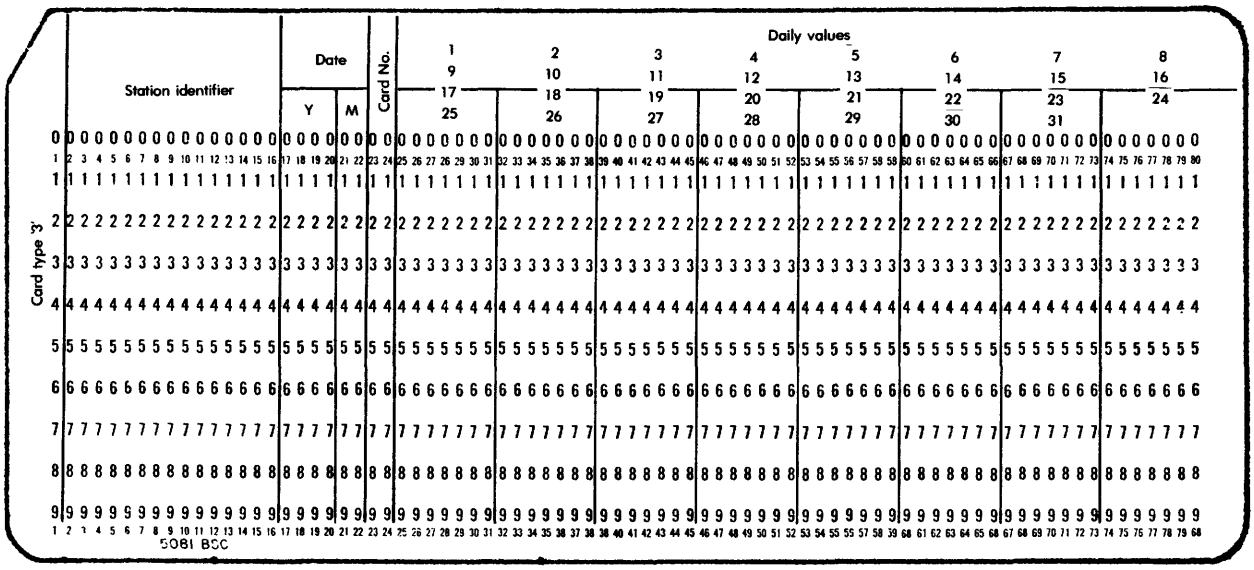

Figure 4-5.--ADP format for card type 3, which is used for daily values

EDIT OF CARDS PUNCHED IN CARTER FORMAT

Program A556

Cataloged Procedure RRCARDED

Description

The program A556 (RRCARDED) provides an edit of rainfall-runoff unit or daily data coded in the 'Carter' formats (Section 4). A card deck or card images on magnetic tape is permissible program input.

Types of input data acceptable to the program are unit discharge and rainfall, and daily rainfall and evaporation. However, the program is restricted to only three data-card types in any single program execution.

The only program output is a printed listing of information and (or) diagnostic messages which indicate invalid or potentially invalid rainfall-runoff data punched on the cards. Included are an edit of card-type, date, card sequence, and data value fields. In addition, an edit for matching dates for unit rainfall and discharge is performed.

If "-100" indicators are punched on daily rainfall cards, these days should be changed to the actual quantity of daily rainfall after this edit and prior to entry to the Daily Values Files (program H267, section 6).

Cataloged Procedure

```
/*RELAY PUNCH RE2
//xxxxxxxx JOB (-------)
/*PROCLIB  WRD.PROCLIB
// EXEC RRCARDED
//A556.FT05F001 DD *
          .
          .
          .
    Control card, followed by rainfall-runoff cards in the Carter format
          .
          .
          .
//
$$$
```

The format of the control card is given later in this section.

Tape Input

If data is to be read in card image form from magnetic tape, the following must be added following the 'EXEC' card in addition to the appropriate tape setup card:

```
//A556.FTaaF001 DD DSN=name,DISP=(OLD,KEEP),UNIT=2400,LABEL=(,SL,,IN),
//  DCB=(DEN=y,RECFM=FB,LRECL=80,BLKSIZE=tttt),VOL=SER=ssssss
```

Where aa represents the user designated FORTRAN tape drive input device (must be the same as coded in cols. 1-2 on control card), name represents file name on tape, y represents the tape density, tttt represents the blocksize of input records, and ssssss represents the volume-serial number of the tape.

NOTE: The tape reference (aa), DSN, UNIT, LABEL, DCB, and VOL=SER= will vary depending on user choice and the particular input tape. A control card is required with tape input.

Input Cards

1. Control card (Required):

The program requires one control card, and this card must precede any rainfall-runoff Carter-format data cards in the job stream. Two fields are used on the control cards; the card format follows:

Column(s)	Identifier	Coding
1-2	Input device number	If card input only, code a "5" in col. 2. If tape input, code the input device designation (a number greater than 9).
3		Always blank.
4 [a/]	Number of types of data to be considered in the edit.	Code one of the following: '1' = only one type of data '2' = two types of data '3' = three types of data.
5-80		Always blank.

a/ This field is used by the program to check for missing data. Data which is to be edited for missing data should be grouped together in the input stream (example: daily rainfall followed by unit rainfall, or unit rainfall followed by unit discharge).

2. Carter Card formats:

   a. Unit rainfall (Type 1), unit discharge (Type 2), daily rainfall (Type 3), and daily evaporation (Type 4) data-card formats are described in section 4.

SPECIAL NOTES:

1. Rainfall and evaporation data on Carter cards should be punched in hundredths of inches without the decimal; i.e., a punched value of 244 represents 2.44 inches.

2. Discharge is punched in cfs (cubic feet per second) with or without a decimal.

3. Data values should be right justified in the data fields.

4. Data cards in each data set must be arranged in ascending time sequence.

Diagnostic Messages

The diagnostic messages for program A556, are in the form of a statement and are generally self-explanatory. The message(s) describe corrections that should be made to the 'Carter' cards prior to entering data into the files.

Messages:

1. NO DATA CODE IN COL 80 - MAY BE CHANGE IN DATA CODE - STATION - 'station ID' CARD # 'card number'

2. NON-NUMERIC CHARACTERS - 'station ID' CARD # 'card number'

3. CHANGE IN STA. NUMBER - 'station ID' CARD # 'card number'

4. CHANGE IN DATA CODE - 'station ID CARD # 'card number'

5. INVALID TIME CODE - 'station ID' CARD # 'card number'

6. INVALID MONTH CODE - 'station ID' CARD # 'card number'

7. INCORRECT TIME CODE - 'station ID' CARD # 'card number'

8. INCORRECT UNIT DATA CARD SEQUENCE - 'station ID' CARD # 'card number'

9. UNIT DATA (FIELD XX) TOO LARGE? - 'station ID' CARD # 'card number'

10. UNIT DATA (FIELD XX) BLANK - 'station ID' CARD # 'card number'

11. UNIT DATA SEQUENCE ERROR - 'station ID' CARD # 'card number'

12. IMBEDDED BLANK IN DATA FIELD - 'station ID' CARD # 'card number'

13. BREAK IN YEAR SEQUENCE - 'station ID' CARD # 'card number'

14. BREAK IN MONTH SEQUENCE - 'station ID' CARD # 'card number'

15. BREAK IN CARD SEQUENCE - 'station ID' CARD # 'card number'

16. DAILY DATA (DAY XX) BLANK - 'station ID' CARD # 'card number'

17. DAILY DATA SEQUENCE ERROR - 'station ID' CARD # 'card number'

In most messages, an image of the card causing the message and its position in the deck is printed.

Example of Setting Up Job

An example of a complete job and deck including cards in the Carter format to be edited is listed below.

Several types of errors have been inserted in the Carter format cards to illustrate editing messages which appear in the line printer output from this program; this output follows the listing of the card deck.

Data listed on the Carter format cards are unit rainfall (code 1) and discharge (code 2) for Little Beaver Creek near Rolla, Missouri with station identifiers 06931500 and daily evaporation (code 4) for the Lakeside Evaporation Pan Site, Missouri, for the month of June, 1948. Note that an 8-digit identifier furnished by the user which is the same as the streamflow station downstream order number has been used.

After editing, the Carter format cards would be loaded into the Current Unit and Daily Unit Files using RRCRCDIN (section 9) providing proper site information has been previously stored in the WRD Station Header File.

PROGRAMMER ______ DIVISION ______

LOCATION ______ PHONE ______

U. S. DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

COMPUTER CODING FORM

PROGRAM NO. ______

PROJECT ______

SHEET ___ OF ___

PROGRAM IDENTIFICATION: ______

PROGRAM INFORMATION: ______

STATEMENT IDENTIFICATION

```
//*RELAY  PUNCH REZ
// XXXXXXXX JØB (-------)
//*PRØCLIB  WRD.PRØCLIB
// EXEC RRCARDED
//A556.FT05F001 DD *
 5 3
0693150048 61715 8    0    0    0   13   55   14    1    0    0    0    0    0 1
0693150048 61815 3    3    3    3    3        3    3    3    3    3    3    2 1
0693150048 61715 1    0    0    0    0    0    0    0    0    0    0    0    0
0693150048771715 2    0    0    0    0    0    0    0    0    0    0    0    0
0693150048 61715 3    0    0    0    0    0    0    0    0    0    0    0    0
0693150048 61788 4    0    0    0    0    0    0    0    0    0    0    0    0
0693150048 61715 5  888    0    0    0    0    0    0    0    0    0    0    0
0693150048 61715 6   12   16   20   23   21   20   17   15   13   11    9    7
0693150048 61715 7    6    6    5    5    5    5    4    4    3    3    3    3
0693150048 61715 8    3         2    2    2    2   10   17  160  376  290  192
0693150048 61815 1  150  115   75   47   40   37   32   28   24   20   18   17
0693150048 61815 2   17   16   15   15   14   13   12   10   10   10   10   10
0693150048 61815 3   10   UX   10   10   10   11   12   13   14   15   17   18
0693150048 61815 4   19   20   20   21   20   20   19   18   17   16   15   15
0693150048 61815 5   14   14   13   13   13   12   12   12   11   11   11   10 2
0693150048 61815 6   10   10   10   10   10    9    9    8    8    7    7    7
0693150048 61815 7    7    6    6    6    6    5    5    5    5    5    5    5 2
0693150048 61815 8    5    5    5    5    5    5    5    5    4    4    4    4 2
0693150048 61  23  24  25  27  26  34  15  30  38  26  25  26  24  21  39  15  4
0693150048 62  10   0  17  22  19  14   8   6  18   5  10  17  16  16         4
//
$$$
```

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0 = ZERO | Ø = ALPHA O | 1 = ONE | I = ALPHA I | 2 = TWO | Z = ALPHA Z | / = SLASH | ‖ = VERT. BAR | - = MINUS | _ = HORZ. BAR

PROGRAM CODING FORM

GPO : 1968 O - 286-594

RAINFALL-RUNOFF-MODEL DATA EDIT

```
UNIT DATA (FIELD  5) BLANK --      0693150048 61815 3    3    3    3    3         3    3    3    3    3    3    2 1 CARD #      2
   2 CARDS WITH DATA CODE  1 AT STATION 06931500                                                                CARD #'S      1 TO      2
CHANGE IN DATA CODE --           0693150048 61715 1    0    0    0    0    0    0    0    0    0    0    0    0    0 2 CARD #      3
INVALID MONTH CODE --              0693150048771715 2    0    0    0    0    0    0    0    0    0    0    0    0    0 2 CARD #      4
UNIT DATA SEQUENCE ERROR --        0693150048 61715 3    0    0    0    0    0    0    0    0    0    0    0    0    0 2 CARD #      5
INCORRECT TIME CODE --             0693150048 61788 4    0    0    0    0    0    0    0    0    0    0    0    0    0 2 CARD #      6
UNIT DATA (FIELD  2) BLANK --      0693150048 61715 8    3         2    2    2    2   10   17  160  376  290  192 2 CARD #     10

   2 NON-NUMERIC CHARACTERS --     0693150048 61815 3   10   UX   10   10   10   11   12   13   14   15   17   18 2 CARD #     13
NO DATA CODE IN COL 80- MAY BE CHANGE IN DATA CODE- STATION- 0693150048 61815 6                                                CARD #     16
  16 CARDS WITH DATA CODE  2 AT STATION 06931500                                                               CARD #'S      3 TO     18
CHANGE IN DATA CODE --           0693150048 61  23   24   25   27   26   34   15   30   38   26   25   26   24   21   39   15   4 CARD #     19
   2 CARDS WITH DATA CODE  4 AT STATION 06931500                                                               CARD #'S     19 TO     20
```

CARD ENTRY TO FILES - CARTER FORMAT

Program H267

Cataloged Procedure RRCRCDIN

Description

The cataloged procedure RRCRCDIN, containing as its principal program H267, loads all types of data punched on cards in the Carter format (Section 4) into the Current Unit and/or Daily Values Files. Program H267 creates two temporary files (unit and daily values) which are used as input by the two other programs, H269 and H475, in the cataloged procedure to respectively enter the data into the Current Unit and Daily Values Files. The current data files are available for immediate access.

The printout contains a summary of the data entered into the Current Unit and Daily Values Files, and optionally has available listings of the specific unit and daily value data loaded into the files.

The user must furnish the 15-digit station identifier which is equivalent to the 8-digit station number punched in columns 1-8 of the Carter formatted cards.

Cataloged Procedure

```
/*RELAY  PUNCH RE2

//xxxxxxxx JOB (-------)

/*PROCLIB  WRD.PROCLIB

// EXEC RRCRCDIN

//H267.SYSIN DD *

    Station identifier equivalence card for type n of the Carter-format
    cards

    Type-n Carter-format data cards

        .
        .
        .

//
$$$
```

where n = 1, 2, 3, or 4, indicating the card type.

As many sets of cards containing a Station Identifier Equivalence Card and Carter-format cards for a station may be loaded as desired.

The region size assigned in this catalog procedure should be adequate for all jobs. The default time is 3 minutes. If it is necessary to increase the time, add

,T=time

to the EXEC card.

This cataloged procedure uses an agency-code default of 'USGS'. If different agency codes are applicable to the site(s) processed in the job then add

,AGENCY=agency code

to the EXEC card. These above programs also assume that there is no password protection; however, if a password is required and is applicable to all site(s) processed in the job then add

,PASSWRD=password

to the EXEC card.

If a different agency code and/or password applies to different sites, then the job has to be broken up and run with appropriate codes or passwords; it is recommended to avoid storing site data with an agency code other than 'USGS' or storing site data with different passwords, particularly a grouping of sites used with the rainfall-runoff models.

Input Cards

All data loaded into the Current Unit and Daily Values Files are identified by a 15-digit station identifier (includes leading blanks). Because the Carter-format cards only have provision for an 8-digit station number, the Station Identifier Equivalence Card must be the first card in each input data set to give the necessary correspondence of the station identifier to the 8-digit station number.

The format for the Station Identifier Equivalence Card is as follows:

Column	Description
1-8	8-digit station number as punched in cols. 1-8 of the Carter-format cards.
9-20	Blank.
21-35	15-digit station identifier[1/] as it appears in WRD Station Header File (right justified).

Column	Description
36-79	Blank.
80	'1', if output from program is to be printed; otherwise blank.

1/ See p. B5, Chap. B, Vol. 1, WATSTORE User's Guide (Hutchison, 1975).

The formats for the Carter Cards are described in Section 4.

Conventions or Assumptions

This procedure is primarily an initial data entry program, used to create a record in the file when none exists. There are several assumptions made in the program while processing data. These are summarized as follows:

1. General station information is obtained from the WRD Station Header File and supplied to the record outputted. This information includes the State, district, site, and county codes.

2. All records written have a 'NO VALUE' indicator and a cross-section and depth value of '999999'.

3. The agency code is assumed to be 'USGS'.

4. Within an execution of a job, the date of entry to the file is the current date and the accounting number is taken as that which appears on the job card.

5. The EPA parameter code assignment to data records is 00045 for type-1 and type-3 Carter-format cards; 00050 for type-4 Carter-format cards; and 00060 for type-2 Carter-format cards. The statistics code assignments are 00011 for type-2 Carter-format cards; and 00006 for types-1, -3, and -4 Carter-format cards. Negative values on type-3 Carter-format cards are converted to 'NO VALUE.' If all values for a unit-rainfall record are zero, then only the first zero value is kept in the unit record.

6. If this program is executed in an update mode (a record exists), then include data that comprise a whole record (as to recreate) i.e., all cards for a water year or for a day. It is recommended not to use this program as an update program.

7. The user is reminded that for modeling there must be corresponding days of unit discharge and rainfall, i.e., a unit rainfall record must be created in the Unit Values File even though the rainfall is zero.

Diagnostic Messages

Messages that may be printed are:

A. Card input

Errors:

'Card image'	STATION NO - STATION ID EQUIVALENCE MISSING
'Card image'	STATION ID NOT FOUND IN HEADER FILE
'Card image'	UNKNOWN DATA TYPE ON CARTER CARD
'Card image"	WRONG DATA TYPE FOR HEADER FILE SITE CODE

To indicate additional cards may not have been processed the above error messages are followed by:

	SKIPPING FOR NEW STA NUMBER OR NEXT EOUIV. CARD CONVERSION ERROR
"Card image'	The "conversion error" is caused by any nonnumeric character in any card field except the eight character station number field. This includes data fields that are all blank or fields that have intervening blanks between numbers.

B. Records Created

UNIT VALUES RECORD WRITTEN FOR 'station number'
PARAMETER CODE='parameter code' STATISTIC CODE='statistic code
RPD='readings per day' 'date'
'station number'

DAILY VALUES RECORD WRITTEN FOR 'station number'
PARAMETER CODE=' parameter code' STATISTIC CODE='statistic code'
WATER YEAR='year'

The printing of record output, if requested by a '1' in Column 80 of equivalence card, is shown in the following example.

Example of Setting Up Job

An example of a complete job card deck including cards in the Carter format which are to be loaded (create new records) into the Current Unit and Daily Values Files is given below.

The line printer output from this program follows the listing of the card deck.

Data listed on the Carter format cards are unit discharge (code 2) with station identifier 02203820 and rainfall (code 1) with station identifier

02203820 (rainfall collected at gaging station) for Sugar Creek at Clifton Church Road nr. Atlanta, Georgia, and daily evaporation (code 4) with station identifier 335700083190001 at airport at Athens, Georgia. The data are for water years 1974-75, and part of the 1976 water year. All station information exists in the WRD Station Header FIle (station ID, site codes).

Before loading, the Carter formatted cards should have been edited by RRCARDED (Section 5).

U. S. DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

COMPUTER CODING FORM

PROGRAMMER ______ DIVISION ______ PROGRAM NO. ______ SHEET ___ OF ___

LOCATION ______ PHONE ______ PROJECT ______

PROGRAM IDENTIFICATION: ______

PROGRAM INFORMATION: ______

STATEMENT IDENTIFICATION

```
//*RELAY   PUNCH RE2
//XXXXXXXX JØB (-------)
//*PRØCLIB  WRD.PRØCLIB
// EXEC RRCRCDIN
//H267.SYSIN DD *
02203820                   02203820                                      1
0220382073121558  7.0  7.0  7.0  7.0  7.2  7.2  7.2  7.2  7.3  7.4  7.6 -7.8 2
02203820                   02203820                                      1
0220382073121558     0    0    0    0    1    1    3    2    1    3    5    4 1
02203820                   02203820                                      1
0220382073101    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0 3
0220382073102    0    0    0    0    0    0    0    0    0    0    0   12    0    0   18      3
11304322            3357000831900001                                     1
1130432273101   12   12    0   14   19   20   20   10   14   14   15   16   11    9    9   11 4
1130432273102   16   10   18   12   13   12   14   15   13   13   22   22   11    7    7      4
//
$$$
```

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0 = ZERO Ø = ALPHA O 1 = ONE I = ALPHA I 2 = TWO Z = ALPHA Z / = SLASH || = VERT. BAR - = MINUS _ = HORZ. BAR

PROGRAM CODING FORM

GPO : 1968 O - 286-594

6-1

PROGRAM H267 , REVISED 03-24-76

DAILY VALUES AND UNIT VALUES RECORDS CREATED FROM CARTER CARD INPUT

DETECTED ERRORS AND RECORDS WRITTEN ARE INDICATED BELOW

UNIT VALUES RECORD WRITTEN FOR 02203820
ID= 02203820 PARAMETER CODE = 60 STATISTIC CODE = 11 RPD= 288 FOR DEC. 15, 1973

UNIT VALUES RECORD WRITTEN FOR 02203820
ID= 02203820 PARAMETER CODE = 60 STATISTIC CODE = 11 RPD= 288 FOR FEB. 14, 1974

UNIT VALUES RECORD WRITTEN FOR 02203820
ID= 02203820 PARAMETER CODE = 60 STATISTIC CODE = 11 RPD= 288 FOR FEB. 15, 1974

UNIT VALUES RECORD WRITTEN FOR 02203820
ID= 02203820 PARAMETER CODE = 60 STATISTIC CODE = 11 RPD= 288 FOR FEB. 16, 1974

UNIT VALUES RECORD WRITTEN FOR 02203820
ID= 02203820 PARAMETER CODE = 60 STATISTIC CODE = 11 RPD= 288 FOR APR. 4, 1974

UNIT VALUES RECORD WRITTEN FOR 02203820
ID= 02203820 PARAMETER CODE = 60 STATISTIC CODE = 11 RPD= 288 FOR APR. 5, 1974

UNIT VALUES RECORD WRITTEN FOR 02203820
ID= 02203820 PARAMETER CODE = 60 STATISTIC CODE = 11 RPD= 288 FOR JUNE 6, 1974

UNIT VALUES RECORD WRITTEN FOR 02203820
ID= 02203820 PARAMETER CODE = 60 STATISTIC CODE = 11 RPD= 288 FOR JUNE 7, 1974

UNIT VALUES RECORD WRITTEN FOR 02203820
ID= 02203820 PARAMETER CODE = 60 STATISTIC CODE = 11 RPD= 288 FOR JUNE 8, 1974

UNIT VALUES RECORD WRITTEN FOR 02203820
ID= 02203820 PARAMETER CODE = 60 STATISTIC CODE = 11 RPD= 288 FOR JULY 3, 1974

UNIT VALUES RECORD WRITTEN FOR 02203820
ID= 02203820 PARAMETER CODE = 60 STATISTIC CODE = 11 RPD= 288 FOR JULY 4, 1974

UNIT VALUES RECORD WRITTEN FOR 02203820
ID= 02203820 PARAMETER CODE = 60 STATISTIC CODE = 11 RPD= 288 FOR AUG. 7, 1974

UNIT VALUES RECORD WRITTEN FOR 02203820
ID= 02203820 PARAMETER CODE = 60 STATISTIC CODE = 11 RPD= 288 FOR AUG. 8, 1974

UNIT VALUES RECORD WRITTEN FOR 02203820
ID= 02203820 PARAMETER CODE = 60 STATISTIC CODE = 11 RPD= 288 FOR DEC. 15, 1974

UNIT VALUES RECORD WRITTEN FOR 02203820
ID= 02203820 PARAMETER CODE = 60 STATISTIC CODE = 11 RPD= 288 FOR DEC. 29, 1974

UNIT VALUES RECORD WRITTEN FOR 02203820
ID= 02203820 PARAMETER CODE = 60 STATISTIC CODE = 11 RPD= 288 FOR DEC. 30, 1974

UNIT VALUES RECORD WRITTEN FOR 02203820
ID= 02203820 PARAMETER CODE = 60 STATISTIC CODE = 11 RPD= 288 FOR JAN. 10, 1975

```
UNIT VALUES RECORD WRITTEN FOR 02203820
ID=       02203820    PARAMETER CODE =   60    STATISTIC CODE =   11   RPD=  288    FOR JULY 26, 1975

UNIT VALUES RECORD WRITTEN FOR 02203820
ID=       02203820    PARAMETER CODE =   60    STATISTIC CODE =   11   RPD=  288    FOR AUG. 27, 1975

UNIT VALUES RECORD WRITTEN FOR 02203820
ID=       02203820    PARAMETER CODE =   60    STATISTIC CODE =   11   RPD=  288    FOR AUG. 28, 1975

UNIT VALUES RECORD WRITTEN FOR 02203820
ID=       02203820    PARAMETER CODE =   60    STATISTIC CODE =   11   RPD=  288    FOR SEP. 18, 1975

UNIT VALUES RECORD WRITTEN FOR 02203820
ID=       02203820    PARAMETER CODE =   60    STATISTIC CODE =   11   RPD=  288    FOR JAN. 26, 1976

UNIT VALUES RECORD WRITTEN FOR 02203820
ID=       02203820    PARAMETER CODE =   60    STATISTIC CODE =   11   RPD=  288    FOR JAN. 27, 1976

UNIT VALUES RECORD WRITTEN FOR 02203820
ID=       02203820    PARAMETER CODE =   60    STATISTIC CODE =   11   RPD=  288    FOR MAR. 12, 1976

UNIT VALUES RECORD WRITTEN FOR 02203820
ID=       02203820    PARAMETER CODE =   60    STATISTIC CODE =   11   RPD=  288    FOR MAR. 13, 1976

UNIT VALUES RECORD WRITTEN FOR 02203820
ID=       02203820    PARAMETER CODE =   60    STATISTIC CODE =   11   RPD=  288    FOR MAR. 15, 1976

UNIT VALUES RECORD WRITTEN FOR 02203820
ID=       02203820    PARAMETER CODE =   60    STATISTIC CODE =   11   RPD=  288    FOR MAR. 16, 1976

UNIT VALUES RECORD WRITTEN FOR 02203820
ID=       02203820    PARAMETER CODE =   60    STATISTIC CODE =   11   RPD=  288    FOR MAR. 17, 1976

UNIT VALUES RECORD WRITTEN FOR 02203820
ID=       02203820    PARAMETER CODE =   45    STATISTIC CODE =    6   RPD=  288    FOR DEC. 15, 1973

UNIT VALUES RECORD WRITTEN FOR 02203820
ID=       02203820    PARAMETER CODE =   45    STATISTIC CODE =    6   RPD=  288    FOR FEB. 14, 1974

UNIT VALUES RECORD WRITTEN FOR 02203820
ID=       02203820    PARAMETER CODE =   45    STATISTIC CODE =    6   RPD=  288    FOR FEB. 15, 1974

UNIT VALUES RECORD WRITTEN FOR 02203820
ID=       02203820    PARAMETER CODE =   45    STATISTIC CODE =    6   RPD=  288    FOR FEB. 16, 1974

UNIT VALUES RECORD WRITTEN FOR 02203820
ID=       02203820    PARAMETER CODE =   45    STATISTIC CODE =    6   RPD=  288    FOR APR.  4, 1974

UNIT VALUES RECORD WRITTEN FOR 02203820
ID=       02203820    PARAMETER CODE =   45    STATISTIC CODE =    6   RPD=  288    FOR APR.  5, 1974

UNIT VALUES RECORD WRITTEN FOR 02203820
ID=       02203820    PARAMETER CODE =   45    STATISTIC CODE =    6   RPD=  288    FOR JUNE  6, 1974

UNIT VALUES RECORD WRITTEN FOR 02203820
ID=       02203820    PARAMETER CODE =   45    STATISTIC CODE =    6   RPD=  288    FOR JUNE  7, 1974

UNIT VALUES RECORD WRITTEN FOR 02203820
ID=       02203820    PARAMETER CODE =   45    STATISTIC CODE =    6   RPD=  288    FOR JUNE  8, 1974
```

DAILY VALUES RECORD WRITTEN FOR 02203820
ID= 02203820 PARAMETER CODE = 45 STATISTIC CODE = 6 WATER YEAR= 1975

DAILY VALUES RECORD WRITTEN FOR 02203820
ID= 02203820 PARAMETER CODE = 45 STATISTIC CODE = 6 WATER YEAR= 1976

DAILY VALUES RECORD WRITTEN FOR 11304322
ID=335700083190001 PARAMETER CODE = 50 STATISTIC CODE = 6 WATER YEAR= 1974

DAILY VALUES RECORD WRITTEN FOR 11304322
ID=335700083190001 PARAMETER CODE = 50 STATISTIC CODE = 6 WATER YEAR= 1975

DAILY VALUES RECORD WRITTEN FOR 11304322
ID=335700083190001 PARAMETER CODE = 50 STATISTIC CODE = 6 WATER YEAR= 1976

STATION ID = 02203820 PARAMETER CODE = 60 STATISTIC CODE = 11

DEPTH =999999.00 DATE OF PROCESSING = 760701 STATE CODE = 13
X-SECTION =999999.00 ACCOUNT NUMBER =$$$$$$$$$ AGENCY CODE = USGS

DATE: DEC. 15, 1973 READINGS PER DAY = 288 NO VALUE INDICATOR=999999.00

HR.MIN.SEC	VALUE	HR.MIN.SEC	VALUE	HR.MIN.SEC	VALUE	HR.MIN.SEC	VALUE	HR.MIN.SEC	VALUE	HR.MIN.SEC	VALUE
07.05.00	7.00	07.10.00	7.00	07.15.00	7.00	07.20.00	7.00	07.25.00	7.20	07.30.00	7.20
07.35.00	7.20	07.40.00	7.20	07.45.00	7.30	07.50.00	7.40	07.55.00	7.60	08.00.00	7.80
08.05.00	7.90	08.10.00	8.00	08.15.00	8.50	08.20.00	9.00	08.25.00	9.50	08.30.00	10.00
08.35.00	12.00	08.40.00	13.00	08.45.00	15.00	08.50.00	16.00	08.55.00	18.00	09.00.00	20.00
09.05.00	22.00	09.10.00	23.00	09.15.00	25.00	09.20.00	27.00	09.25.00	30.00	09.30.00	32.00
09.35.00	33.00	09.40.00	36.00	09.45.00	38.00	09.50.00	40.00	09.55.00	42.00	10.00.00	46.00
10.05.00	87.00	10.10.00	95.00	10.15.00	111.00	10.20.00	136.00	10.25.00	164.00	10.30.00	191.00
10.35.00	224.00	10.40.00	247.00	10.45.00	263.00	10.50.00	276.00	10.55.00	286.00	11.00.00	294.00
11.05.00	300.00	11.10.00	304.00	11.15.00	307.00	11.20.00	307.00	11.25.00	306.00	11.30.00	306.00
11.35.00	304.00	11.40.00	301.00	11.45.00	295.00	11.50.00	286.00	11.55.00	273.00	12.00.00	259.00
12.05.00	241.00	12.10.00	224.00	12.15.00	207.00	12.20.00	191.00	12.25.00	175.00	12.30.00	161.00
12.35.00	150.00	12.40.00	140.00	12.45.00	131.00	12.50.00	121.00	12.55.00	112.00	13.00.00	105.00
13.05.00	100.00	13.10.00	95.00	13.15.00	92.00	13.20.00	87.00	13.25.00	83.00	13.30.00	79.00
13.35.00	76.00	13.40.00	73.00	13.45.00	70.00	13.50.00	68.00	13.55.00	65.00	14.00.00	63.00
14.05.00	60.00	14.10.00	59.00	14.15.00	58.00	14.20.00	57.00	14.25.00	55.00	14.30.00	53.00
14.35.00	51.00	14.40.00	49.00	14.45.00	47.00	14.50.00	46.00	14.55.00	44.00	15.00.00	42.00
15.05.00	41.00	15.10.00	40.00	15.15.00	39.00	15.20.00	38.00	15.25.00	37.00	15.30.00	36.00
15.35.00	35.00	15.40.00	34.00	15.45.00	33.00	15.50.00	32.00	15.55.00	31.00	16.00.00	30.00
16.05.00	30.00	16.10.00	29.00	16.15.00	29.00	16.20.00	28.00	16.25.00	27.00	16.30.00	26.00
16.35.00	25.00	16.40.00	24.00	16.45.00	24.00	16.50.00	23.00	16.55.00	23.00	17.00.00	22.00
17.05.00	21.00	17.10.00	20.00	17.15.00	19.00	17.20.00	19.00	17.25.00	18.00	17.30.00	18.00
17.35.00	17.00	17.40.00	17.00	17.45.00	17.00	17.50.00	17.00	17.55.00	16.00	18.00.00	16.00
18.05.00	16.00	18.10.00	15.00	18.15.00	15.00	18.20.00	14.00	18.25.00	14.00	18.30.00	14.00
18.35.00	13.00	18.40.00	13.00	18.45.00	13.00	18.50.00	12.00	18.55.00	12.00	19.00.00	12.00
19.05.00	11.00	19.10.00	11.00	19.15.00	11.00	19.20.00	11.00	19.25.00	10.00	19.30.00	10.00
19.35.00	10.00	19.40.00	10.00	19.45.00	10.00	19.50.00	9.80	19.55.00	9.60	20.00.00	9.20
20.05.00	9.00	20.10.00	8.80	20.15.00	8.60	20.20.00	8.40	20.25.00	8.20	20.30.00	8.00
20.35.00	7.90	20.40.00	7.80	20.45.00	7.60	20.50.00	7.40	20.55.00	7.20	21.00.00	7.00

STATION ID = 02203820 PARAMETER CODE = 45 STATISTIC CODE = 6

DEPTH =999999.00 DATE OF PROCESSING = 760701 STATE CODE = 13
X-SECTION =999999.00 ACCOUNT NUMBER =$$$$$$$$$ AGENCY CODE = USGS

DATE: FEB. 14, 1974 READINGS PER DAY = 288 NO VALUE INDICATOR=999999.00

HR.MIN.SEC	VALUE	HR.MIN.SEC	VALUE	HR.MIN.SEC	VALUE	HR.MIN.SEC	VALUE	HR.MIN.SEC	VALUE	HR.MIN.SEC	VALUE
15.35.00	0.03	15.40.00	0.05	15.45.00	0.04	15.50.00	0.00	15.55.00	0.00	16.00.00	0.00
16.05.00	0.00	16.10.00	0.01	16.15.00	0.00	16.20.00	0.00	16.25.00	0.00	16.30.00	0.01
16.35.00	0.00	16.40.00	0.00	16.45.00	0.00	16.50.00	0.00	16.55.00	0.00	17.00.00	0.00
17.05.00	0.00	17.10.00	0.00	17.15.00	0.01	17.20.00	0.00	17.25.00	0.00	17.30.00	0.00
17.35.00	0.00	17.40.00	0.00	17.45.00	0.02	17.50.00	0.06	17.55.00	0.05	18.00.00	0.03
18.05.00	0.05	18.10.00	0.03	18.15.00	0.02	18.20.00	0.03	18.25.00	0.02	18.30.00	0.00
18.35.00	0.04	18.40.00	0.01	18.45.00	0.01	18.50.00	0.01	18.55.00	0.01	19.00.00	0.02
19.05.00	0.01	19.10.00	0.01	19.15.00	0.01	19.20.00	0.01	19.25.00	0.01	19.30.00	0.01
19.35.00	0.00	19.40.00	0.01	19.45.00	0.02	19.50.00	0.02	19.55.00	0.02	20.00.00	0.03
20.05.00	0.02	20.10.00	0.02	20.15.00	0.02	20.20.00	0.04	20.25.00	0.02	20.30.00	0.03
20.35.00	0.02	20.40.00	0.01	20.45.00	0.01	20.50.00	0.01	20.55.00	0.00	21.00.00	0.01
21.05.00	0.00	21.10.00	0.01	21.15.00	0.00	21.20.00	0.01	21.25.00	0.00	21.30.00	0.00
21.35.00	0.00	21.40.00	0.01	21.45.00	0.00	21.50.00	0.00	21.55.00	0.00	22.00.00	0.00
22.05.00	0.00	22.10.00	0.01	22.15.00	0.00	22.20.00	0.01	22.25.00	0.01	22.30.00	0.00
22.35.00	0.01	22.40.00	0.00	22.45.00	0.00	22.50.00	0.01	22.55.00	0.00	23.00.00	0.00
23.05.00	0.01	23.10.00	0.00	23.15.00	0.01	23.20.00	0.01	23.25.00	0.01	23.30.00	0.02
23.35.00	0.02	23.40.00	0.02	23.45.00	0.02	23.50.00	0.01	23.55.00	0.02	24.00.00	0.03

FILE TYPE	STATE CODE	AGENCY CODE	STATION IDENTIFICATION NUMBER	CROSS SECTION	SAMPLING DEPTH	PARA-METER CODE	YEAR	STAT CODE	NO VALUE INDICATOR	DIST CODE	COUNTY CODE	DRAINAGE AREA	CONTRIB. DRAINAGE AREA
R	13	USGS	02203820	999999.000	999999.000	00045	1974	00006	999999.0000	13		8.67	0.00

STATION NAME OR LOCAL WELL NUMBER	WELL DEPTH	DATUM	HYDROLOGIC UNIT CODE	RTV SEQ NO	BEG MO	SITE CODE	STATION LOCATOR LAT-ITUDE	LONG-ITUDE	SEQ NO	GEOLOGIC UNIT CODE
SUGAR CR AT CLIFTON CHURCH ROAD NR ATLANTA, GA.	0.00	0.00	000000000	00	10					

DAY	10	11	12	01	02	03	04	05	06	07	08	09
1	0.000	0.000	0.000	0.000	0.150	0.000	0.000	0.000	0.530	0.000	0.000	0.100
2	0.000	0.000	0.000	0.000	0.370	0.000	0.740	0.440	0.180	0.090	0.040	0.080
3	0.000	0.000	0.000	0.460	0.000	0.000	0.000	0.390	0.000	0.180	0.490	0.000
4	0.000	0.000	0.610	0.190	0.000	0.000	1.770	0.000	0.000	2.020	0.000	0.000
5	0.000	0.000	0.540	0.000	0.000	0.000	0.000	0.000	0.000	0.230	0.160	0.030
6	0.000	0.030	0.000	0.000	1.070	0.000	0.000	0.000	0.170	0.000	0.000	0.250
7	0.000	0.020	0.000	0.170	0.400	0.000	0.000	0.000	2.410	0.000	2.560	0.000
8	0.000	0.030	0.000	0.070	0.000	0.000	0.170	0.000	0.000	0.000	0.000	0.000
9	0.000	0.020	0.000	0.000	0.000	0.000	0.000	0.360	0.000	0.000	0.450	0.000
10	0.000	0.050	0.000	0.000	0.000	0.000	0.030	0.000	0.540	0.000	0.060	0.000
11	0.000	0.000	0.000	0.090	0.000	0.000	0.000	0.460	0.040	0.000	0.080	0.000
12	0.000	0.030	0.000	0.000	0.000	0.070	0.030	0.290	0.060	0.000	0.000	0.000
13	0.000	0.000	0.000	0.000	0.000	0.030	0.240	0.000	0.300	0.000	0.000	0.000
14	0.000	0.000	0.000	0.420	1.190	0.120	0.140	0.000	0.000	0.000	0.640	0.000
15	0.000	0.070	0.870	0.000	0.380	0.000	0.000	0.190	0.000	0.000	0.000	0.000
16	0.000	0.000	0.000	0.000	1.160	0.000	0.000	0.000	0.000	0.000	0.390	0.000
17	0.000	0.020	0.000	0.000	0.000	0.000	0.000	0.000	0.050	0.000	0.200	0.000
18	0.000	0.000	0.050	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.050	0.000
19	0.000	0.000	0.000	0.000	0.200	0.250	0.000	0.230	0.000	1.130	0.000	0.000
20	0.000	0.080	0.550	1.110	0.030	0.460	0.000	0.000	0.000	0.000	0.000	0.000
21	0.000	1.030	0.000	0.000	0.200	0.170	0.000	0.070	0.050	0.000	0.000	0.000
22	0.000	0.000	0.020	0.060	0.480	0.030	0.520	0.780	0.050	0.000	0.000	0.000
23	0.000	0.000	0.000	0.500	0.030	0.000	0.000	0.500	0.000	0.040	0.000	0.000
24	0.000	0.000	0.000	0.170	0.000	0.000	0.000	0.000	0.060	0.060	0.000	0.000
25	0.000	0.080	0.040	0.640	0.000	0.320	0.060	0.000	0.000	0.000	0.000	0.220
26	0.000	0.000	1.400	0.000	0.040	0.000	0.000	0.450	0.000	1.320	0.150	0.000
27	0.000	0.080	0.000	0.100	0.000	0.090	0.000	0.000	0.070	0.000	0.000	0.050
28	0.120	0.260	0.000	0.290	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
29	0.000	0.000	1.040	0.110	999999	0.470	0.050	0.000	0.000	0.000	1.250	0.000
30	0.000	0.020	0.000	0.000	999999	0.130	0.000	0.000	0.000	0.000	0.240	0.000
31	0.180	999999	2.800	0.000	999999	0.000	999999	0.030	999999	0.000	0.040	999999

FILE TYPE	STATE CODE	AGENCY CODE	STATION IDENTIFICATION NUMBER	CROSS SECTION	SAMPLING DEPTH	PARA-METER CODE	YEAR	STAT CODE	NO VALUE INDICATOR	DIST CODE	COUNTY CODE	DRAINAGE AREA	CONTRIB. DRAINAGE AREA
R	13	USGS	335700083190001	999999.000	999999.000	00050	1974	00006	999999.0000	13		0.00	0.00

STATION NAME OR LOCAL WELL NUMBER	WELL DEPTH	DATUM	HYDROLOGIC UNIT CODE	RTV SEQ NO	BEG MO	SITE CODE	STATION LOCATOR LAT-ITUDE	LONG-ITUDE	SEQ NO	GEOLOGIC UNIT CODE
ATHENS WB AP, GA	W13873	0.00	0.00 000000000	00	10					

DAY	10	11	12	01	02	03	04	05	06	07	08	09
1	0.120	0.110	0.140	0.000	0.150	0.140	0.210	0.270	0.430	0.300	0.260	0.290
2	0.120	0.090	0.110	0.050	0.090	0.150	0.300	0.340	0.170	0.270	0.240	0.140
3	0.000	0.120	0.070	0.020	0.120	0.100	0.120	0.140	0.170	0.370	0.120	0.150
4	0.140	0.110	0.000	0.040	0.170	0.240	0.270	0.260	0.360	0.140	0.210	0.170
5	0.190	0.120	0.000	0.040	0.160	0.190	0.280	0.140	0.250	0.250	0.120	0.180
6	0.200	0.200	0.190	0.020	0.080	0.210	0.310	0.190	0.150	0.230	0.320	0.030
7	0.200	0.060	0.060	0.120	0.010	0.210	0.320	0.200	0.210	0.110	0.140	0.020
8	0.100	0.050	0.070	0.130	0.010	0.250	0.020	0.330	0.170	0.210	0.160	0.090
9	0.140	0.140	0.050	0.050	0.170	0.250	0.220	0.200	0.240	0.240	0.100	0.150
10	0.140	0.200	0.120	0.020	0.100	0.280	0.230	0.200	0.290	0.370	0.260	0.090
11	0.150	0.110	0.100	0.130	0.120	0.300	0.230	0.150	0.240	0.310	0.250	0.200
12	0.160	0.000	0.140	0.180	0.150	0.120	0.160	0.120	0.310	0.200	0.150	0.220
13	0.110	0.230	0.100	0.120	0.160	0.250	0.220	0.230	0.320	0.270	0.230	0.160
14	0.090	0.090	0.130	0.060	0.010	0.120	0.050	0.310	0.200	0.260	0.180	0.140
15	0.090	0.110	0.080	0.040	0.160	0.220	0.270	0.280	0.330	0.360	0.120	0.190
16	0.110	0.140	0.000	0.050	0.090	0.150	0.220	0.190	0.280	0.330	0.250	0.210
17	0.160	0.200	0.120	0.110	0.180	0.230	0.260	0.230	0.460	0.260	0.160	0.220
18	0.100	0.050	0.080	0.080	0.080	0.200	0.210	0.250	0.260	0.240	0.470	0.180
19	0.180	0.070	0.040	0.070	0.270	0.130	0.170	0.440	0.330	0.330	0.230	0.210
20	0.120	0.120	0.000	0.030	0.230	0.020	0.290	0.200	0.290	0.290	0.310	0.210
21	0.130	0.190	0.030	0.090	0.150	0.360	0.220	0.150	0.350	0.220	0.130	0.260
22	0.120	0.030	0.020	0.130	0.130	0.220	0.210	0.220	0.360	0.290	0.210	0.210
23	0.140	0.100	0.160	0.120	0.150	0.100	0.250	0.110	0.260	0.110	0.230	0.150
24	0.150	0.080	0.040	0.040	0.170	0.100	0.180	0.280	0.330	0.080	0.240	0.240
25	0.130	0.040	0.090	0.070	0.180	0.140	0.230	0.450	0.350	0.070	0.210	0.070
26	0.130	0.010	0.050	0.040	0.120	0.060	0.250	0.210	0.200	0.170	0.180	0.040
27	0.220	0.130	0.190	0.090	0.110	0.040	0.300	0.130	0.200	0.190	0.220	0.030
28	0.220	0.240	0.050	0.150	0.200	0.080	0.410	0.290	0.150	0.260	0.260	0.130
29	0.110	0.220	0.060	0.030	999999	0.280	0.320	0.270	0.330	0.180	0.190	0.240
30	0.070	0.110	0.110	0.050	999999	0.500	0.330	0.350	0.340	0.320	0.200	0.200
31	0.070	999999	0.020	0.190	999999	0.440	999999	0.270	999999	0.340	0.350	999999

```
PROGRAM H475 CREATED 4/01/75

DATE OF THIS REPORT (YEAR,MONTH,DAY) = 760701

YOU HAVE SUBMITTED TO PROGRAM H475 THE FOLLOWING CONDITIONS:

    AGENCY CODE = USGS
    UPDATE PASSWORD =
    EDIT OPTION = ,
    SECURITY RETRIEVAL FLAG TURNED OFF FOR ALL DATA CREATED

THE ABOVE CONDITIONS WILL BE USED FOR ANY INPUT TAPE DATA AND ALL OTHER DATA UNTIL A Z CARD IS PROCESSED
```

```
00006 RECORDS ENTERED FROM TAPE

00000 RECORDS UPDATED FROM TAPE

00000 RECORDS NOT TRANSFERRED FROM TAPE


NORMAL END OF PROCESSING OF PROGRAM H475
```

PROGRAM H-269 , REVISED 01-01-76

UNIT VALUES FILE UPDATE BY CARD OR RECORD INPUT

RECORD DATA ENTRY FOR STATION	02203820	PARAM=	60	STAT=	11	READINGS PER DAY=	288	DATE: DEC. 15, 1973
RECORD DATA ENTRY FOR STATION	02203820	PARAM=	60	STAT=	11	READINGS PER DAY=	288	DATE: FEB. 14, 1974
RECORD DATA ENTRY FOR STATION	02203820	PARAM=	60	STAT=	11	READINGS PER DAY=	288	DATE: FEB. 15, 1974
RECORD DATA ENTRY FOR STATION	02203820	PARAM=	60	STAT=	11	READINGS PER DAY=	288	DATE: FEB. 16, 1974
RECORD DATA ENTRY FOR STATION	02203820	PARAM=	60	STAT=	11	READINGS PER DAY=	288	DATE: APR. 4, 1974
RECORD DATA ENTRY FOR STATION	02203820	PARAM=	60	STAT=	11	READINGS PER DAY=	288	DATE: APR. 5, 1974
RECORD DATA ENTRY FOR STATION	02203820	PARAM=	60	STAT=	11	READINGS PER DAY=	288	DATE: JUNE 6, 1974
RECORD DATA ENTRY FOR STATION	02203820	PARAM=	60	STAT=	11	READINGS PER DAY=	288	DATE: JUNE 7, 1974
RECORD DATA ENTRY FOR STATION	02203820	PARAM=	60	STAT=	11	READINGS PER DAY=	288	DATE: JUNE 8, 1974
RECORD DATA ENTRY FOR STATION	02203820	PARAM=	60	STAT=	11	READINGS PER DAY=	288	DATE: JULY 3, 1974
RECORD DATA ENTRY FOR STATION	02203820	PARAM=	60	STAT=	11	READINGS PER DAY=	288	DATE: JULY 4, 1974
RECORD DATA ENTRY FOR STATION	02203820	PARAM=	60	STAT=	11	READINGS PER DAY=	288	DATE: AUG. 7, 1974
RECORD DATA ENTRY FOR STATION	02203820	PARAM=	60	STAT=	11	READINGS PER DAY=	288	DATE: AUG. 8, 1974
RECORD DATA ENTRY FOR STATION	02203820	PARAM=	60	STAT=	11	READINGS PER DAY=	288	DATE: DEC. 15, 1974
RECORD DATA ENTRY FOR STATION	02203820	PARAM=	60	STAT=	11	READINGS PER DAY=	288	DATE: DEC. 29, 1974
RECORD DATA ENTRY FOR STATION	02203820	PARAM=	60	STAT=	11	READINGS PER DAY=	288	DATE: DEC. 30, 1974
RECORD DATA ENTRY FOR STATION	02203820	PARAM=	60	STAT=	11	READINGS PER DAY=	288	DATE: JAN. 10, 1975
RECORD DATA ENTRY FOR STATION	02203820	PARAM=	60	STAT=	11	READINGS PER DAY=	288	DATE: JAN. 11, 1975
RECORD DATA ENTRY FOR STATION	02203820	PARAM=	60	STAT=	11	READINGS PER DAY=	288	DATE: JAN. 12, 1975
RECORD DATA ENTRY FOR STATION	02203820	PARAM=	60	STAT=	11	READINGS PER DAY=	288	DATE: JAN. 13, 1975
RECORD DATA ENTRY FOR STATION	02203820	PARAM=	60	STAT=	11	READINGS PER DAY=	288	DATE: FEB. 16, 1975
RECORD DATA ENTRY FOR STATION	02203820	PARAM=	60	STAT=	11	READINGS PER DAY=	288	DATE: FEB. 17, 1975
RECORD DATA ENTRY FOR STATION	02203820	PARAM=	60	STAT=	11	READINGS PER DAY=	288	DATE: FEB. 18, 1975
RECORD DATA ENTRY FOR STATION	02203820	PARAM=	60	STAT=	11	READINGS PER DAY=	288	DATE: FEB. 19, 1975
RECORD DATA ENTRY FOR STATION	02203820	PARAM=	60	STAT=	11	READINGS PER DAY=	288	DATE: MAR. 24, 1975
RECORD DATA ENTRY FOR STATION	02203820	PARAM=	60	STAT=	11	READINGS PER DAY=	288	DATE: APR. 2, 1975
RECORD DATA ENTRY FOR STATION	02203820	PARAM=	60	STAT=	11	READINGS PER DAY=	288	DATE: APR. 3, 1975
RECORD DATA ENTRY FOR STATION	02203820	PARAM=	60	STAT=	11	READINGS PER DAY=	288	DATE: MAY 3, 1975

RECORD DATA ENTRY FOR STATION 02203820 PARAM= 60 STAT= 11 READINGS PER DAY= 288 DATE: MAY 17, 1975

RECORD DATA ENTRY FOR STATION 02203820 PARAM= 60 STAT= 11 READINGS PER DAY= 288 DATE: MAY 18, 1975

RECORD DATA ENTRY FOR STATION 02203820 PARAM= 60 STAT= 11 READINGS PER DAY= 288 DATE: JUNE 10, 1975

RECORD DATA ENTRY FOR STATION 02203820 PARAM= 60 STAT= 11 READINGS PER DAY= 288 DATE: JUNE 11, 1975

RECORD DATA ENTRY FOR STATION 02203820 PARAM= 60 STAT= 11 READINGS PER DAY= 288 DATE: JUNE 12, 1975

RECORD DATA ENTRY FOR STATION 02203820 PARAM= 60 STAT= 11 READINGS PER DAY= 288 DATE: JUNE 19, 1975

RECORD DATA ENTRY FOR STATION 02203820 PARAM= 60 STAT= 11 READINGS PER DAY= 288 DATE: JULY 10, 1975

RECORD DATA ENTRY FOR STATION 02203820 PARAM= 60 STAT= 11 READINGS PER DAY= 288 DATE: JULY 11, 1975

RECORD DATA ENTRY FOR STATION 02203820 PARAM= 60 STAT= 11 READINGS PER DAY= 288 DATE: JULY 25, 1975

RECORD DATA ENTRY FOR STATION 02203820 PARAM= 60 STAT= 11 READINGS PER DAY= 288 DATE: JULY 26, 1975

RECORD DATA ENTRY FOR STATION 02203820 PARAM= 60 STAT= 11 READINGS PER DAY= 288 DATE: AUG. 27, 1975

RECORD DATA ENTRY FOR STATION 02203820 PARAM= 60 STAT= 11 READINGS PER DAY= 288 DATE: AUG. 28, 1975

RECORD DATA ENTRY FOR STATION 02203820 PARAM= 60 STAT= 11 READINGS PER DAY= 288 DATE: SEP. 18, 1975

RECORD DATA ENTRY FOR STATION 02203820 PARAM= 60 STAT= 11 READINGS PER DAY= 288 DATE: JAN. 26, 1976

RECORD DATA ENTRY FOR STATION 02203820 PARAM= 60 STAT= 11 READINGS PER DAY= 288 DATE: JAN. 27, 1976

RECORD DATA ENTRY FOR STATION 02203820 PARAM= 60 STAT= 11 READINGS PER DAY= 288 DATE: MAR. 12, 1976

RECORD DATA ENTRY FOR STATION 02203820 PARAM= 60 STAT= 11 READINGS PER DAY= 288 DATE: MAR. 13, 1976

RECORD DATA ENTRY FOR STATION 02203820 PARAM= 60 STAT= 11 READINGS PER DAY= 288 DATE: MAR. 15, 1976

RECORD DATA ENTRY FOR STATION 02203820 PARAM= 60 STAT= 11 READINGS PER DAY= 288 DATE: MAR. 16, 1976

RECORD DATA ENTRY FOR STATION 02203820 PARAM= 60 STAT= 11 READINGS PER DAY= 288 DATE: MAR. 17, 1976

RECORD DATA ENTRY FOR STATION 02203820 PARAM= 45 STAT= 6 READINGS PER DAY= 288 DATE: DEC. 15, 1973

RECORD DATA ENTRY FOR STATION 02203820 PARAM= 45 STAT= 6 READINGS PER DAY= 288 DATE: FEB. 14, 1974

RECORD DATA ENTRY FOR STATION 02203820 PARAM= 45 STAT= 6 READINGS PER DAY= 288 DATE: FEB. 15, 1974

RECORD DATA ENTRY FOR STATION 02203820 PARAM= 45 STAT= 6 READINGS PER DAY= 288 DATE: FEB. 16, 1974

RECORD DATA ENTRY FOR STATION 02203820 PARAM= 45 STAT= 6 READINGS PER DAY= 288 DATE: APR. 4, 1974

RECORD DATA ENTRY FOR STATION 02203820 PARAM= 45 STAT= 6 READINGS PER DAY= 288 DATE: APR. 5, 1974

RECORD DATA ENTRY FOR STATION 02203820 PARAM= 45 STAT= 6 READINGS PER DAY= 288 DATE: JUNE 6, 1974

RECORD DATA ENTRY FOR STATION 02203820 PARAM= 45 STAT= 6 READINGS PER DAY= 288 DATE: JUNE 7, 1974

RECORD DATA ENTRY FOR STATION 02203820 PARAM= 45 STAT= 6 READINGS PER DAY= 288 DATE: JUNE 8, 1974

RECORD DATA ENTRY FOR STATION 02203820 PARAM= 45 STAT= 6 READINGS PER DAY= 288 DATE: JULY 3, 1974

RECORD DATA ENTRY FOR STATION 02203820 PARAM= 45 STAT= 6 READINGS PER DAY= 288 DATE: JULY 4, 1974
RECORD DATA ENTRY FOR STATION 02203820 PARAM= 45 STAT= 6 READINGS PER DAY= 288 DATE: AUG. 7, 1974
RECORD DATA ENTRY FOR STATION 02203820 PARAM= 45 STAT= 6 READINGS PER DAY= 288 DATE: AUG. 8, 1974
RECORD DATA ENTRY FOR STATION 02203820 PARAM= 45 STAT= 6 READINGS PER DAY= 288 DATE: DEC. 15, 1974
RECORD DATA ENTRY FOR STATION 02203820 PARAM= 45 STAT= 6 READINGS PER DAY= 288 DATE: DEC. 29, 1974
RECORD DATA ENTRY FOR STATION 02203820 PARAM= 45 STAT= 6 READINGS PER DAY= 288 DATE: DEC. 30, 1974
RECORD DATA ENTRY FOR STATION 02203820 PARAM= 45 STAT= 6 READINGS PER DAY= 288 DATE: JAN. 10, 1975
RECORD DATA ENTRY FOR STATION 02203820 PARAM= 45 STAT= 6 READINGS PER DAY= 288 DATE: JAN. 11, 1975
RECORD DATA ENTRY FOR STATION 02203820 PARAM= 45 STAT= 6 READINGS PER DAY= 288 DATE: JAN. 12, 1975
RECORD DATA ENTRY FOR STATION 02203820 PARAM= 45 STAT= 6 READINGS PER DAY= 288 DATE: JAN. 13, 1975
RECORD DATA ENTRY FOR STATION 02203820 PARAM= 45 STAT= 6 READINGS PER DAY= 288 DATE: FEB. 16, 1975
RECORD DATA ENTRY FOR STATION 02203820 PARAM= 45 STAT= 6 READINGS PER DAY= 288 DATE: FEB. 17, 1975
RECORD DATA ENTRY FOR STATION 02203820 PARAM= 45 STAT= 6 READINGS PER DAY= 288 DATE: FEB. 18, 1975
RECORD DATA ENTRY FOR STATION 02203820 PARAM= 45 STAT= 6 READINGS PER DAY= 288 DATE: FEB. 19, 1975
RECORD DATA ENTRY FOR STATION 02203820 PARAM= 45 STAT= 6 READINGS PER DAY= 288 DATE: MAR. 24, 1975
RECORD DATA ENTRY FOR STATION 02203820 PARAM= 45 STAT= 6 READINGS PER DAY= 288 DATE: APR. 2, 1975
RECORD DATA ENTRY FOR STATION 02203820 PARAM= 45 STAT= 6 READINGS PER DAY= 288 DATE: APR. 3, 1975
RECORD DATA ENTRY FOR STATION 02203820 PARAM= 45 STAT= 6 READINGS PER DAY= 288 DATE: MAY 3, 1975
RECORD DATA ENTRY FOR STATION 02203820 PARAM= 45 STAT= 6 READINGS PER DAY= 288 DATE: MAY 17, 1975
RECORD DATA ENTRY FOR STATION 02203820 PARAM= 45 STAT= 6 READINGS PER DAY= 288 DATE: MAY 18, 1975
RECORD DATA ENTRY FOR STATION 02203820 PARAM= 45 STAT= 6 READINGS PER DAY= 288 DATE: JUNE 10, 1975
RECORD DATA ENTRY FOR STATION 02203820 PARAM= 45 STAT= 6 READINGS PER DAY= 288 DATE: JUNE 11, 1975
RECORD DATA ENTRY FOR STATION 02203820 PARAM= 45 STAT= 6 READINGS PER DAY= 288 DATE: JUNE 12, 1975
RECORD DATA ENTRY FOR STATION 02203820 PARAM= 45 STAT= 6 READINGS PER DAY= 288 DATE: JUNE 19, 1975
RECORD DATA ENTRY FOR STATION 02203820 PARAM= 45 STAT= 6 READINGS PER DAY= 288 DATE: JULY 10, 1975
RECORD DATA ENTRY FOR STATION 02203820 PARAM= 45 STAT= 6 READINGS PER DAY= 288 DATE: JULY 11, 1975
RECORD DATA ENTRY FOR STATION 02203820 PARAM= 45 STAT= 6 READINGS PER DAY= 288 DATE: JULY 25, 1975
RECORD DATA ENTRY FOR STATION 02203820 PARAM= 45 STAT= 6 READINGS PER DAY= 288 DATE: JULY 26, 1975
RECORD DATA ENTRY FOR STATION 02203820 PARAM= 45 STAT= 6 READINGS PER DAY= 288 DATE: AUG. 27, 1975
RECORD DATA ENTRY FOR STATION 02203820 PARAM= 45 STAT= 6 READINGS PER DAY= 288 DATE: AUG. 28, 1975

```
RECORD DATA ENTRY FOR STATION    02203820    PARAM=  45    STAT=   6    READINGS PER DAY=  288    DATE: SEP. 18, 1975
RECORD DATA ENTRY FOR STATION    02203820    PARAM=  45    STAT=   6    READINGS PER DAY=  288    DATE: JAN. 26, 1976
RECORD DATA ENTRY FOR STATION    02203820    PARAM=  45    STAT=   6    READINGS PER DAY=  288    DATE: JAN. 27, 1976
RECORD DATA ENTRY FOR STATION    02203820    PARAM=  45    STAT=   6    READINGS PER DAY=  288    DATE: MAR. 12, 1976
RECORD DATA ENTRY FOR STATION    02203820    PARAM=  45    STAT=   6    READINGS PER DAY=  288    DATE: MAR. 13, 1976
RECORD DATA ENTRY FOR STATION    02203820    PARAM=  45    STAT=   6    READINGS PER DAY=  288    DATE: MAR. 15, 1976
RECORD DATA ENTRY FOR STATION    02203820    PARAM=  45    STAT=   6    READINGS PER DAY=  288    DATE: MAR. 16, 1976
RECORD DATA ENTRY FOR STATION    02203820    PARAM=  45    STAT=   6    READINGS PER DAY=  288    DATE: MAR. 17, 1976
```



```
END PROGRAM H-269, UNIT VALUES FILE UPDATE
```

GENERATION OF SYNTHETIC EVAPORATION DATA

Program H266

Cataloged Procedure RRGENEVP

Description

Program H266 utilizes continuously observed daily evaporation data for one or more water years to generate synthetic daily evaporation data for user specified periods (complete water years). The user specified periods are generally for periods outside the period of data collection.

The synthesis is accomplished by least squares fitting of a harmonic (sine-cosine) function to observed daily data, or, optionally, determining the average for 1, 3, or 7 days (arithmetic running means). If negative synthetic daily evaporation values are generated, the values are automatically changed to zero by the program.

The program output includes any or all of the following: 1) plot of each year of observed input data, 2) a listing of the synthetic daily evaporation generated, 3) a multi-page plot of the synthetic daily evaporation, and 4) diagnostic messages if applicable. The multi-page plot can be optionally suppressed to obtain a single page plot of synthetic data.

In the cataloged procedure, the generated evaporation data is automatically entered into the Current Daily Values File.

Limitations and Precautions

1. The program requires complete water years of observed input data.

2. The user's specified period of synthetic evaporation data should not include water years prior to 1881. This limitation is due to restrictions in other programs.

3. Synthetic daily values records are flagged to prevent the data from being merged into the Historical Daily Values File. It is recommended not to generate synthetic data until it is needed.

4. Output from the program does not include punched cards.

5. If the synthetic period overlaps or corresponds to the observed period, the observed data will be overwritten by the synthetic data.

6. An optional password/agency identification card, type Z, may be needed to retrieve data from the Current Daily Values File. If an agency identification other than 'USGS' is in the WRD Station Header File for the station or if the data are password protected, then this card is required.

Cataloged Procedure

```
/*RELAY  PUNCH RE2

//xxxxxxxx JOB (----)

/*PROCLIB  WRD.PROCLIB

//         EXEC RRGENEVP

//H266.SYSIN DD *
    - Type Z card (optional; format in section 8)
    - Input card, one for each station

//

$$$
```

The default time for each step in this procedure is 2 minutes which should be sufficient for most jobs. If it should become necessary to increase this value, insert the following on the 'EXEC' card:

,T=time

The region in this procedure is fixed and should not require changing.

This procedure contains programs H266 and H475 (daily values file input program).

Input Card

The program requires one input card per evaporation station (processing of multiple stations is possible). The format of each input card follows:

Column	Description
1	Card type G or leave blank.
2-16	15-digit evaporation station identifier.
17	Blank.
18	Output option - code either a '1', '2', or '3' (required): '1' = Desire table of the synthesized data only.

Column	Description
	'2' = Desire table of the synthesized data and line printer plot (multi-page or single page optional) of the water year synthesized data. '3' = Desire options 1 and 2 plus line printer plots of each year of observed (input) data.
19	Printer option - If column 18 is coded with either a '2' or '3' then code either an 'M' or 'S': 'M' = Multi-page line printer plot of synthetic data. 'S' = Single page line printer plot of synthetic data (default).
20-30	Blank.
31-34	Beginning water year (4 digits) of observed data (required).
35-38	Ending water year (4 digits) of observed data (required).
39	Blank.
40-41	Method of computation option - Leave blank or code 'A1', 'A3', or 'A7': Blank = Generated data (synthetic) is based on a harmonic (sine-cosine) fit to observed data. 'A1' = Generated data is the daily average (1-day) of the observed data 'A3' = Generated data is a 3-day average of observed data. 'A7' = Generated data is a 7-day average of observed data.
42-72	Blank.
73-76	Beginning water year (4 digits) of synthetic data (required).

Column	Description
77-80	Ending water year (4 digits) of synthetic data (required).

The observed data for the years shown in columns 31-38 of the input card are retrieved from the Current Daily Values File for the desired station, and synthesized data for the years shown in columns 73-80 is entered into the Current Daily Values File.

Note that all observed data must be on the Current Daily Values File before attempting to run this program. Data from the historical file may be retrieved and loaded on the current file using DVRETR and DVINPUT (See section 3).

Diagnostic Messages

1. Header File Retrieval

   STATION 'station ID' HEADER FILE RECORD NOT FOUND

   Specified station identifier cannot be located in WRD Station Header File. Next input card is processed.

2. Disk Record Retrieval

   (A) Data Not Found

   STATION 'station ID' WATER YEARS 'year' TO 'year' NOT FOUND

   The program sets up a key for each record to be retrieved from the file. If no record is found for the station and for period of years specified, the above message is printed. Next input card is processed.

   (B) Year Not Found

   WATER YEAR 'year' NOT FOUND ON FILE FOR STATION 'station ID'

   The program reads consecutive water years of data from the disk file. If a water year within the specified period is not found the above message is printed. Retrieval of the next water year is attempted.

3. Other Messages

   (A) Conversion Error

   CONVERSION ERROR - PROBABLY IN INPUT CARD

   This message may occur for several reasons but most likely is for incorrect coding of input card. Next input card is processed.

(B) Unkown Errors

UNKOWN ERROR - PROGRAM TERMINATED - CODE = 'code number'

STATION = 'station ID'

OPTION = 'option code'

BEGIN - WATER YEAR = 'year'

END - WATER YEAR = 'year'

This message will be required for all error conditions not covered above. PL/I User Manual should be consulted for explanation of CODE values. Other data printed in message may not be relevant. Processing is terminated.

(C) Unable to Accomplish a Fit of Observed Data

LINE COULD NOT BE FITTED FOR EVAP DATA

The observed data is invalid for some reason or the data contains some erroneous values.

(D) Invalid evaporation value

NO VALUE INDICATOR(S) -999999-PROBABLY EXIST IN DATA FOR WATER YEAR 'year'; PROCESSING TERMINATED.

Check evaporation data for a no value indicators; update data, and rerun the job.

(E) Unusual evaporation value

***WARNING - YEARLY EVAP. TOTAL GREATER THAN 180 INCHES FOUND FOR WATER YEAR 'year'; PROCESSING CONTNUED.

A warning message; self explanatory; check daily data for an unusual value(s); if data is incorrect, correct and rerun job.

Examples of Setting up a Job

Example 1

A synthetic daily evaporation record is to be generated for the 1967-70 water years for the Milton Experiment Station near Milton, Florida. The harmonic generating equation is to be defined by data observed during the 1971-73 water years; the station identifier is 304637087082701 (lat-long-seq.no). The parameter and statistic codes 00050 and 00006 are set automatically by the program.

Following the listing of the job card deck is an example of the line printer output, showing plots of the 3 years of observed data, a table of synthesized

data, and a portion of the multi-page line printer plot of synthesized data. The output option (col. 18) is set to '3'.

Example 2

This example is the same as example 1 (station, dates, etc.) except that a single page line printer plot of synthetic data is desired instead of a multi-page plot, and a 3-day average of the daily evaporation is desired as the synthetic data instead of the harmonic fit.

PROGRAMMER ______ DIVISION ______ LOCATION ______ PHONE ______

U. S. DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

COMPUTER CODING FORM

PROGRAM NO. ______ PROJECT ______ SHEET ___ OF ___

PROGRAM IDENTIFICATION: ______

PROGRAM INFORMATION: ______

STATEMENT IDENTIFICATION

EXAMPLE 1

```
/*RELAY  PUNCH RE2
//xxxxxxxx JØB (---------)
/*PRØCLIB  WRD.PRØCLIB
//STP1 EXEC RRGENEVP
//H266.SYSIN DD *
G30463708708270l 3M            1971/1973                               1967/1970
/*
//
$$$
```

EXAMPLE 2

```
/*RELAY  PUNCH RE2
//  xxxxxxxxx JØB (--------)
/*PRØCLIB  WRD.PRØCLIB
//STP1 EXEC RRGENEVP
//H266.SYSIN DD *
G30463708708270l 3S            1971/1973 A3                            1967/1970
/*
//
$$$
```


FORM 9—1634 A
JULY 1967

0 = ZERO   Ø = ALPHA O   1 = ONE   I = ALPHA I   2 = TWO   Z = ALPHA Z   / = SLASH | = VERT. BAR   - = MINUS   _ = HORZ. BAR

PROGRAM CODING FORM

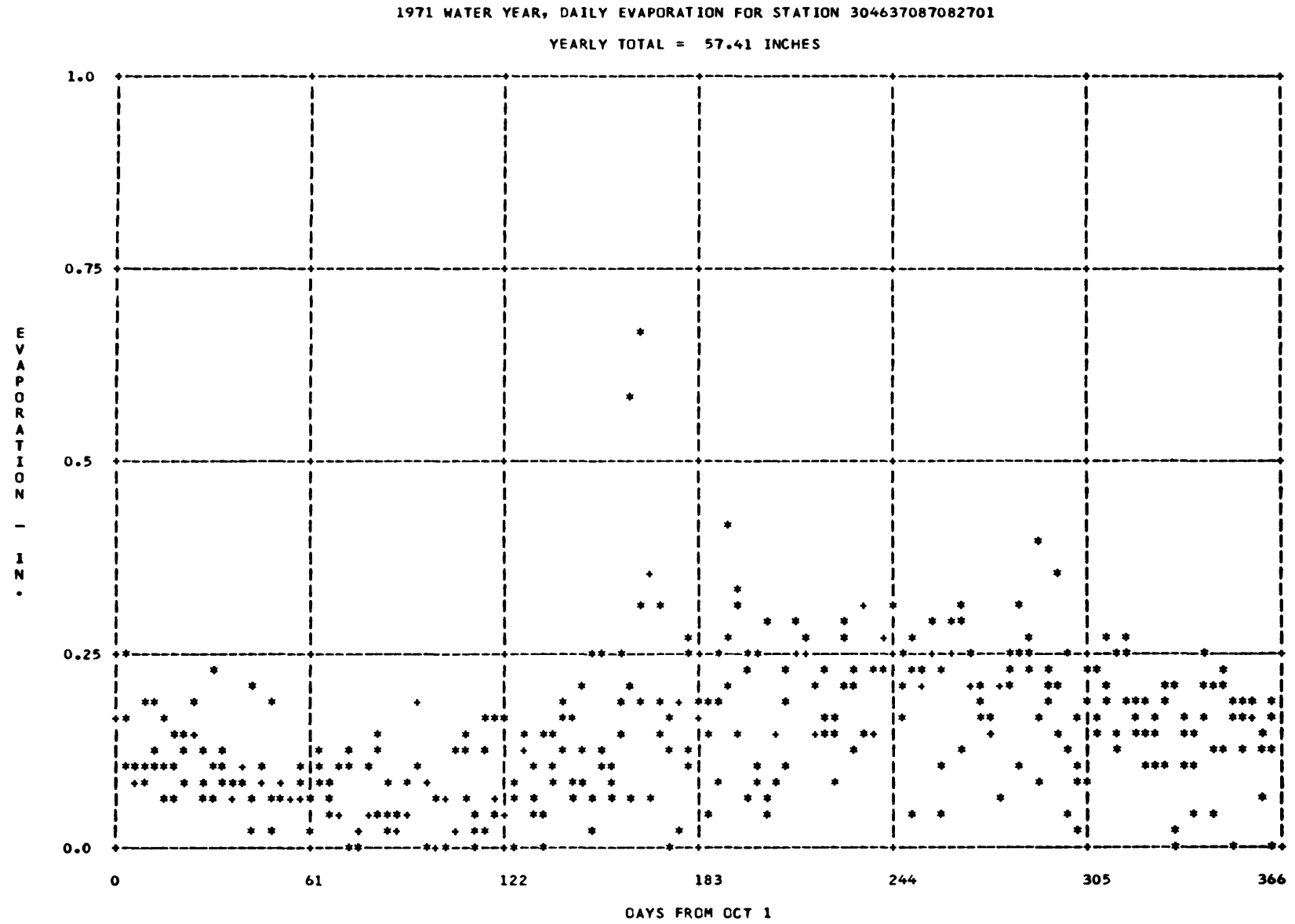
PROGRAM H266 - REVISED 09-15-76
SYNTHETIC DAILY EVAPORATION DATA GENERATOR
DATA WILL BE STORED IN DAILY VALUES FILE IN SUBSEQUENT JOB STEP
THESE DATA WILL BE DELETED FROM CURRENT DAILY VALUES FILE WHEN NEXT BACK FILE MERGE OCCURS

*** IMAGE OF INPUT CARD FOLLOWS ***
G304637087082701 3M 19711973 19671970

OUTPUT OPTION TO OBTAIN LINE PRINTER PLOT(S) OF OBSERVED DATA, A TABLE OF GENERATED DATA, AND LINE PRINTER PLOT OF GENERATED DATA WAS SELECTED.

OPTION TO OBTAIN MULTI-PAGE PRINTER PLOT ALSO SELECTED.

OPTION TO FIT HARMONIC (SINE-COSINE) FUNCTION TO OBSERVED DAILY EVAP. DATA WAS SELECTED.

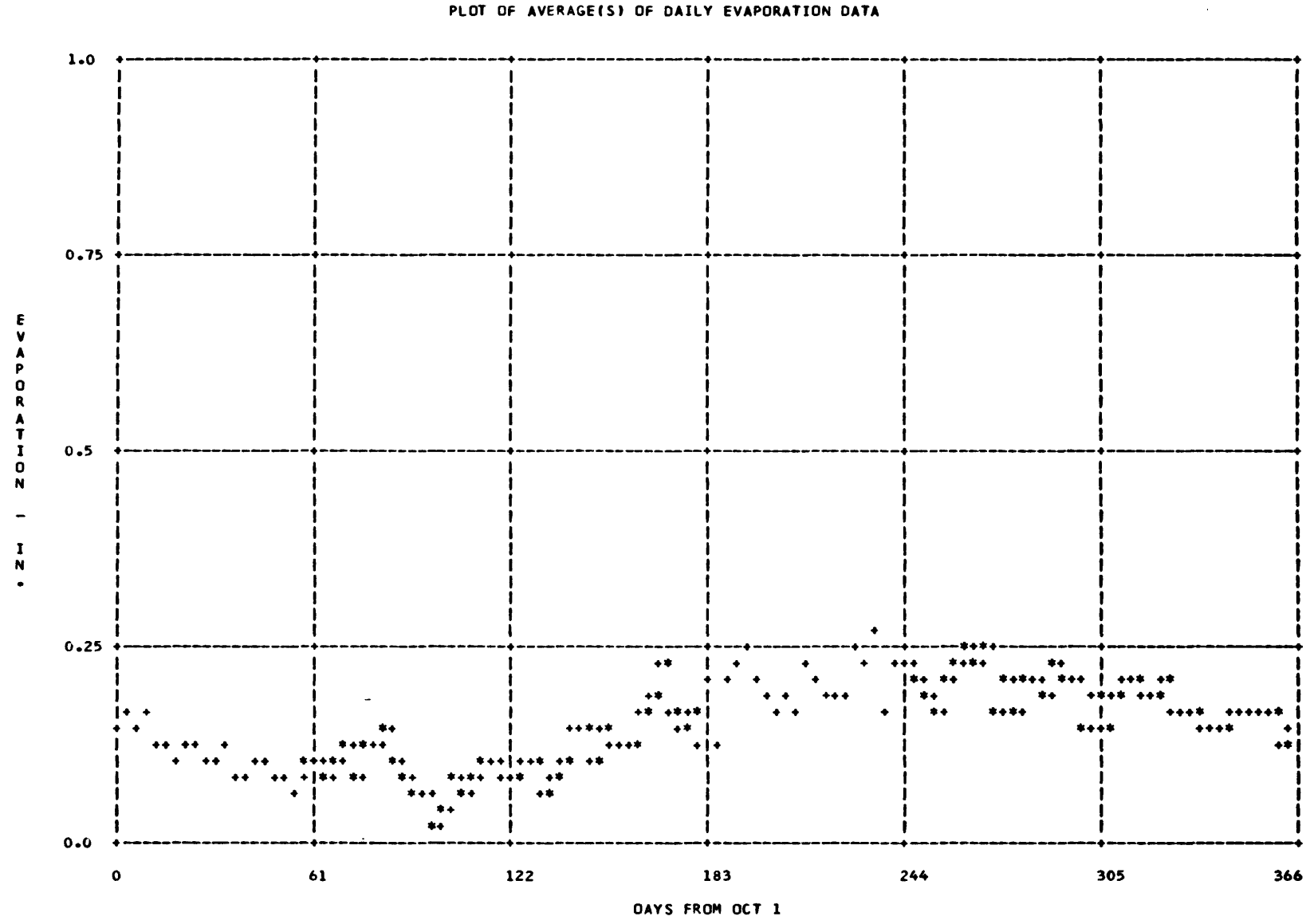

1971 WATER YEAR, DAILY EVAPORATION FOR STATION 304637087082701
YEARLY TOTAL = 57.41 INCHES
1.0
0.75
0.5
0.25
0.0
EVAPORATION - IN.
0
61
122
183
244
305
366
DAYS FROM OCT 1
NUMBER OF POINTS PLOTTED = 366
NUMBER OF MULTIPLE POINTS = 45
NUMBER OF POINTS OFF GRID = 0

FILE TYPE	STATE CODE	AGENCY CODE	STATION IDENTIFICATION NUMBER	CROSS SECTION	SAMPLING DEPTH	PARA-METER CODE	YEAR	STAT CODE	NO VALUE INDICATOR	DIST CODE	COUNTY CODE	DRAINAGE AREA	CONTRIB. DRAINAGE AREA
R	12	USGS	304637087082701			00050	0000	00006	999999.0000				

STATION NAME OR LOCAL WELL NUMBER	WELL DEPTH	DATUM	HYDROLOGIC UNIT CODE	RTV SEQ NO	BEG MO	SITE CODE	STATION LOCATOR LAT-ITUDE	LONG-ITUDE	SEQ NO	GEOLOGIC UNIT CODE
MILTON EXP STA NR MILTON, FLA.	WB5793	0.00	0.00	00	10					

DAY	10	11	12	01	02	03	04	05	06	07	08	09
1	0.146	0.115	0.098	0.098	0.115	0.143	0.178	0.208	0.226	0.227	0.210	0.179
2	0.145	0.115	0.098	0.098	0.116	0.144	0.179	0.209	0.226	0.226	0.209	0.178
3	0.144	0.114	0.097	0.098	0.117	0.146	0.181	0.210	0.227	0.226	0.208	0.177
4	0.143	0.113	0.097	0.099	0.118	0.147	0.182	0.210	0.227	0.226	0.207	0.176
5	0.142	0.112	0.097	0.099	0.118	0.148	0.183	0.211	0.227	0.225	0.206	0.175
6	0.141	0.112	0.097	0.099	0.119	0.149	0.184	0.212	0.227	0.225	0.205	0.174
7	0.139	0.111	0.097	0.100	0.120	0.150	0.185	0.213	0.228	0.225	0.204	0.173
8	0.138	0.110	0.096	0.100	0.121	0.151	0.186	0.213	0.228	0.224	0.204	0.171
9	0.137	0.109	0.096	0.101	0.122	0.152	0.187	0.214	0.228	0.224	0.203	0.170
10	0.136	0.109	0.096	0.101	0.123	0.153	0.188	0.215	0.228	0.223	0.202	0.169
11	0.135	0.108	0.096	0.101	0.124	0.155	0.189	0.216	0.228	0.223	0.201	0.168
12	0.134	0.107	0.096	0.102	0.125	0.156	0.190	0.216	0.228	0.222	0.200	0.167
13	0.133	0.107	0.096	0.102	0.126	0.157	0.191	0.217	0.228	0.222	0.199	0.166
14	0.132	0.106	0.096	0.103	0.127	0.158	0.192	0.217	0.228	0.221	0.198	0.165
15	0.131	0.105	0.096	0.103	0.128	0.159	0.193	0.218	0.228	0.221	0.197	0.163
16	0.130	0.105	0.096	0.104	0.129	0.160	0.194	0.219	0.228	0.220	0.196	0.162
17	0.129	0.104	0.096	0.105	0.130	0.161	0.195	0.219	0.228	0.220	0.195	0.161
18	0.128	0.104	0.096	0.105	0.131	0.162	0.196	0.220	0.228	0.219	0.194	0.160
19	0.127	0.103	0.096	0.106	0.132	0.164	0.197	0.220	0.228	0.219	0.193	0.159
20	0.126	0.103	0.096	0.106	0.133	0.165	0.198	0.221	0.228	0.218	0.192	0.158
21	0.125	0.102	0.096	0.107	0.134	0.166	0.199	0.221	0.228	0.217	0.191	0.157
22	0.124	0.102	0.096	0.108	0.135	0.167	0.200	0.222	0.228	0.217	0.190	0.155
23	0.123	0.101	0.096	0.108	0.136	0.168	0.201	0.222	0.228	0.216	0.189	0.154
24	0.122	0.101	0.096	0.109	0.137	0.169	0.202	0.223	0.228	0.215	0.188	0.153
25	0.121	0.100	0.096	0.110	0.138	0.170	0.203	0.223	0.228	0.215	0.187	0.152
26	0.121	0.100	0.096	0.110	0.139	0.172	0.204	0.224	0.228	0.214	0.186	0.151
27	0.120	0.099	0.096	0.111	0.140	0.173	0.205	0.224	0.227	0.213	0.185	0.150
28	0.119	0.099	0.097	0.112	0.141	0.174	0.205	0.225	0.227	0.213	0.184	0.149
29	0.118	0.099	0.097	0.113	0.142	0.175	0.206	0.225	0.227	0.212	0.183	0.148
30	0.117	0.098	0.097	0.113	999999	0.176	0.207	0.225	0.227	0.211	0.181	0.146
31	0.116	999999	0.097	0.114	999999	0.177	999999	0.226	999999	0.210	0.180	999999

***** GENERATED PAN EVAPORATION DATA *****
BASED ON THE ANALYSIS OF WATER YEARS 1971 TO 1973 - WATER YEARS 1967 TO 1970 WERE GENERATED.
YEARLY TOTAL = 59.28 INCHES IF A LEAP YEAR, OR 59.14 INCHES IF NON-LEAP YEAR.


PLOT OF AVERAGE(S) OF DAILY EVAPORATION DATA
1.0
0.75
0.5
0.25
0.0
EVAPORATION - IN.
0
61
122
183
244
305
366
DAYS FROM OCT 1
NUMBER OF POINTS PLOTTED = 366
NUMBER OF MULTIPLE POINTS = 187
NUMBER OF POINTS OFF GRID = 0

RETRIEVAL FROM CURRENT UNIT AND DAILY VALUES FILES

Program H268

Cataloged Procedure RRLIST

Program H268 is the main retrieval program which passes unit rainfall, unit discharge, daily rainfall, and daily evaporation from the Current Unit and Daily Values Files to other programs for editing, analyzing, and modeling purposes. The cataloged procedure RRLIST automatically sets the -100 storm indicators in the daily rainfall data if the word 'PASS' is coded on the retrieval card. The procedure will also punch cards (no -100 storm indicators) in the Carter format (unit time interval must be equal to or greater than 5 min.) by coding 'PUNCH' on the retrieval card, and will produce a line printer listing of the retrieved data by coding 'PRINT' on the retrieval card. The word 'PASS' must be coded on the retrieval card in order for the retrieved data set to be used by other programs in the same job.

Precaution

Unit data recorded at different time intervals may be loaded in the Current and Historical Unit Values Files. The -100 storm indicators will be set in the retrieved daily rainfall data regardless of whether the unit time interval is constant or variable. Data recorded with a specific unit time interval can be retrieved from records with a mixed interval by specifying dates of records with this specific time interval to be retrieved on the retrieval card. Presently, rainfall-runoff models do not allow use of mixed time intervals in the unit data.

Cataloged Procedure

This procedure will retrieve, list, pass, or punch (Carter format) data from the Current Unit or Daily Values File, and create a temporary file of this data for use by subsequent job steps.

```
/*RELAY  PUNCH RE2

//xxxxxxxx JOB (-------)

/*PROCLIB  WRD.PROCLIB

// EXEC RRLIST

//H268.SYSIN DD *
   .
   .
   .
```

```
   H268 input cards
    .
    .
    .
//

$$$
```

The default time in this procedure is 3 minutes which should be sufficient for most job runs. The execution time may be increased by coding the following on the "EXEC" card:

,RTIME=time

This procedure contains programs H268 and DSK268. All data cards must be assembled in accordance with H268 program documentation.

The temporary file that is created by use of the cataloged procedure may be accessed in a subsequent job step by using the following DD (data definition) information:

```
//DISK DD DSN=&&DISK,UNIT=SYSDK,DCB=DSORG=IS,DISP=(OLD,DELETE)
```

If card output is obtained by use of the cataloged procedure, the cards will contain the last 8 digits of the station identification number or the 8-character number specified by the user. See input card instructions for field position of user specified identification number.

If the user does not have card punch facilities, a line printer listing of the Carter format card images may be obtained by coding the following on the "EXEC" card

,SYSOUT=A

along with making the appropriate changes on the input card(s) requesting card output.

Input Cards

A. A Password-Agency Identification Card (type Z), Volume I, Chapter IV, Section B, B-22, WATSTORE User's Guide (Hutchison, 1975) input card may be necessary to retrieve from the Current Unit and Daily Values Files. If station is identified in the WRD Station Header file with an agency code other than "USGS," and/or if it is password protected at the WRD Station Header File level, then a type Z card may be required. If a type Z card is required or used, it must precede the first type 'D' or 'U' card (see below) in program H268, and is always the first card in input card stream (one exception is in use of cataloged procedure RRCALB75-section 13; in this case the 'Z' card would follow the type 'X' card if the type X card option is used). The format of the Z card follows:

Column(s)	Definition
1	Always code a Z.
2-16	Station identifier (right justified) which must be stored in Station Header File.
17-24	Blank.
25-28	Retrieval password as stored in Station Header File.
29-32	Blank.
33-37	Retrieval agency code that is associated with retrieved sites.
38-80	Blank.

B. The primary input card(s) to program H268 consist of cards which define the retrievals to be made from the Current Unit and Daily Values Files and specifies the output option. The format of these cards follows:

Column (s)	Definition
1	File designation: 'D' retrieve from Daily Values File. 'U' retrieve from Unit Values File.
2-16	Station identifier (right justified) which must be stored in Station Header File.
17-28	Blank.
29-33	Parameter code (right justified).
34-38	Statistic code (right justified).
39-46	Beginning date of data requested: 1/ 39-42 Calendar year. 43-44 Calendar month. 45-46 Day of month.
47-54	Ending date of data requested: 1/ 47-50 Calendar year. 51-52 Calendar month. 53-54 Day of month.

Column(s)	Definition
55-72	Output option requested: Code in any order, with or without punctuation, any or all of the following: 'PASS' = Retrieved records will be passed to subsequent job steps. 'PRINT' = Retrieved data will be printed. 'PUNCH' = Carter card output will be punched.
73-80	8-digit user-designated station identifier to be used for card output; if left blank, then last 8 positions of station identifier field (cols. 2-16) will be used.

1/ If the beginning date field is left blank, retrieval will begin with the first chronological record on file. If the ending date field is left blank, the retrieval will end with the last chronological record on file. Only complete water years of daily values are retrieved and a blank in the month field(s) (cols. 43-44 and/or 51-52) will cause the assumption that retrieval of the complete water year has been specified.

Output

There are several messages that may be printed whenever program H268 is executed. These messages are summarized in two groups below. The first group of messages is for errors detected during attempted retrievals, and the second group of messages is for retrievals successfully made. Additional output from the program is dependent on the requested option(s) (cols. 55-72) on the requesting card. The 'PASS' option will cause the records retrieved from the files to be written on a magnetic storage device in the same format as they were read. The 'PRINT' option will cause the records retrieved to be printed as shown in the example. The final option 'PUNCH' will cause the data retrieved to be punched as 'Carter' formatted cards. The format of these cards is found in Section 4.

Diagnostic Messages

Each retrieval card will cause either an error or retrieval message to be printed. An example of each message is listed below.

Errors.--Detected errors in a retrieval request card will cause one of the following messages to be printed. In each case, processing will continue with the next retrieval request card submitted.

1. 'Card image' STATION ID NOT FOUND IN HEADER FILE

   Columns 2-16 do not contain a station ID that can be found in the WRD Station Header File.

2. 'Card image' CONVERSION ERROR IN RETRIEVAL CARD

   The date (cols. 39-46, 47-54), the parameter code (cols. 29-33), or the statistic code (cols. 34-38) fields contain non-numeric characters.

3. 'Card image' UNKOWN FILE DEFINITION

   Column 1 does not contain a 'U' or 'D'.

4. 'Card image' DATA NOT FOUND IN DAILY VALUES FILE

   The data specified on the request card was not found in the Current Daily Values File.

5. 'Card image' DATA NOT FOUND IN UNIT VALUES FILE

   The data specified on the request card was not found in the Current Unit Values File.

Retrievals.--Successful retrievals of records from the WRD files cause one of the following messages to be printed.

1. DAILY VALUES RECORDS RETRIEVAL: STATION ID='station ID', PARAMETER= 'parameter code', STATISTIC='statistic code'

   THE WATER YEARS LISTED BELOW WERE RETRIEVED, PASSED, PRINTED, PUNCHED: The words underlined will be printed only for the options requested. This message is followed by the years for the daily records retrieved.

2. UNIT VALUES RECORDS RETRIEVAL STATION ID='station ID', PARAMETER= 'parameter code', STATISTIC='statistic code'

   THE DAYS LISTED BELOW WERE RETRIEVED, PASSED, PRINTED, PUNCHED: The words underlined will be printed only for options requested. This message is followed by the dates of the records retrieved and the number of readings per day in parenthesis.

Example of Setting Up Job

The user wants to determine (a) the days during the 1976 water year for which daily reinfall is stored in the Daily Values File and (b) to examine unit rainfall in the Unit Values File for the 1976 year. The station is Sugar Creek at Clifton Church Road nr. Atlanta, Georgia. Only the PRINT option in this program will be required. This station identifier is 02203820 for both daily and unit rainfall.

A listing of the job card deck and the line printer output follow.

PROGRAMMER _____ DIVISION _____
LOCATION _____ PHONE _____

U. S. DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

COMPUTER CODING FORM

PROGRAM NO. _____
PROJECT _____

SHEET ____ OF ____

PROGRAM IDENTIFICATION: _____
PROGRAM INFORMATION: _____

STATEMENT IDENTIFICATION

```
1  /*RELAY   PUNCH RE2
2  //xxxxxxxx JØB (--------)
3  /*PRØCLIB  WRD. PRØCLIB
4  //   EXEC RRLIST
5  //H268.SYSIN DD *
6  D          02203820          00045000006197510011976093ØPRINT
7  U          02203820          00045000006197510011976093ØPRINT
8  //
9  $$$
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
```

FORM 9—1634 A
JULY 1967

0 = ZERO Ø = ALPHA O 1 = ONE I = ALPHA I 2 = TWO Z = ALPHA Z / = SLASH | = VERT. BAR - = MINUS _ = HORZ. BAR

PROGRAM CODING FORM

GPO : 1968 O - 286-594

PROGRAM H268 , REVISED DEC 1975

RETRIEVE, PRINT, PUNCH AND/OR PASS UNIT AND DAILY VALUES FOR RAINFALL-RUNOFF MODELING PROGRAMS

MESSAGES - RETRIEVALS MADE AND ATTEMPTED, AND ERRORS FOLLOW:

DAILY VALUES DATA RETRIEVAL: STATION= 02203820 PARAMETER= 45 STATISTIC= 6
THE WATER YEARS LISTED BELOW WERE RETRIEVED, PRINTED:
1976

UNIT VALUES DATA RETRIEVAL: STATION= 02203820 PARAMETER= 45 STATISTIC= 6
THE DATES LISTED BELOW WERE RETRIEVED, PRINTED:
JAN. 26, 1976(288) JAN. 27, 1976(286) MAR. 12, 1976(286) MAR. 13, 1976(288) MAR. 15, 1976(288) MAR. 16, 1976(288)
MAR. 17, 1976(286)

FILE TYPE	STATE CODE	AGENCY CODE	STATION IDENTIFICATION NUMBER	CROSS SECTION	SAMPLING DEPTH	PARA-METER CODE	WATER YEAR	STAT CODE	NO VALUE INDICATOR	CREATE DATE	ACCOUNT NUMBER	PRO-CESS CODE	DIST CODE	SEC FLAG	RCD DISP
F	13	USGS	02203820	999999.000	999999.000	00045	1976	00006	999999.0000	760701	*********	B	13		

DAY	10	11	12	01	02	03	04	05	06	07	08	09
1	0.020	0.000	0.370	0.000	0.310	0.000	999999	999999	999999	999999	999999	999999
2	0.000	0.000	0.010	0.010	0.000	0.000	999999	999999	999999	999999	999999	999999
3	0.000	0.000	0.000	0.260	0.000	0.010	999999	999999	999999	999999	999999	999999
4	0.100	0.000	0.000	0.000	0.010	0.000	999999	999999	999999	999999	999999	999999
5	1.670	0.000	0.010	0.040	0.000	0.020	999999	999999	999999	999999	999999	999999
6	0.050	0.000	0.010	0.000	0.050	0.080	999999	999999	999999	999999	999999	999999
7	0.790	0.570	0.060	0.460	0.030	0.000	999999	999999	999999	999999	999999	999999
8	0.040	0.020	0.000	0.000	0.000	0.000	999999	999999	999999	999999	999999	999999
9	0.000	0.000	0.070	0.000	0.020	0.530	999999	999999	999999	999999	999999	999999
10	0.000	0.140	0.020	0.020	0.000	0.010	999999	999999	999999	999999	999999	999999
11	0.000	0.000	0.000	0.160	0.030	0.000	999999	999999	999999	999999	999999	999999
12	0.000	1.200	0.000	0.000	0.000	1.530	999999	999999	999999	999999	999999	999999
13	0.000	0.000	0.000	0.520	0.010	0.820	999999	999999	999999	999999	999999	999999
14	0.010	0.000	0.000	0.000	0.000	0.040	999999	999999	999999	999999	999999	999999
15	0.000	0.010	0.020	0.030	0.000	3.080	999999	999999	999999	999999	999999	999999
16	0.040	0.000	0.270	0.040	0.000	2.370	999999	999999	999999	999999	999999	999999
17	1.890	0.000	0.430	0.000	0.000	0.000	999999	999999	999999	999999	999999	999999
18	0.000	0.000	0.000	0.040	0.590	0.000	999999	999999	999999	999999	999999	999999
19	0.000	0.000	0.010	0.000	0.010	0.000	999999	999999	999999	999999	999999	999999
20	0.000	0.400	0.000	0.000	0.000	0.060	999999	999999	999999	999999	999999	999999
21	0.030	0.000	0.000	0.000	0.440	0.580	999999	999999	999999	999999	999999	999999
22	0.000	0.020	0.000	0.020	0.300	0.000	999999	999999	999999	999999	999999	999999
23	0.000	0.400	0.000	0.010	0.010	0.000	999999	999999	999999	999999	999999	999999
24	0.000	0.000	0.000	0.010	0.000	0.000	999999	999999	999999	999999	999999	999999
25	0.000	0.010	0.010	0.000	0.000	0.010	999999	999999	999999	999999	999999	999999
26	0.010	0.000	0.020	2.890	0.000	0.390	999999	999999	999999	999999	999999	999999
27	0.000	0.170	0.000	0.000	0.000	0.000	999999	999999	999999	999999	999999	999999
28	0.010	0.010	0.010	0.000	0.000	0.010	999999	999999	999999	999999	999999	999999
29	0.000	0.000	0.000	0.000	0.000	0.000	999999	999999	999999	999999	999999	999999
30	0.000	0.500	0.570	0.010	999999	1.510	999999	999999	999999	999999	999999	999999
31	0.000	999999	0.660	0.000	999999	0.000	999999	999999	999999	999999	999999	999999

STATION ID = 02203820 PARAMETER CODE = 45 STATISTIC CODE = 6

DEPTH =999999.00 DATE OF PROCESSING = 760701 STATE CODE = 13
X-SECTION =999999.00 ACCOUNT NUMBER =$$$$$$$$$ AGENCY CODE = USGS

DATE: JAN. 26, 1976 READINGS PER DAY = 288 NO VALUE INDICATOR=999999.00

HR.MIN.SEC	VALUE	HR.MIN.SEC	VALUE	HR.MIN.SEC	VALUE	HR.MIN.SEC	VALUE	HR.MIN.SEC	VALUE	HR.MIN.SEC	VALUE
03.10.00	0.01	03.15.00	0.03	03.20.00	0.03	03.25.00	0.05	03.30.00	0.03	03.35.00	0.05
03.40.00	0.04	03.45.00	0.02	03.50.00	0.03	03.55.00	0.05	04.00.00	0.07	04.05.00	0.01
04.10.00	0.00	04.15.00	0.00	04.20.00	0.00	04.25.00	0.04	04.30.00	0.01	04.35.00	0.00
04.40.00	0.00	04.45.00	0.00	04.50.00	0.01	04.55.00	0.02	05.00.00	0.00	05.05.00	0.00
05.10.00	0.00	05.15.00	0.01	05.20.00	0.00	05.25.00	0.00	05.30.00	0.00	05.35.00	0.01
05.40.00	0.01	05.45.00	0.02	05.50.00	0.05	05.55.00	0.03	06.00.00	0.05	06.05.00	0.03
06.10.00	0.05	06.15.00	0.02	06.20.00	0.03	06.25.00	0.05	06.30.00	0.10	06.35.00	0.12
06.40.00	0.07	06.45.00	0.06	06.50.00	0.06	06.55.00	0.03	07.00.00	0.06	07.05.00	0.06
07.10.00	0.05	07.15.00	0.00	07.20.00	0.10	07.25.00	0.05	07.30.00	0.02	07.35.00	0.06
07.40.00	0.03	07.45.00	0.02	07.50.00	0.02	07.55.00	0.03	08.00.00	0.04	08.05.00	0.01
08.10.00	0.02	08.15.00	0.02	08.20.00	0.01	08.25.00	0.01	08.30.00	0.01	08.35.00	0.02
08.40.00	0.02	08.45.00	0.04	08.50.00	0.02	08.55.00	0.02	09.00.00	0.02	09.05.00	0.06
09.10.00	0.03	09.15.00	0.02	09.20.00	0.03	09.25.00	0.03	09.30.00	0.04	09.35.00	0.04
09.40.00	0.02	09.45.00	0.02	09.50.00	0.02	09.55.00	0.03	10.00.00	0.02	10.05.00	0.01
10.10.00	0.01	10.15.00	0.03	10.20.00	0.00	10.25.00	0.00	10.30.00	0.01	10.35.00	0.04
10.40.00	0.01	10.45.00	0.00	10.50.00	0.01	10.55.00	0.00	11.00.00	0.00	11.05.00	0.01
11.10.00	0.00	11.15.00	0.00	11.20.00	0.01	11.25.00	0.00	11.30.00	0.00	11.35.00	0.01
11.40.00	0.00	11.45.00	0.00	11.50.00	0.00	11.55.00	0.00	12.00.00	0.00	12.05.00	0.00
12.10.00	0.00	12.15.00	0.00	12.20.00	0.00	12.25.00	0.00	12.30.00	0.01	12.35.00	0.00
12.40.00	0.02	12.45.00	0.03	12.50.00	0.01	12.55.00	0.02	13.00.00	0.01	13.05.00	0.01
13.10.00	0.00	13.15.00	0.01	13.20.00	0.00	13.25.00	0.00	13.30.00	0.00	13.35.00	0.00
13.40.00	0.00	13.45.00	0.00	13.50.00	0.00	13.55.00	0.00	14.00.00	0.00	14.05.00	0.01
14.10.00	0.00	14.15.00	0.00	14.20.00	0.01	14.25.00	0.00	14.30.00	0.00	14.35.00	0.00
14.40.00	0.01	14.45.00	0.00	14.50.00	0.00	14.55.00	0.00	15.00.00	0.00	15.05.00	0.00
15.10.00	0.00	15.15.00	0.00	15.20.00	0.00	15.25.00	0.00	15.30.00	0.00	15.35.00	0.00
15.40.00	0.00	15.45.00	0.01	15.50.00	0.00	15.55.00	0.00	16.00.00	0.00	16.05.00	0.00
16.10.00	0.00	16.15.00	0.00	16.20.00	0.00	16.25.00	0.00	16.30.00	0.00	16.35.00	0.01
16.40.00	0.00	16.45.00	0.00	16.50.00	0.00	16.55.00	0.01	17.00.00	0.01	17.05.00	0.02
17.10.00	0.00	17.15.00	0.00	17.20.00	0.01	17.25.00	0.00	17.30.00	0.01	17.35.00	0.00
17.40.00	0.00	17.45.00	0.01	17.50.00	0.00	17.55.00	0.00	18.00.00	0.00	18.05.00	0.00
18.10.00	0.00	18.15.00	0.00	18.20.00	0.01	18.25.00	0.01	18.30.00	0.00	18.35.00	0.01

STATION ID = 02203820 PARAMETER CODE = 45 STATISTIC CODE = 6

DEPTH =999999.00 DATE OF PROCESSING = 760701 STATE CODE = 13
X-SECTION =999999.00 ACCOUNT NUMBER =$$$$$$$$$ AGENCY CODE = USGS

DATE: JAN. 27, 1976 READINGS PER DAY = 288 NO VALUE INDICATOR=999999.00

HR.MIN.SEC	VALUE	HR.MIN.SEC	VALUE	HR.MIN.SEC	VALUE	HR.MIN.SEC	VALUE	HR.MIN.SEC	VALUE	HR.MIN.SEC	VALUE
00.05.00	0.00										

DATA EDITING AND CREATION OF DATA SET INTERFACE

Program A604

Cataloged Procedure RREDIT75

Description

This cataloged procedure is the principal one used to edit rainfall-runoff data in the Current Unit and Daily Values Files. All four types of data, unit rainfall and discharge, daily rainfall and evaporation, may be edited with this program. The procedure contains programs H268 (section 8) and A604. The procedure may also be used to create an output data set.

In the first job step of this cataloged procedure, the data are retrieved from the Current Unit and Daily Values Files by program H268 (Section 8), which creates a temporary data set on a systems disk. The temporary data set is passed to the next job step in which program A604 is executed.

Program A604 has several functions, listed in the options below. The principal functions are to edit data and to create output data sets (option 2). Both uses are described in this section. Output record formats of program A604 are given in Supplementary Data. Program A604 is used to create a temporary output data set (option 2) in record formats which are capatible with input requirements of the natural basin model calibration program A634 (section 13). If calibration or synthesis is to be the next step in the job, then a temporary data set is created on a systems disk. The user can specify that the output data set from program A604 be permanently stored in a private file on disk or tape which will be utilized in subsequent jobs.

Program Options

Option	Description
1	Checks that both unit rainfall and unit discharge are stored in the Current Unit and Daily Values Files for each storm event deemed necessary for calibration or synthesis at a particular station.
2	Provides an output of selected records on a temporary or private file on tape or disk in record formats suitable for use by program A634.
3	Creates a plot tape for the Calcomp X-Y plotters. The plot is used to verify the adequacy of definition of unit discharge and/or unit rainfall data. Four log cycles are shown for discharge scale on hydrograph.

Oxtion	Description
	Examples of a plot and of the Computer Center Division form to request a Calcomp plot are shown in figures 9-1 and 9-2.
4	Lists the unit and/or daily values data in the current files for selected time period in the Carter format.
5	Provides for output of cards punched in the Carter format (section 4).
6	Computes the storm rainfall and runoff totals.

Precautions

1. Program A604 in itself will not retrieve records from the current files. The retrieval is made by program H268, indicated by the card

```
//H268.SYSIN DD *
```

in the cataloged procedure. The formats for program H268 input cards are given in section 8. It is recommended this retrieval of records by program H268 be in the order required by program A604. If a Password/Agency Identification (type Z) Card is required, refer to section 8 for placement in the job stream.

2. If daily rainfall data are retrieved without retrieval of unit rainfall data, no -100 storm indicators will appear in the listing of data,

3. The -100 storm indicators are automatically set in the temporary data set created in the retrieval job step operation. These indicators should not ever be found or put in the current and/or historical files. Hence, use of option 1 above is not required but is useful as a check to insure the indicators are being properly set.

4. If unit rainfall records are retrieved for two or more stations the -100 storm indicators for all unit days, regardless of their origin, will be temporarily set in the retrieval operation and not in subsequent processing by program A604. Hence, the user should not attempt to analyze more than one daily and one unit rainfall data set in a job.

5. The daily and unit rainfall records need not be for the same station; the user may use different station identifiers for the daily and unit rainfall records. It is recommended, however, to limit retrieval and editing, by this program, to data for only one site; this limitation prevails because of retrieval methods used.

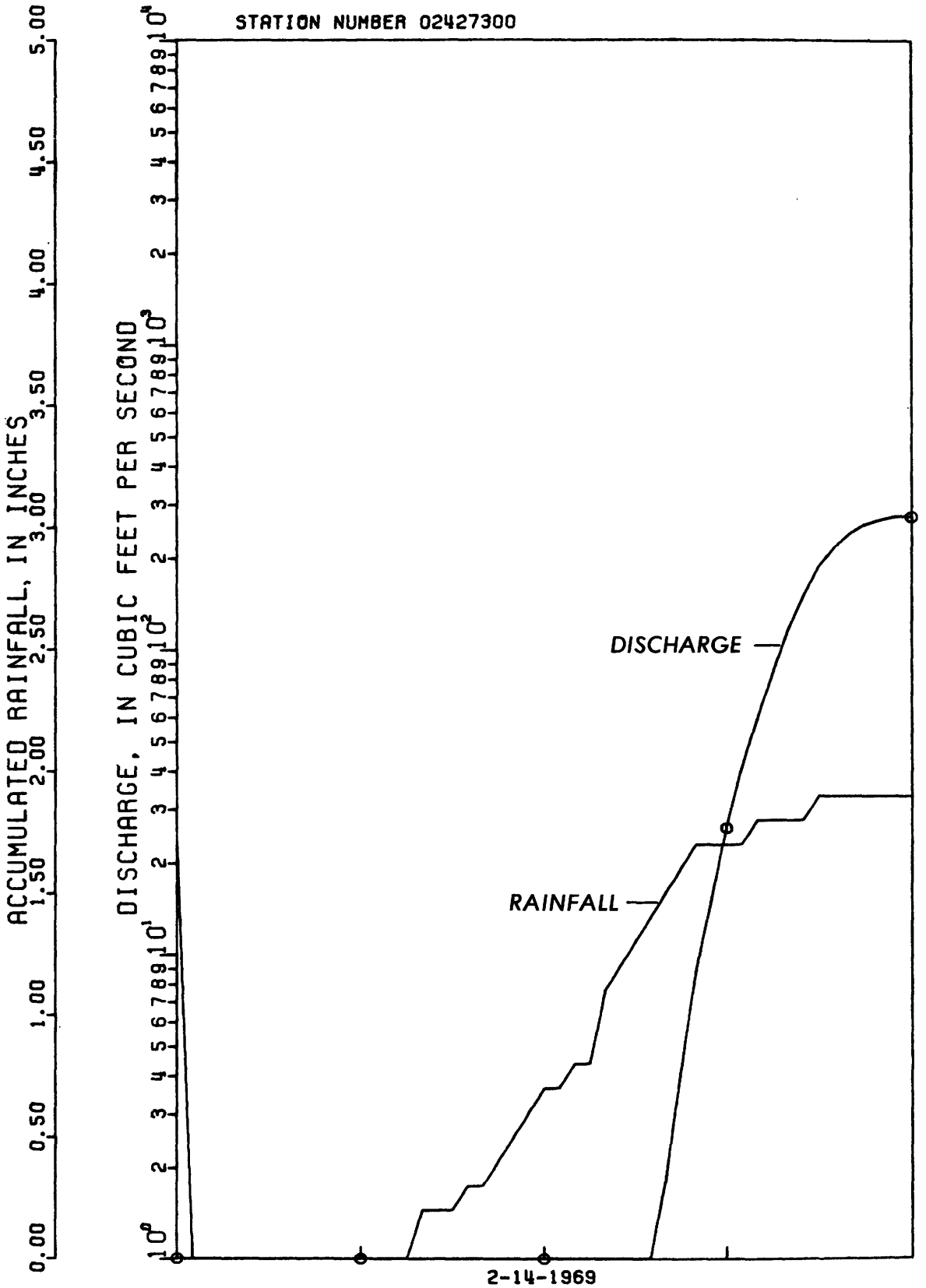


Figure 9-1. Example of rainfall hyetograph and discharge hydrograph produced by Calcomp plotter.

COMPUTER CENTER
REQUEST FOR PLOTTING FACILITIES

NAME BOWING | TELEPHONE 860-6837 | DATE--REQUEST 4/4/73

USER CODE 1AH | ACCT# | DIV. G4 | PROGRAM NUMBER A604

CALCOMP DRUM PLOTTER

TAPE NUMBER 001106 DENSITY 800

30 inch [ ] plain [X] grid [ ]

DEFINE STARTING POINT
Set pen 1" above lower margin

ball point pen [X] or ink color [ ]

black [X] blue [ ] green [ ] red [ ]

special(state color) [ ]

number of plotting frames See instruction below

SPECIAL INSTRUCTIONS
Set dial at '999'

CALCOMP FLATBED PLOTTER

TAPE NUMBER DENSITY

TYPE PAPER

DEFINE STARTING POINT

ball point pen [ ] or ink color [ ]

black [ ] blue [ ] green [ ] red [ ]

special (state color) [ ]

number of plotting frames

SPECIAL INSTRUCTIONS

Figure 9-2. Sample of Computer Center Division form used to request Calcomp plots.

Cataloged Procedure

This procedure will list, edit, punch cards (Carter format), and plot rainfall-runoff data.

```
/*RELAY  PUNCH RE2

//xxxxxxxx JOB (-------)

/*PROCLIB  WRD.PROCLIB

// EXEC RREDIT75

//H268.SYSIN DD *

  - Type Z card (optional)

  - Input cards for program H268

//A604.SYSIN DD *

  - Input cards for program A604

//

$$$
```

The default time for each step in this procedure is 3 minutes, which should be sufficient for most jobs. If it should become necessary to increase the time, it may be done by inserting the following on the "EXEC" card:

```
,RTIME=time
```

The region size for each step is fixed, and should not require changing except for CALCOMP plots. If a CALCOMP plot is required, it will be necessary to add a setup card for the plot tape in addition to inserting the following on the "EXEC" card:

```
,PLTTAPE=xxxxxx,PREGION=365K
```

where xxxxxx is a 7-track tape volume-serial number.

If the user does not have a card punch, but would like a line printer listing of card output, he may obtain a listing by inserting the following on the "EXEC" card:

```
,SYSOUT=A
```

If the user wishes to pass data to subsequent job step (option 2) such as for a user written program, it will be necessary to add the following cards just prior to the A604.SYSIN DD card in the cataloged procedure:

```
//A604.TAPEOUT DD DSN=&&name,UNIT=SYSDK,SPACE=(TRK,(15,5)),
//  DCB=(RECFM=VBS,LRECL=1596,BLKSIZE=13030),DISP=(,PASS)
```

where name = any 1-6 alphabetic characters chosen by the user to uniquely identify the data set during execution of the job.

Note.--The station identification on any requested card output will be the last 8 digits of the 15-digit identification number unless the user specifies his own 8-character identification number in step H268 of this procedure.

A private file may be created by adding a SETUP card identifying the volume-serial number of a tape or disk and inserting one of the following versions of DD cards immediately ahead of the A604.SYSIN card:

a. Data set on 9-track tape

```
//A604.TAPEOUT DD DSN=username,UNIT=TAPE9,LABEL=(,SL),DISP=(NEW,KEEP),
//  DCB=(RECFM=VBS,LRECL=1596,BLKSIZE=13030),VOL=SER=tapeno
```

b. Data set on private disk mounted on 3330 drive

```
//A604.TAPEOUT DD DSN=username,UNIT=3330,
//  SPACE=(TRK,(15,5),DISP=(NEW,KEEP),
//  DCB=(RECFM=VBS,LRECL=1596,BLKSIZE=13030),VOL=SER=CCDyyy
```

c. Data set on an online systems disk

```
//A604.TAPEOUT DD DSN=pointer.username,UNIT=ONLINE,
//  SPACE=(TRK,(15,5),RLSE),DISP=(NEW,KEEP)
//  DCB=(RECFM=VBS,LRECL=1596,BLKSIZE=13030)
```

where username = any 8-character name to uniquely identify data set

tapeno = volume serial number of 9-track tape

yyy = volume serial number of disk

pointer = 7-character cataloged pointer assigned by the Computer Center Division to user

The serial number of the online system disk will be found in the printout of the JCL in the system messages (beginning on third page of printout) somewhat below the line

```
//A604.TAPEOUT DD ...
```

Look for a line containing

IEF2851 pointer.username

Immediately following this line will be the line

IEF2851 VOL SER NOS = SYSyyy

where yyy = number of system disk.

Input Card for Program A604

A single card format is used. One card is required for each type of record (unit rainfall, unit discharge, daily rainfall, daily evaporation) retrieved.

For option 2, the following order of the data types is mandatory:

(a) daily rainfall record,

(b) unit discharge record,

(c) unit rainfall record,

(d) daily evaporation record.

Although not critical for other options, this order is suggested for processing all options.

Information entered in column 78 of the card identifies the order (1,2,...) in which data types are processed by particular option (col. 80). A '0' in column 79 indicates one or more data types in the set follows; an '1' in column 79 indicates the last card in a set of data types. An many sets of data types as desired may be processed, keeping in mind that only one unit rainfall site should be retrieved if excessive setting of -100 storm indicators in the daily rainfall record(s) is to be avoided.

Column	Description
1-15	15-digit station identifier.
16-20	Parameter code '00045' rainfall; '00050' evaporation; '00060' discharge.
21-25	Statistic code '00006' rainfall or evaporation; '00011' discharge.
26-29	Readings per day (RPD), right justified. Use '1' for daily data.

Column	Description
30-45	Period of record. Leave blank if entire period is to be processed. 30-33 Beginning of calendar year. 34-35 Beginning calendar month 36-37 Day of month. 38-41 Ending calendar year. 42-43 Ending calendar month. 44-45 Day of month.
46-51	Option 3 only. Minimum magnitude of discharge scale, in cfs, on Calcomp X-Y plot. Must be power of 10 (0.01, 0.1,...,100). Default is 1 cfs.
52-57	Option 3 only. Rainfall plotting scale; inches of cumulative rainfall per one inch of plot. Default is 0.5 inches per vertical inch of plot scale.
58-70	Blank.
71-75	Option 6 only. Drainage area. Punch decimal point if significant figures to its right. Right justify.
76-77	Blank.
78	Sequence order of data type (1,2,...) in set to be processed by option indicated in column 80.
79	'0' indicates more data types to follow in set; '1' indicates last data type in set.
80	Options = '1' - Edit of dates for -100 storm indicators '2' - Output of records on tape or disk; records to be used later by calibration or synthesis program. '3' - Calcomp X-Y plot '4' - Listing of daily and/or unit data in printout '5' - Cards punched in Carter format '6' - Storm rainfall and runoff totals

Diagnostic Messages

1. Card Input Error

   (A) Unit data

   ERROR IN CARD DATA FOR UNIT DATA PROCESSING REQUEST, STA. NO. 'station ID' PARM. CD. 'parameter code' STATIS. CD. 'statistic code' DATE BEGIN 'date' DATE END 'date' SWITCH IND. 1 OPTION 0.

   (B) Daily data

   ERROR IN CARD DATA FOR DAILY DATA PROCESSING REQUEST STA. NO. 'station ID' PARM. CD. 'parameter code' STATIS. CD. 'statistic code' WAT. YR. BEG. 'year' WAT. YR. END 'year' CD SWITCH IND. 1 OPTION 0.

   Program tests the parameter code, statistic code and the beginning and end dates specified.

2. Station Record Not Found

   (A) OPTION = 1, 4, or 5

   STATION RECORD NOT FOUND ON DISK STA. NO. 'station ID' PARM. CD. 'parameter code' STATIS. CD. 'statistic code' RPD 'readings per day' DURING THE TAPE WRITE OR CARD PUNCH PROCEDURE OR TABLE (DAILY OR UNIT) PRINTOUT PROCEDURE

   (B) OPTION = 2

   STATION RECORD NOT FOUND ON DISK STA. NO. 'station ID' PARM. CD. 'parameter code' STATIS. CD. 'statistic code' RPD 'readings per day' DURING THE STATION DATE EDIT PROCEDURE.

   (C) OPTION = 3

   STATION RECORD NOT FOUND ON DISK STA. NO. 'station ID' PARM. CD. 'parameter code' STATIS CD. 'statistic code' RPD 'readings per day' DURING THE LOG PLOT PROCEDURE

   The program sets up the disk record retrieval key information from the card input data. If the initial record is not found (key cond. = 51) the program will print out one of the above error messages (depending on option) and branch to the next card. The program will also omit any further cards concerning this option and station site.

3. Initial Record For Station Not Found - (Unit Data)

   (A) Date Edit Check (OPTION = 1)

   UNIT DATA DESIRED FOR STATION NOT FOUND DURING STATION DATA EDIT - PERIOD 'date' TO 'date' IDENTIFICATION - STA. NO. 'station ID' PARM. CD. 'parameter code' STATIS. CD. 'statistic code' RPD 'readings per day"

(B) Tape Write, Card Punch, or Printout Table (OPTION = 2,4,5)

UNIT DATA FOR STATION NOT FOUND - PERIOD 'data' TO 'date' IDENTIFICATION - STA. NO. 'station ID' STATIS. CD. 'statistic code' PARM. CD. 'parameter code' RPD 'readings per day'

(C) Unit Plot (OPTION = 3)

INITIAL UNIT DATA FOR STATION NOT FOUND DURING STATION UNIT PLOT - PERIOD 'date' TO 'date' IDENTIFICATION -STA. NO. 'station ID' PARM. CD. 'parameter code' STATIS. CD. 'statistic code' RPD 'readings per day'

In each case listed above, the program will set an indicator and branch to reach the next card. On the basis of the indicator switch which was set, the program will read data cards until it encounters the next station card set.

4. Initial Record Not Found For Station (Daily Data)

(A) Date Edit Check (OPTION = 1)

DAILY DATA FOR STATION NO. 'station ID' PARM. CD. 'parameter code' PERIOD DESIRED 'year' TO 'year' NOT FOUND

(B) Tape Write, Card Punch, or Printout Table (OPTION = 2,4, or 5)

DAILY DATA FOR STATION 'station ID, parameter code, statistic code' NOT FOUND WATER YEAR PERIOD DESIRED = 'year' TO 'year'

In both cases the program again sets an indicator switch and branches to read the next card. The program then reads successive data cards until it encounters the next station card set.

5. Date Edit Number Data Sets Not Within Allowable 2-3 Range

DATA EDIT NOT COMPLETED FOR STA. NO. 'station ID' LAST PARM. CD. 'parameter code' NUMBER STATION DATA TYPES TO BE DATE EDITED = 'number of types' NOT WITHIN ALLOWABLE 2-3 TYPES

The program will allow up to 2 or 3 data sets for any station site date edit analysis. This should always be adequate to cover the present model scheme or event dates for unit discharge, unit precipitation, and daily precipitation (-100 indicator). The error usually would indicate that a proper ending card has not been encountered for the previous set.

6. NON-Matching Dates Unit Dates in Unit Plot Attempt

RECORD DATES FOR DISCHARGE AND PRECIP. RECORDS TO BE PLOTTED DO NOT MATCH - DISCHARGE DATA - 'data' - PRECIP. DATE - 'date' IDENTIFICATION - STA. NO. 'station ID' RPD 'readings per day'

The program after writing the unit records (discharge and precipitation) on the temporary work disk space calls the actual unit-data plot procedure.

The procedure then reads successive unit discharge and precipitation records and checks for a date match with each record set. If they do not match the above message is printed and the program branches to next station card set. It is recommended before attempting to plot any data that the date edit option be used to check for correspondence of station event dates.

Examples of Setting Up Jobs

Daily rainfall and evaporation and unit discharge and rainfall have been entered into the Current Daily and Unit Values Files for Sugar Creek at Clifton Church Road nr. Altanta, Georgia, for water years 1974 and 1975, and part of water year 1976. It is desired to perform a date check of unit and daily rain and discharge data and to check the extent of daily evaporation data in the files for a potential calibration of the rainfall-runoff model. The job will retrieve data from the current files and pass the data set for editing by program A604. All data that exists in the files is to be checked, therefore, no dates are needed.

For daily rain, the station identifier is 2203820, parameter code = 00045, statistic code = 00006, and readings per day = 1; For unit discharge, the station identifier is 02203820, parameter code = 00060, statistic code = 00011, and readings per day = 288; For unit rain, the station identifier is 02203820, parameter code = 00045, statistic code = 00006, and readings per day = 288; For daily evaporation, the station identifier is 335700083190001, parameter code = 00050, statistic code = 00006, and readings per day = 1.

Listing of the job deck and a copy of the printout follow.

U. S. DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

COMPUTER CODING FORM

PROGRAMMER ______ DIVISION ______ PROGRAM NO. ______ SHEET ___ OF ___

LOCATION ______ PHONE ______ PROJECT ______

PROGRAM IDENTIFICATION: ______

PROGRAM INFORMATION: ______ STATEMENT IDENTIFICATION

```
/*RELAY  PUNCH REZ
//XXXXXXXX JOB (-------)
/*PROCLIB WRD.PROCLIB
// EXEC RREDIT75
//H268.SYSIN DD *
D       02203820            0004500006                PASS
U       02203820            0006000011                PASS
U       02203820            0004500006                PASS
D335700083190001            0005000006                PASS
//A604.SYSIN DD *
       022038200004500006   1                                                 101
       022038200006000011 288                                                 201
       022038200004500006 288                                                 311
3357000831900010005000006   1                                                 114
//
$$$
```

9-12

FORM 9—1634 A
JULY 1967

0 = ZERO Ø = ALPHA O 1 = ONE I = ALPHA I 2 = TWO Ƶ = ALPHA Z / = SLASH | = VERT. BAR - = MINUS _ = HORZ. BAR

PROGRAM CODING FORM

GPO : 1968 O - 286-594

PROGRAM H268 , REVISED DEC 1975

RETRIEVE, PRINT, PUNCH AND/OR PASS UNIT AND DAILY VALUES FOR RAINFALL-RUNOFF MODELING PROGRAMS

MESSAGES - RETRIEVALS MADE AND ATTEMPTED, AND ERRORS FOLLOW:

DAILY VALUES DATA RETRIEVAL: STATION= 02203820 PARAMETER= 45 STATISTIC= 6
THE WATER YEARS LISTED BELOW WERE RETRIEVED, PASSED:
1974 1975 1976

UNIT VALUES DATA RETRIEVAL: STATION= 02203820 PARAMETER= 60 STATISTIC= 11
THE DATES LISTED BELOW WERE RETRIEVED, PASSED:

DEC. 15, 1973(288)	FEB. 14, 1974(288)	FEB. 15, 1974(288)	FEB. 16, 1974(288)	APR. 4, 1974(288)	APR. 5, 1974(288)
JUNE 6, 1974(288)	JUNE 7, 1974(288)	JUNE 8, 1974(288)	JULY 3, 1974(288)	JULY 4, 1974(288)	AUG. 7, 1974(288)
AUG. 8, 1974(288)	DEC. 15, 1974(288)	DEC. 29, 1974(288)	DEC. 30, 1974(288)	JAN. 10, 1975(288)	JAN. 11, 1975(288)
JAN. 12, 1975(288)	JAN. 13, 1975(288)	FEB. 16, 1975(288)	FEB. 17, 1975(288)	FEB. 18, 1975(288)	FEB. 19, 1975(288)
MAR. 24, 1975(288)	APR. 2, 1975(288)	APR. 3, 1975(288)	MAY 3, 1975(288)	MAY 17, 1975(288)	MAY 18, 1975(288)
JUNE 10, 1975(288)	JUNE 11, 1975(288)	JUNE 12, 1975(288)	JUNE 19, 1975(288)	JULY 10, 1975(288)	JULY 11, 1975(288)
JULY 25, 1975(288)	JULY 26, 1975(288)	AUG. 27, 1975(288)	AUG. 28, 1975(288)	SEP. 18, 1975(288)	JAN. 26, 1976(288)
JAN. 27, 1976(288)	MAR. 12, 1976(288)	MAR. 13, 1976(288)	MAR. 15, 1976(288)	MAR. 16, 1976(288)	MAR. 17, 1976(288)

UNIT VALUES DATA RETRIEVAL: STATION= 02203820 PARAMETER= 45 STATISTIC= 6
THE DATES LISTED BELOW WERE RETRIEVED, PASSED:

DEC. 15, 1973(288)	FEB. 14, 1974(288)	FEB. 15, 1974(288)	FEB. 16, 1974(288)	APR. 4, 1974(288)	APR. 5, 1974(288)
JUNE 6, 1974(288)	JUNE 7, 1974(288)	JUNE 8, 1974(288)	JULY 3, 1974(288)	JULY 4, 1974(288)	AUG. 7, 1974(288)
AUG. 8, 1974(288)	DEC. 15, 1974(288)	DEC. 29, 1974(288)	DEC. 30, 1974(288)	JAN. 10, 1975(288)	JAN. 11, 1975(288)
JAN. 12, 1975(288)	JAN. 13, 1975(288)	FEB. 16, 1975(288)	FEB. 17, 1975(288)	FEB. 18, 1975(288)	FEB. 19, 1975(288)
MAR. 24, 1975(288)	APR. 2, 1975(288)	APR. 3, 1975(288)	MAY 3, 1975(288)	MAY 17, 1975(288)	MAY 18, 1975(288)
JUNE 10, 1975(288)	JUNE 11, 1975(288)	JUNE 12, 1975(288)	JUNE 19, 1975(288)	JULY 10, 1975(288)	JULY 11, 1975(288)
JULY 25, 1975(288)	JULY 26, 1975(288)	AUG. 27, 1975(288)	AUG. 28, 1975(288)	SEP. 18, 1975(288)	JAN. 26, 1976(288)
JAN. 27, 1976(288)	MAR. 12, 1976(288)	MAR. 13, 1976(288)	MAR. 15, 1976(288)	MAR. 16, 1976(288)	MAR. 17, 1976(288)

DAILY VALUES DATA RETRIEVAL: STATION=335700083190001 PARAMETER= 50 STATISTIC= 6
THE WATER YEARS LISTED BELOW WERE RETRIEVED, PASSED:
1974 1975 1976

PROGRAM DSK268 REVISED 04-01-75

CREATES A TEMPERARY ISAM FILE FOR RAINFALL-RUNOFF PROGRAMS

SUMMARY OF RECORDS ENTERED INTO ISAM FILE:

STA= 02203820	PARM= 45	STAT= 6	RPD= 1	RECORDS WRITTEN= 3
STA= 02203820	PARM= 45	STAT= 6	RPD= 288	RECORDS WRITTEN= 48
STA= 02203820	PARM= 60	STAT= 11	RPD= 288	RECORDS WRITTEN= 48
STA= 335700083190001	PARM= 50	STAT= 6	RPD= 1	RECORDS WRITTEN= 3

******* STATION DATE EDIT SUMMARY *******

STA.(1) = 02203820

STA.(2) = 02203820

STA.(3) = 02203820

LIST OF BEGINNING AND ENDING DATES FROM DAILY PRECIP. DATA
STORM NO. 119731215 TO 19731215
STORM NO. 219740214 TO 19740214
STORM NO. 319740215 TO 19740215
STORM NO. 419740216 TO 19740216
STORM NO. 519740404 TO 19740404
STORM NO. 619740405 TO 19740405
STORM NO. 719740606 TO 19740606
STORM NO. 819740607 TO 19740607
STORM NO. 919740608 TO 19740608
STORM NO. 1019740703 TO 19740703
STORM NO. 1119740704 TO 19740704
STORM NO. 1219740807 TO 19740807
STORM NO. 1319740808 TO 19740808
STORM NO. 1419741215 TO 19741215
STORM NO. 1519741229 TO 19741229
STORM NO. 1619741230 TO 19741230
STORM NO. 1719750110 TO 19750110
STORM NO. 1819750111 TO 19750111
STORM NO. 1919750112 TO 19750112
STORM NO. 2019750113 TO 19750113
STORM NO. 2119750216 TO 19750216
STORM NO. 2219750217 TO 19750217
STORM NO. 2319750218 TO 19750218
STORM NO. 2419750219 TO 19750219
STORM NO. 2519750324 TO 19750324
STORM NO. 2619750402 TO 19750402
STORM NO. 2719750403 TO 19750403
STORM NO. 2819750503 TO 19750503
STORM NO. 2919750517 TO 19750517
STORM NO. 3019750518 TO 19750518
STORM NO. 3119750610 TO 19750610
STORM NO. 3219750611 TO 19750611
STORM NO. 3319750612 TO 19750612
STORM NO. 3419750619 TO 19750619
STORM NO. 3519750710 TO 19750710
STORM NO. 3619750711 TO 19750711
STORM NO. 3719750725 TO 19750725
STORM NO. 3819750726 TO 19750726
STORM NO. 3919750827 TO 19750827
STORM NO. 4019750828 TO 19750828
STORM NO. 4119750918 TO 19750918
STORM NO. 4219760126 TO 19760126
STORM NO. 4319760127 TO 19760127
STORM NO. 4419760312 TO 19760312
STORM NO. 4519760313 TO 19760313

STORM NO. 4619760315 TO 19760315
STORM NO. 4719760316 TO 19760316
STORM NO. 4819760317 TO 19760317

TOTAL STORMS = 48

COMPARISON OF NUMBER UNIT PRECIP, UNIT DISCH. AND -100 DAYS

NUPD= 48 NUDD= 48 NDPD= 48

DATE	DAILY CODE	UNIT PREC	UNIT DISC

NO MISSING DATA FOUND

DAILY WATER YEAR EVAPORATION DATA SUMMARY FOR NOAA, EDS AT ATHENS AIRPORT, GA. W13873 STATE 13 DISTRICT 13

STA.NO. 335700083190001 WATER YEAR 1974

MONTH	CARD NO.																
10	1	12	12	0	14	19	20	20	10	14	14	15	16	11	9	9	11
10	2	16	10	18	12	13	12	14	15	13	13	22	22	11	7	7	
11	1	11	9	12	11	12	20	6	5	14	20	11	0	23	9	11	14
11	2	20	5	7	12	19	3	10	8	4	1	13	24	22	11		
12	1	14	11	7	0	0	19	6	7	5	12	10	14	10	13	8	0
12	2	12	8	4	0	3	2	16	4	9	5	19	5	6	11	2	
1	1	0	5	2	4	4	2	12	13	5	2	13	18	12	6	4	5
1	2	11	8	7	3	9	13	12	4	7	4	9	15	3	5	19	
2	1	15	9	12	17	16	8	1	1	17	10	12	15	16	1	16	9
2	2	18	8	27	23	15	13	15	17	18	12	11	20				
3	1	14	15	10	24	19	21	21	25	25	28	30	12	25	12	22	15
3	2	23	20	13	2	36	22	10	10	14	6	4	8	28	50	44	
4	1	21	30	12	27	28	31	32	2	22	23	23	16	22	5	27	22
4	2	26	21	17	29	22	21	25	18	23	25	30	41	32	33		
5	1	27	34	14	26	14	19	20	33	20	20	15	12	23	31	28	19
5	2	23	25	44	20	15	22	11	28	45	21	13	29	27	35	27	
6	1	43	17	17	36	25	15	21	17	24	29	24	31	32	20	33	28
6	2	46	26	33	29	35	36	26	33	35	20	20	15	33	34		
7	1	30	27	37	14	25	23	11	21	24	37	31	20	27	26	36	33
7	2	26	24	33	29	22	29	11	8	7	17	19	26	18	32	34	
8	1	26	24	12	21	12	32	14	16	10	26	25	15	23	18	12	25
8	2	16	47	23	31	13	21	23	24	21	18	22	26	19	20	35	
9	1	29	14	15	17	18	3	2	9	15	9	20	22	16	14	19	21
9	2	22	18	21	21	26	21	15	24	7	4	3	13	24	20		

DAILY WATER YEAR EVAPORATION DATA SUMMARY FOR NOAA, EDS AT ATHENS AIRPORT, GA. W13873 STATE 13 DISTRICT 13

STA.NO. 335700083190001 WATER YEAR 1975

MONTH	CARD NO.																
10	1	23	18	23	20	24	33	26	19	13	17	14	18	13	13	14	15
10	2	15	22	19	27	14	15	6	15	17	15	18	15	20	7	18	
11	1	11	19	19	17	13	15	15	4	10	13	11	16	11	7	20	5
11	2	3	3	3	25	27	12	9	14	9	12	7	8	7	23		
12	1	9	6	7	10	9	3	10	0	16	10	5	2	6	5	10	10
12	2	14	6	7	10	5	12	4	6	7	11	5	22	3	8	10	
1	1	41	19	2	11	16	1	4	8	0	4	8	5	8	8	3	5
1	2	14	11	8	5	16	4	4	2	2	10	15	7	16	11	18	
2	1	5	1	9	12	6	3	19	11	3	9	15	20	20	18	10	27
2	2	4	26	17	10	8	5	5	15	19	15	18	5				
3	1	23	12	17	8	9	19	4	23	20	7	2	2	10	8	6	24
3	2	1	11	9	24	31	18	18	17	40	28	27	13	8	44	13	
4	1	12	21	6	31	42	21	32	10	12	5	7	35	26	6	12	24
4	2	27	30	22	28	29	24	16	25	29	23	34	28	18	10		
5	1	14	12	15	16	23	27	16	13	13	21	23	13	32	28	6	36
5	2	14	25	32	35	17	30	39	25	29	28	35	28	22	18	15	
6	1	8	24	42	20	37	25	23	30	21	18	12	22	30	44	30	12
6	2	27	33	37	21	42	38	27	27	17	20	23	25	25	36		
7	1	34	21	22	32	36	17	33	33	27	23	15	23	34	15	23	23
7	2	14	18	36	25	18	23	35	14	4	21	15	20	44	22	61	
8	1	4	21	31	9	20	9	14	13	19	17	15	25	29	26	27	15
8	2	22	30	10	22	28	23	29	28	28	30	30	49	32	22	22	
9	1	25	20	26	20	31	27	15	0	16	25	10	19	34	23	18	6
9	2	15	2	18	13	15	10	4	34	7	14	16	12	23	17		

DAILY WATER YEAR EVAPORATION DATA SUMMARY FOR NOAA, EDS AT ATHENS AIRPORT, GA. W13873 STATE 13 DISTRICT 13

STA.NO. 335700083190001 WATER YEAR 1976

MONTH	CARD NO.																
10	1	6	16	28	13	10	8	6	14	16	21	16	20	14	13	19	10
10	2	11	24	12	15	12	15	13	17	12	9	10	1	9	25	14	
11	1	10	11	11	16	14	2	6	18	5	4	6	6	7	15	8	11
11	2	8	15	10	9	15	11	3	2	8	6	16	9	13	12		
12	1	18	8	12	5	7	10	2	3	3	10	5	10	6	5	3	8
12	2	4	7	5	9	12	3	7	8	18	5	8	3	1	6	5	
1	1	13	7	48	19	7	12	26	15	22	8	3	0	17	1	25	12
1	2	4	6	3	4	43	14	11	7	6	14	36	13	12	9	15	
2	1	5	1	9	12	6	3	19	11	13	9	15	20	20	18	10	27
2	2	4	26	17	10	8	5	5	15	19	15	18	5	10			
3	1	23	12	17	8	9	19	4	23	20	7	2	2	0	8	6	0
3	2	1	11	9	24	31	18	18	17	40	28	27	13	8	44	13	
4	1	9999999999999999999999999999999999999999999999999999999999999999999999999999999999999999999999999999999999999999															
4	2	9999999999999999999999999999999999999999999999999999999999999999999999999999999999999999999999999999999999999999															
5	1	9999999999999999999999999999999999999999999999999999999999999999999999999999999999999999999999999999999999999999															
5	2	9999999999999999999999999999999999999999999999999999999999999999999999999999999999999999999999999999999999999999															
6	1	9999999999999999999999999999999999999999999999999999999999999999999999999999999999999999999999999999999999999999															
6	2	9999999999999999999999999999999999999999999999999999999999999999999999999999999999999999999999999999999999999999															
7	1	9999999999999999999999999999999999999999999999999999999999999999999999999999999999999999999999999999999999999999															
7	2	9999999999999999999999999999999999999999999999999999999999999999999999999999999999999999999999999999999999999999															
8	1	9999999999999999999999999999999999999999999999999999999999999999999999999999999999999999999999999999999999999999															
8	2	9999999999999999999999999999999999999999999999999999999999999999999999999999999999999999999999999999999999999999															
9	1	9999999999999999999999999999999999999999999999999999999999999999999999999999999999999999999999999999999999999999															
9	2	9999999999999999999999999999999999999999999999999999999999999999999999999999999999999999999999999999999999999999															

DATA SUMMARY

Program G159

Cataloged Procedure RRDATASM

Description

Program G159 performs the following operations either singularly or in combination:

1. Lists the daily rainfall in each water year indicating the days for which matching unit rainfall exists and for which the daily rainfall exceeds 10 and 50 inches (Table P1).

2. Lists for each flood event the total rainfall and number of days in the event, lists the rainfall duration, beginning and ending unit time intervals (array positions for each storm within a flood event) for each water year (Table P2). Duration of storm ceases when no rainfall occurs in 3 or more hourly periods.

3. Lists for days of unit rainfall in files the maximum 5, 15, 30, 60, 120, and 180-minute rainfalls during each water year (Table P3). The depth-duration data may be optionally punched on cards.

4. Computes the monthly and annual rainfall for each water year and compares the mean annual rainfall computed by summing annual monthly rainfalls (Table P4). The monthly and annual rainfalls may be optionally punched on cards.

5. Lists the daily monthly evaporation data for each water year indicating those days with evaporation less than or equal to zero and between 1 and 10 inches.

6. Computes monthly and annual evaporation for each water year and compares mean annual evaporation computed by summing monthly and annual evaporations (Table E2). Faulty values (Table E1) are not used. The monthly and annual evaporations may be optionally punched on cards.

7. Lists the rainfall and runoff (discharge) in inches for each flood event in each water year, indicating beginning and ending array positions of the unit data, and also lists daily rainfall and runoff totals (Table U1). If information is not desired on rainfall, or the rainfall is not present, only the runoff data is listed (Table D1).

8. Scans the long-term daily rainfall data to find the storms in which the 1- or 2-day total rainfall exceeds a specified threshold magnitude (default threshold is 1.00 in). These rainfalls will be ranked and the 5 highest events will be listed for each year. If rainfall occurred on preceding or following days, the dates for the storm period will include these days (Table S1). Days in the storm period may be optionally indicated in Table P1.

All storm days which meet the 1- or 2-day storm total criteria but do not exist in the Unit Values File are listed (Table S2).

For user reference a more detailed description of tabular output is presented later in this documentation.

Line printer output can consist of tables P1, P2, P3, P4, E1, E2, D1, U1, S1, and/or S2. Note that table P1(A) may be printed as output, but it is not applicable using the data processed by the revised data handling programs. Examples of most tables produced by this program are given at the end of this section.

The input of unit rainfall, unit discharge, daily rainfall, and/or daily evaporation data to the program may be from the Current Unit and Daily Values Files, from card images stored on a magnetic device, or from punched cards; the cards or card images must be in the Carter format.

The cataloged procedure contains program H268 which is used to retrieve requested data from the Current Unit and Daily Values Files and to pass the data set to program G159.

Cataloged Procedures

Three cataloged procedures are available for use with program G159. One is used to retrieve and analyze data which are in the current data files; the second is to analyze data on cards; and the third is to analyze card images on tape or disk. When program H268 is used for retrieval and a Password-Agency Identification card (Z card) may be required, refer to Section 8, program H268) for placement in job stream.

1. Retrieve and analyze data in Current Unit and Daily Values Files:

```
/*RELAY  PUNCH RE2

//xxxxxxxx JOB (-------)

/*PROCLIB  WRD.PROCLIB

// EXEC RRDATASM

//H268.SYSIN DD *
                .
                .
        Program H268 input cards
                .
                .

//G159.SYSIN DD *

        Program G159 input cards
                .
                .
```

```
//
$$$
```

2. Analyze data punched on cards in Carter format:

```
/*RELAY  PUNCH RE2
//xxxxxxxx JOB (-------)
/*PROCLIB  WRD.PROCLIB
// EXEC RRDATASM,DISK=NULLFILE
//G159.TAPE DD *
                .
                .
       Carter-format data cards
                .
                .
//G159.SYSIN DD *
                .
                .
       Program G159 input cards
                .
                .
//
$$$
```

3. (a) Analyze data in Carter format card images on 9-track tape:

```
/*RELAY  PUNCH RE2
//xxxxxxxx JOB (-------)
/*SETUP  xxxxxx/9
/*PROCLIB  WRD.PROCLIB
// EXEC RRDATASM,DISK=NULLFILE
//G159.TAPE DD DSN=name,VOL=SER=xxxxxx,   (all that is needed if tape is
//  UNIT=TAPE9, DISP=(OLD,KEEP)           a standard label tape)
//G159.SYSIN DD *
            .
            .
```

```
       Program G159 data cards
               .
               .
//
$$$
```

(b) Analyze data in Carter card images on disk, or 7 or 9-track tape:

```
/*RELAY  PUNCH RE2
//xxxxxxxx JOB (-------)
/*SETUP  xxxxxx/y
/*PROCLIB WRD.PROCLIB
// EXEC RRDATASM,DISK=NULLFILE
//G159.TAPE DD DSN=name,VOL=SER=xxxxxx,
//  UNIT=uuuu,DISP=(OLD,KEEP)
//G159.SYSIN DD *
                .
                .
//
$$$
```

where xxxxxx = 6-digit tape or 6-character disk volume-serial number, y = D for disk or 7 or 9 for tape, name = data set name, and uuuu = TAPE7, or TAPE9, 2314, or 3330.

For terminals not equipped with a punch, a line printer listing of the card output of this program (options 8, 9, and/or 10 described later) may be obtained by adding the following to the 'EXEC' card:

```
,SYSOUT=A
```

For storage of card images (options 8, 9, or 10) on a user 9-track tape (unlabeled) the following cards must follow the 'EXEC' card:

```
//G159.PUNCH DD DSN=name,UNIT=TAPE9,DISP(NEW,KEEP),VOL=SER=xxxxxx,
// DCB=(RECFM=FB,LRECL=80,BLKSIZE=4000),LABEL=(1,NL)
```

The volume-serial number of the tape must be indicated on a setup card.

The number of cards to be punched should be indicated on the job card if the number exceeds 600. A maximum of 15 cards per water year will be produced for program options 8, 9, or 10.

The execution time defaults to 3 minutes and the region of 415K is sufficient for most jobs. If the time or region must be increased, add the folowing to the 'EXEC' card:

```
,GTIME=time
,GREGION=rrrK
```

where rrr is the increased region size.

An adequate estimate of the execution time is to assume 10 seconds for each water year to be processed.

Input Cards

Program G159 requires four cards per group of stations normally used in calibrating the rainfall/runoff model. A brief summary about the cards and the format of each card type is given below.

Ten options, seven pertaining to tabular output and three pertaining to punched card output, are possible in program G159. Any number of the options may be executed in any run, except option 4 which should not be attempted when retrieving long-term data, and option 5 which is not ordinarily applied to short-term data.

Card types 1, 2, 3, and 4, respectively, identify the stations for unit discharge, unit rainfall, daily rainfall, and daily evaporation data. The identification of data designated for retrieval by these cards should agree with that designated in the program H268 retrieval cards which precedes this step in executing the cataloged procedure. Formats for coding each card type follows:

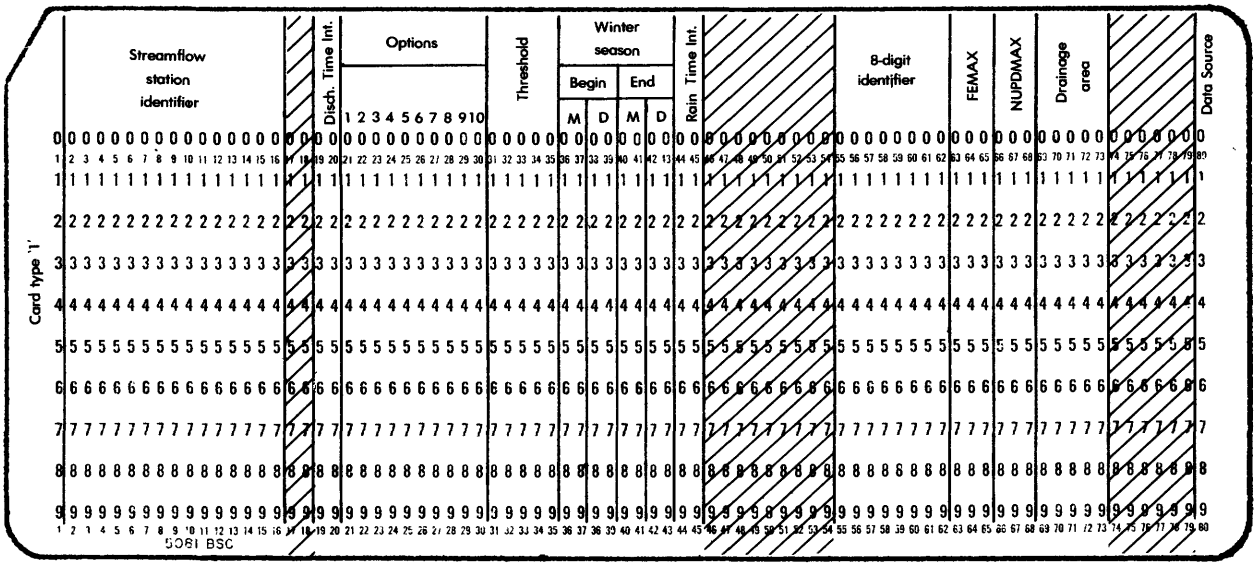
Card Type 1
(Required)

Column(s)		Desription
1		'1'
2-16		Streamflow (discharge) station identifier. (If 8 digit then right justified).
17-18		Blank
19-20		Discharge time interval - code only if discharge time interval is different than rainfall time interval; see cols. 44-45.
	(Options, not executed if blank)	
21	Option(1) = 1	Tables P1, P1A, and P4 (P1 and P1A are daily tables, P4 is monthly and yearly totals).

Column(s)		Description
22	Option(2) =	Blank - Daily data only (tables P2 and P3 not produced) 1 - Tables P2 and P3 (unit data has to be on file). 2 - Do not desire tables P2 and P3.
23	Option(3) = 1	Tables E1 and E2.
24	Option(4) = 1	Table U1; also get table P1 if option(2) = blank or 2.
25	Option(5) =	Identify 5 highest storm events in water year (1- to 2-day rainfall exceeds threshold, cols. 31-35): 0, not desired (may be blank). 1, days flagged in table P1. 2, dates for events listed for water year. 3, items 1 and 2 combined. 4, dates for events having no unit rainfall data in file listed for water year. 5, items 1 and 4 combined. 6, items 2 and 4 combined. 7, items 1, 2, and 4 combined.
26	Option(6) =	0 - then assumes zero monthly precipitation is valid. 1 - If total monthly precipitation is zero, assumes data are missing.
27	Option(7) = 1	Winter season is to be excluded from option (5) analyses: otherwise left blank. (See cols. 36-43).
28	Option(8) = 1	Card output of monthly and annual precipitation.
29	Option(9) = 1	Card output of monthly and annual evaporation.
30	Option(10) = 1	Card output of maximum annual precipitation for selected durations.

Column(s)	Description
31-35	Threshold for option(5), (if blank, threshold = 1.00 in.); punch the decimal.
36-37 a/	Beginning month of winter season; defaults to '12' (December).
38-39 a/	Beginning day in the month of winter season; defaults to '01'.
40-41 a/	Ending month of winter season; defaults to '03' (March).
42-43 a/	Ending day of the month of winter season; default is '31' if ending month is defaulted, otherwise defaults to '01'.
44-45	Unit rainfall time in minutes (5, 10, 15, etc.), right justified (always required).
46-54	Blank.
55-62 b/	8-digit identifier for card output of precipitation for selected duration (Option 10 = 1).
63-65	FEMAX, maximum number of days which may occur in unit discharge record for any one year; default is 20.
66-68	NUPDMAX, maxumum number of days which may occur in unit rainfall record in any one year; default is 30.
69-73 c/	Drainage area (punch decimal if required, right justified).
80	Source of retrieval data: Blank for input from Unit or Daily Values Current File. '1' for input from cards or tape.

a/ Required only if Option (7) = 1; default dates are Dec. 1 and March 31.
b/ Required only if Options (8), (9), or (10) = 1.
c/ Required only if Option (4) = 1.



Card Type 2
(Required)

Column(s)	Description
1	'2'
2-16	Unit rainfall station identifier.
17-65	Station name (left justified).
66-80	Blank.

Card Type 3
(Required)

Column(s)	Description
1	'3'
2-16	Daily rainfall station identifier.
17-65	Station name (left justified).

Card type 3.--continued

Column(s)	Description
66-77	Data summary period (required).
66-67	Beginning Calendar year.
68-69	Beginning month; dafault is '10' (October).
70-71	Beginning day; default is '01'.
72-73	Ending Calendar Year.
74-75	Ending month; default is '09' (September).
76-77	Ending day; default is '30'.
78-80	Blank.

Card Type 4
(Required)

Column(s)	Description
1	'4'
2-16	Daily evaporation station identifier.
17-65	Station name (left justified).
66-80	Blank.

Card types 1-4 (col. 1) may be repeated for as many successive groups of stations as the user wishes for data summaries, provided the data have been retrieved.

Card Output Formats

1. Monthly and Annual Precipitation (OPTION(8) = 1)

a. Monthly data

Header card

Column	Description
1	'1' indicates monthly data to follow.
2-44	Station name.

Column	Description
45-46	Number of water years.
47-65	'WYS, MONTH PRECIP'.
66-80	15-digit station identifier.

Subsequent Cards are Monthly Precipitations with

One Card For Each Water Year

Column	Description
1	'1' indicates monthly data.
2-4	Blank.
5-8	Water year.
9-80	Twelve 6-column fields for monthly precipitation, punched as XXX.XX Inches.

b. Annual data

Header Card

Column	Description
1	'2' indicates annual data to follow.
2-44	Station name.
45-54	'WY TOTALS,'.
55-58	Beginning water year.
59	'-'.
60-63	Ending water year.
64-65	Blank.
66-80	15-digit station identifier.

Subsequent Cards (Annual Precipitation)

Column	Description
1	'2' indicates annual data.

Column	Description
2-4	Number of water years.
5-64	Ten 6-column fields for annual precipitation, punched as XXX.XX inches.
65	Blank.
66-80	15-digit station identifier.

2. Monthly and Annual Evaporation (OPTION(9)=1)

a. Monthly data

Header Card

Column	Description
1	'1' indicates monthly data to follow.
2-44	Station name.
45-46	Number of water years.
47-62	'WYS, MONTH EVAP'.
63-65	Blank.
66-80	15-digit station identifier.

Subsequent Cards are Monthly Evaporation, with One Card For Each Water Year

Column	Description
1	'1' indicates monthly data.
2-4	Blank.
5-8	Water year.
9-80	Twelve 6-column fields for monthly evaporation (Oct. - Sept.), punched as XXX.XX inches (see 1a. above).

b. Annual data

Header Card

Column	Description
1	'2' indicates annual data to follow.
2-44	Station name.
45-54	'WY TOTALS,'.
55-58	Beginning water year.
59	'-'.
60-63	Ending water year.
64-65	Blank.
66-80	15-digit station identifier.

Subsequent Cards, Annual Evaporation

Column	Description
1	'2' indicates annual data .
2-4	Number of water years.
5-64	Ten 6-column fields per card for annual evaporations, punched as XXX.XX inches.
65	Blank.
66-80	15-digit station identifier.

3. Maximum Annual Rainfall Depth-Duration (OPTION(10)=1)

a. Rainfall duration cards

Header Card

Column	Description
1-16	Station name, truncated.

Column	Description
17-33	'100* RAINFALL'; indicates rainfall punched in hundredths of inch.
34-36	Duration in minutes (5, 15, 30, 60, 120, or 180).
37-52	'-MINUTE DURATION'.
53-56	Blank.
57	'1'.
58-67	Blank.
68-70	Number of data items that follow on succeeding cards.
71-78	8-digit number to identify station.
79-80	Card identifier based on sequence.

Subsequent Cards

Column	Description
1-70	Ten 7-column fields per card for maximum annual rainfalls for given duration punched as XXXXXXX in hundreds of an inch; for example 2.15 inches would be punched '215'.
71-78	8-digit number to identify station (same as on header card).
79-80	Card identifier based on sequence (same as on header card).

1. TYPE RETRIEVAL REQUIRED FOR DATA SET NOT GIVEN ON OPTION CARD FOR STATION 'station number'.

   JOB IS ABORTED.

   User has not indicated where data is located, and thus, job must be aborted.

2. DATA SUMMARY FOR PRECIP. STA 'station name' AND EVAP STA 'station name' IS NOT DONE. CHECK OPTIONS ON OPTION CARD FOR RUN NO. 'run number'.

   THESE VALUES MUST BE GIVEN

   User does not have one or more of the following options indicated: 1, 2, 3, or 5.

3. CHECK OPTION CARD FOR PRECIP. STA NO. 'station number' AND EVAP STA 'station number' FEMAX AND/OR NUPDMAX HAVE A VALUE=0,

   IE, SEE RUN NO. 'run number'

   DEFAULT VALUES USED

   THESE ARE - (1) FEMAX=20, AND (2) NUPDMAX=30

   Self explanatory. Note that only a variable which is equal to 0 will be set to default value. User should check approximate core requirements to determine if default values are adequate.

4. *****DAILY DATA NOT ON FILE FOR W.Y. = 'year'

        TABLE P1 IS NOT AVAILABLE

   Self explanatory.

5. *****OPTION(5) CANNOT BE RUN FOR W.Y. = 'year' AS NO DAILY DATA ON FILE

   OPTION(5) operates only on daily data.

6. ****NO UNIT DATA FOR WATER YEAR 'year' TABLE NOS. P2 & P3 ARE NOT AVAILABLE****

   No unit days have been selected for water year, i.e., no unit data on file. Table P1 will be present for this water year; tables P2 and P3 cannot be produced; and table P4 will only contain the monthly totals and yearly total for this water year. If OPTION(2) = 1 and OPTION(1)=0, this message will occur.

7. *****SOME UNIT DATA ON FILE FOR WATER YEAR 'year' TABLE NOS. P2 P3 ARE AVAILABLE BUT MAY NOT CONTAIN ALL UNIT DATA ON FILE.

   COMPARE COMPUTED NUPD-'number of unit precipitation days' and FE = 'number of unit discharge days' WITH INPUTTED (OR DEFAULTED) NUPDMAX = 'maximum number of unit precipitation days' and FEMAX = 'maximum number of unit discharge days'

   IF COMPUTED = INPUTTED,RERUN W.Y. AND INCREASE NUPDMAX AND FEMAX.

   Editing of unit data has indicated possible faulty unit data. Another message will follow tables P2 and P3. User may want to rerun this water year with NUPDMAX and/or FEMAX increased, after checking other messages. (See messages 8-11.)

8. *****NO. EVENT NOT SAME FOR UNIT AND DAILY RAINFALL - STA 'station number', FOR W.Y. 'year'

   TABLE NOS. P1 & P4 WILL BE IN ERROR BUT ARE AVAILABLE*****

   *****NOTE THAT NUPD = -100 DAYS*****

   The water year contains days which have no unit data on file. All unit rainfall days on file will be available in tables P2 and P3, but tables P1 and P4 will contain '0' for monthly and yearly totals in this water year. Data listing for this station should be checked as it is possible that unit days are incorrectly dated. Corrections should be made with programs H269 and H475.

9. *****NO. EVENTS NOT SAME FOR UNIT AND DAILY RAINFALL AND UNIT PRECIP. DAYS - 'number of unit precipitations days' NOT EQUAL DAILY -100 DAYS - 'number of days with -100 Indicators' AT STA # 'station number' FOR W.Y. 'year'

   Tables P2 and P3 will contain analysis of number of unit precipitation days. If this value is less than NUPDMAX (see message 8) then all unit data has been analyzed. Note, that if number of days with -100 indicators equals zero then there are no '-100' codes on daily data file and both tables No. P1 and P4 are correct. If number of days with -100 indicators is greater than zero, then tables P1 and P4 will contain errors for this water year and data listing should be checked. Use programs H269 and H475 to correct errors.

10. *****TABLE NOS. P2 & P3 ARE INCOMPLETE.

    VALUES FOR FEMAX AND/OR NUPDMAX ON OPTION CARD ARE TOO LOW FOR W.Y. 'year' TABLES NO. P2 & P3 DO NOT CONTAIN ANALYSIS OF ALL UNIT DATA ON FILE.

    Check with message 7; value of input parameter FEMAX and/or NUPDMAX which equals computed counterpart should be increased. It may be best to let both values equal zero, and use default. Unless another message appears, to contrary, tables P1 and P4 should be correct.

11. *****END OF UNIT DATA FOUND BEFORE LAST YEAR DESIRED, CORRECT ENDING WATER YEAR*****

    The end water year date on type-3 input card is greater than that of actual data stored on file. The ending water year in table P4 will be last water year of data file. The job will continue to run normally, but in order for jobs which involve synthesis not to abnormally terminate, date should be corrected.

12. UNIT DISCHARGE DATA CONTAINS MORE DATA THAN ALLOWED BY ARRAY ALLOCATIONS.

    Size of unit discharge data array is determine by NUPDMAX entered on input card type 1. The value entered on this run was too small, and not all of unit discharge data on file was analyzed. To insure complete analysis, supply correct NUPDMAX and resubmit.

13. NO UNIT DISCHARGE DATA ON FILE FOR 'year' WATER YEAR.

    No unit discharge available for this water year.

14. *****TABLE P1 (A) FOLLOWS: IT CONTAINS 0 FOR DAILY TOTAL FROM DAILY FILE AS DAILY DATA WAS NOT SUMMARIZED,*****

    Program did not analyze daily rainfall data as both OPTION(1)=0 and OPTION(5)=0.

Example of Setting Up Job

An edit (tables P1, P1A, P2, P3, P4, E1, E2, U1, and S1) is needed before calibration of the rainfall-runoff model for Caney Creek nr Monticello, Florida, in the 1971 water year (more years are on file, therefore, dates are needed in the retrieval step). All data is in the Current Daily and Unit Values Files. Caney Creek has a drainage area of 2.54 square miles. The threshold for a pickstorm selection is 1.5 inches. The unit time interval for both rainfall and discharge is 15 minutes.

For daily rainfall, the station identifier is 02326598, name is "Caney Ck. nr. Monticello," parameter code = 00045, and statistic code = 00006.

For unit discharge, the station is 02326598, name is same as for daily rainfall, parameter code = 00060, and statistic code 00011.

For unit rainfall, the station identifier is 02326598, name is same as for daily rainfall, parameter code = 00060, and statistic code = 00006.

For daily evaporation, the station identifier is 304637087082701, name is "Milton Exp. Station nr. Milton, Florida," parameter code = 00050, statistic code = 00006.

The job deck and printout follow.

PROGRAMMER _____ DIVISION _____
LOCATION _____ PHONE _____

U. S. DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
COMPUTER CODING FORM

PROGRAM NO. _____
PROJECT _____
SHEET ___ OF ___

PROGRAM IDENTIFICATION: _____
PROGRAM INFORMATION: _____
STATEMENT IDENTIFICATION

```
1  //*RELAY  PUNCH RE2
2  //  XXXXXXXX JØB (--------)
3  //*PRØCLIB  WAD.PRØCLIB
4  //    EXEC RRDATASM
5  //H268.SYSIN DD *
6  D              02326598                    000450000061970100119710930PASS
7  U              02326598                    000600001119701001197109 30PASS
8  U              02326598                    000450006197010011971093 0PASS
9  D30463708708270 1                          000500000061970100119710930PASS
10 //G159.SYSIN DD *
11 1              02326598      111131            1.5              15              2.54
12 2              02326598CANEY CR NR MØNTICELLØ, FL
13 3              02326598CANEY CR NR MØNTICELLØ, FL                          701001710930
14 430463708708270 1MILTØN EXP. STATIØN NR MILTØN, FL
15 //
16 /*$
17
18
19
20
21
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24
25
26
27
28
29
30
```

10-17

FORM 9—1634 A
JULY 1967

0 = ZERO Ø = ALPHA O 1 = ONE I = ALPHA I 2 = TWO Z = ALPHA Z / = SLASH | = VERT. BAR - = MINUS _ = HORZ. BAR

PROGRAM CODING FORM

PROGRAM H268 , REVISED DEC 1975

RETRIEVE, PRINT, PUNCH AND/OR PASS UNIT AND DAILY VALUES FOR RAINFALL-RUNOFF MODELING PROGRAMS

MESSAGES - RETRIEVALS MADE AND ATTEMPTED, AND ERRORS FOLLOW:

DAILY VALUES DATA RETRIEVAL: STATION= 02326598 PARAMETER= 45 STATISTIC= 6
THE WATER YEARS LISTED BELOW WERE RETRIEVED, PASSED:
1971

UNIT VALUES DATA RETRIEVAL: STATION= 02326598 PARAMETER= 60 STATISTIC= 11
THE DATES LISTED BELOW WERE RETRIEVED, PASSED:
FEB. 7, 1971(96) MAY 8, 1971(96) MAY 9, 1971(96)

UNIT VALUES DATA RETRIEVAL: STATION= 02326598 PARAMETER= 45 STATISTIC= 6
THE DATES LISTED BELOW WERE RETRIEVED, PASSED:
FEB. 7, 1971(96) MAY 8, 1971(96) MAY 9, 1971(96)

DAILY VALUES DATA RETRIEVAL: STATION=304637087082701 PARAMETER= 50 STATISTIC= 6
THE WATER YEARS LISTED BELOW WERE RETRIEVED, PASSED:
1971

PROGRAM DSK268 REVISED 04-01-75

CREATES A TEMPERARY ISAM FILE FOR RAINFALL-RUNOFF PROGRAMS

SUMMARY OF RECORDS ENTERED INTO ISAM FILE:

STA=	02326598	PARM=	45	STAT=	6	RPD=	1	RECORDS WRITTEN= 1
STA=	02326598	PARM=	45	STAT=	6	RPD=	96	RECORDS WRITTEN= 3
STA=	02326598	PARM=	60	STAT=	11	RPD=	96	RECORDS WRITTEN= 3
STA=	304637087082701	PARM=	50	STAT=	6	RPD=	1	RECORDS WRITTEN= 1

END PROGRAM DSK268

```
SUMMARY OF OPTIONS REQUESTED FOR RUN NO.  1:  PROGRAM G159 - DATA SUMMARY(DATASUM)

               *** FOLLOWING STATIONS WERE REQUESTED ***
FOR DAILY PRECIP         02326598  CANEY CK NR MONTICELLO, FLORIDA
FOR UNIT PRECIP          02326598  CANEY CK NR MONTICELLO, FLORIDA
FOR UNIT DISCHG          02326598  CANEY CK NR MONTICELLO, FLORIDA
FOR DAILY EVAP   304637087082701  MILTON EXP. STATION NR MILTON, FLORIDA

     *** FOLLOWING OPTIONS WERE INDICATED ON CARD TYPE #1 ***
         (1) SUMMARY OF DAILY AND UNIT PRECIP - THIS INCLUDES TABLES P1,P1(A) & P4
         (2) SUMMARY OF UNIT PRECIP - THIS INCLUDES TABLES P2 & P3
         (3) SELECTION OF STORMDAYS BY USE OF PICKSTORM CRITERIA.
             THESE SELECTED DAYS ARE PRESENTED AS FOLLOWS:
              (A) PICKSTORM DAYS INDICATED ON TABLE P1
              (B) PICKSTORM DAYS LISTED BY WATER YEAR
             THRESHOLD VALUE USED FOR PICKSTORM SELECTION =  1.50 INCHES.
         (4) SUMMARY OF DAILY EVAP - THIS INCLUDES TABLES E1 & E2
         (5) UNIT DISCHARGE DATA IS PRESENTED FOR COMPARISON WITH UNIT PRECIP DATA.


       *** FOLLOWING LOCATION OF DATA WAS INDICATED ON CARD TYPE #1 ***
                 DATA ON DISK, UNIT DISCHARGE USED

       NOTE - (1)MAX. NO. OF FLOOD EVENTS =  20
                 DEFAULT VALUE USED FOR MAX. NO. OF FLOOD EVENTS.
              (2)MAX. NO. OF UNIT PRECIP DAYS =  30
                 DEFAULT VALUE USED FOR MAX. NO. OF UNIT PRECIP DAYS.

*** FOLLOWING DECISION WITH RESPECT TO ZERO MONTHLY TOTALS WAS INDICATED ***
    FOR PRECIP DATA, ZERO MONTHLY TOTAL IS CONSIDERED MISSING DATA.

*** FROM CARD TYPE #1
    PTIME =  15 AND CARD OUTPUT ID = 02326598

*** FROM CARD TYPE #3
    PERIOD OF RECORD GIVEN IS FROM 10- 1-70 TO  9-30-71
```

SUMMARY OF PRECIPITATION DATA FOR CANEY CK NR MONTICELLO, FLORIDA ,STA.NO. 02326598

TABLE NO.P1: SUMMARY OF DAILY PRECIPITATION DATA,IN HUNDREDTHS OF INCHES,FOR WATER YEAR 1971

MO.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	SUM
OCT	0	0	0	0	0	0	6	6	0	0	0	0	0	0	0	0	0	0	120	60	1	0	0	39	2	0	0	0	61	18	1	314
NOV	0	2	1	0	0	0	0	0	0	57	0	1	0	70	0	0	0	1	0	3	0	0	16	0	0	0	0	0	0	0		151
DEC	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	64	0	1	0	1	0	9	0	2	38	0	0	0	53	8	64	241
JAN	0	1	0	0	39	20	1	86	29	1	13	1	0	1	2	0	0	0	0	0	0	0	0	3	9	0	0	0	0	28	4	238
FEB	0	0	0	0	31	1	227	44	0	0	0	83	2	0	0	0	0	0	0	1	1	44	0	0	0	0	5	17				456
						XXXXXXXXXXX																										
MAR	3	1	34	0	0	0	11	0	0	3	0	0	80	9	7	1	0	0	81	0	0	0	1	0	1	110	0	0	15	0	0	357
APR	0	16	0	14	21	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	71	0	0	0	0	0	0	64	14		201
MAY	0	0	0	0	0	0	1	250	2	0	0	44	2	3	13	0	0	0	0	45	0	0	0	0	0	0	1	1	0	0	0	362
							XXXXXXXXXXX																									
JUN	0	0	0	0	0	0	9	1	37	0	0	0	0	4	0	0	40	61	0	0	0	25	1	0	0	104	1	0	14	2		299
JUL	6	13	133	35	17	1	2	6	0	2	0	0	0	85	13	16	0	21	36	33	0	2	298	21	0	1	88	140	107	26	75	1177
		XXXXXXXX																				XXXXXXXXXXX					XXXXXXXXXXX				
AUG	12	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15
SEP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0

NOTE:(1)—— INDICATES DAY WITH UNIT PRECIP DATA (DAILY TOTAL FROM UNIT PRECIP DATA);
(2)*** INDICATES DAY WITH PRECIP > 10 INCHES(NO UNIT DATA);
(3)### INDICATES DAY WITH UNIT PRECIP DATA AND DAILY TOTAL PRECIP > 10 INCHES (NO -100 CODE);
(4)@@@ INDICATES NO UNIT DATA FOR DAY WITH -100 CODE;
(5)&&& INDICATES DAY WITH UNIT PRECIP DATA > 10 INCHES AND -100 CODE ON DAILY FILE;
(6)+++ INDICATES UNIT DATA ON FILE BUT NO -100 CODE (DAILY TOTAL FROM DAILY DATA);
(7)/// INDICATES DAILY VALUE > 50 INCHES, PROBABLE DATA ERROR;
(8)XXX INDICATES DAY REQUIRED TO MEET PICKSTORM CRITERIA;

SUMMARY OF PRECIPITATION DATA, CONTINUED STATION NO. 02326598

TABLE NO.P1(A): COMPARISON OF DAILY TOTALS STORED ON DAILY DATA FILE WITH THOSE COMPUTED FROM UNIT DATA FILE

NO	DATE	DAILY TOTAL PRECIPITATION, IN INCHES	
		VALUE FROM DAILY DATA FILE	VALUE FROM UNIT DATA FILE
1	2- 7-71	-100.00	2.27
2	5- 8-71	-100.00	2.50
3	5- 9-71	-100.00	0.02

TABLE NO.P2: SUMMARY OF STORM PRECIPITATION DATA,IN INCHES,FOR WATER YEAR 1971

FLOOD EVENT NO.	TOTAL RAINFALL (INCHES)	DAYS IN EVENT	STORM NO. (WITHIN EVENT)	MONTH/DAY/YEAR	BEGIN	END	DURATION (MINUTES)	STORM RAINFALL (INCHES)
1	2.27	1	1	2/ 7/71	17	86	1050	2.27
2	2.52	2	1	5/ 8/71	35	78	660	2.50
			2	5/ 9/71	127	140	210	0.02

TABLE NO.P3: MAX. RAINFALL,IN INCHES, FOR LISTED INTERVALS DURING WATER YEAR,1971

INTERVAL (MINUTES)	MAX.RAIN (INCHES)	MONTH/DAY/YEAR	EVENT	NO.	DURING DURATION OF (MINUTES)
5	0.32	5/ 8/71	2	1	660
15	0.97	5/ 8/71	2	1	660
30	1.50	5/ 8/71	2	1	660
60	1.93	5/ 8/71	2	1	660
120	1.95	5/ 8/71	2	1	660
180	2.11	5/ 8/71	2	1	660

UNIT DISCHARGE ANALYSIS FOR DISCHARGE STA NO. 02326598

TABLE NO. U1: SUMMARY OF UNIT DATA, IN INCHES, FOR WATER YEAR 1971

FLOOD EVENT NO.	PRECIPITATION DATA DATE	DAYS IN EVENT	TOTAL RAINFALL (INCHES)	BEGIN	END	DISCHARGE DATA DATE	DAYS IN EVENT	TOTAL RUNOFF * (INCHES)	BEGIN	END
1	2/ 7/71 TO 2/ 7/71	1	2.27	17	86	2/ 7/71 TO 2/ 7/71	1	0.36	1	96
2	5/ 8/71 TO 5/ 9/71	2	2.52	35	140	5/ 8/71 TO 5/ 9/71	2	0.54	1	192

NOTE - (1)* - INDICATES BASE FLOW HAS NOT BEEN SUBTRACTED FROM TOTAL RUNOFF.
(2)FOR PRECIP DATA, IN BEGIN AND END COLUMNS, VALUE IS RELATIVE TO READINGS PER DAY = 96 .
(3)FOR DISCHG DATA, IN BEGIN AND END COLUMNS, VALUE IS RELATIVE TO READINGS PER DAY = 96 .

DATE	DAILY TOTALS IN INCHES RAINFALL FROM UNIT PRECIP FILE	RUNOFF ** FROM UNIT DISCHG FILE
2/ 7/71	2.27	0.36
5/ 8/71	2.50	0.35
5/ 9/71	0.02	0.19

NOTE - ** - REFER TO (1) ABOVE.

TABLE NO.P4: SUMMARY OF MONTHLY PRECIPITATION IN INCHES, FOR CANEY CK NR MONTICELLO, FLORIDA STA. NO. 02326598

W.Y.	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	TOTAL
1971	3.14	1.51	2.41	2.38	4.56	3.57	2.01	3.62	2.99	11.77	0.15	0.00	38.11
MEAN	3.14	1.51	2.41	2.38	4.56	3.57	2.01	3.62	2.99	11.77	0.15	0.00	0.00

ANNUAL MEAN FROM SUMMING MONTHLY MEANS,INCHES, 38.11

LIST OF PICKSTORM-SELECTED STORM EVENT PERIODS FOR STATION
02326598 CANEY CK NR MONTICELLO, FLORIDA

PERIOD OF RECORD UNDER CONSIDERATION: 1971 TO 1971

***** 1971 *****

TABLE S1: PICKSTORM-SELECTED STORM EVENT PERIODS

NO	BEGIN	END	NO OF DAYS	TOTAL PRECIP (INCHES)	MAX DAILY (INCHES)
1	7-22-71	7-24-71	3	3.21	2.98
2	5- 7-71	5- 9-71	3	2.53	2.50
3	2- 6-71	2- 8-71	3	2.72	2.27
4	7-27-71	7-29-71	3	3.35	1.40
5	7- 3-71	7- 4-71	2	1.68	1.33

SUMMARY OF EVAPORATION DATA FOR MILTON EXP. STATION NR MILTON, FLORIDA ,STA.NO. 304637087082701

TABLE NO.E1: SUMMARY OF DAILY EVAPORATION DATA,IN HUNDREDTHS OF INCHES,FOR WATER YEAR 1971

NO.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	SUM
OCT	17	17	17	11	17	25	12	10	10	10	12	19	19	14	12	11	18	7	15	12	8	10	14	15	15	19	16	8	10	14	7	421
NOV	23	12	13	11	9	9	7	7	11	10	11	4	7	22	11	9	10	3	8	19	8	9	10	8	8	8	8	8	9	11		303
DEC	2	3	7	11	10	14	10	7	5	6	11	5	13	11	1	2	3	4	11	6	5	5	14	15	4	10	6	3	4	5	5	218
JAN	10	5	20	20	12	10	10	0	7	1	1	0	7	8	13	4	4	13	15	8	4	0	6	3	17	14	17	8	8	6	6	257
								####				####										####										
FEB	5	18	7	1	9	16	14	13	12	7	6	5	2	16	10	11	15	19	17	13	9	18	7	22	13	10	7	27				329
MAR	4	12	25	13	8	12	9	25	16	20	7	22	59	67	20	33	37	36	8	19	32	16	0	18	13	19	4	20	12	28	25	639
																							####									
APR	13	20	18	17	5	16	19	20	25	9	43	21	29	34	16	32	7	25	24	26	10	12	8	6	31	16	10	15	20	11		558
MAY	23	26	30	25	27	28	26	15	15	22	17	23	15	18	10	16	29	31	21	13	22	23	33	33	16	15	24	16	29	28	23	692
JUN	29	32	25	25	17	26	22	28	6	23	22	24	22	25	27	30	24	5	12	30	26	25	32	14	31	22	22	26	22	20		694
JUL	18	18	16	15	21	7	21	21	23	26	11	32	27	23	29	27	17	9	40	22	19	23	22	37	16	14	27	6	18	9	4	618
AUG	11	9	23	19	24	16	17	20	28	22	16	14	25	19	27	28	20	16	17	20	15	11	11	18	16	12	20	21	4	21	1	541
SEP	11	17	15	11	15	6	27	21	17	21	13	6	23	22	13	2	20	18	19	18	13	20	18	17	7	16	13	14	20	18		471

NOTE: (1)—— INDICATES DAY WITH EVAP >= 1.00 INCHES BUT < 10.0;
(2)*** INDICATES DAY WITH EVAP >= 10.0 INCHES(POSSIBLE DATA ERROR);
(3)### INDICATES DAY WITH EVAP = 0.0 INCHES(POSSIBLE MISSING DATA--ESPECIALLY IF FOR PERIOD GREATER THAN 3 DAYS);
(4)aaa INDICATES DAY WITH EVAP < 0.0 INCHES - DATA ERROR;

TABLE NO.E2: SUMMARY OF MONTHLY EVAPORATION DATA,IN INCHES,FOR MILTON EXP. STATION NR MILTON, FLORIDA STA. NO. 304637087082701

W.Y.	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	TOTAL
1971	4.21	3.03	2.18	2.57	3.29	6.39	5.58	6.92	6.94	6.18	5.41	4.71	57.41
MEAN	4.21	3.03	2.18	2.57	3.29	6.39	5.58	6.92	6.94	6.18	5.41	4.71	57.41

ANNUAL MEAN FROM SUMMING MONTHLY MEANS,INCHES, 57.41

TEST FOR IDENTICAL DISTRIBUTIONS

OF SYNTHETIC ANNUAL FLOOD RECORDS

Program J503

Cataloged Procedure RRIDSYN

Description

The annual flood record of a streamflow staion may be synthesized (program E784 - RRSIMLOG, section 15) using more than one long-term rainfall record. The analyst may wish to determine if the synthetic flood records from two or more long-term rainfall records for this streamflow station are identically distributed, and if the flood records for two or more streamflow stations are identically distributed. The Cramer - von Mises test for identical distributions (Conover, 1971, p. 314-316) can be applied to test the hypothesis of identical distributions of two or more synthetic flood records at the station. The printed output from the program will indicate if the hypothesis of identical distributions is not acceptable at the one percent or five percent level of significance (with the t statistic T2, respectively, $T2 > 0.743$ or $0.461 < T2 < 0.743$).

The control cards (types 1 and 2) for this program indicate the number of long-term rainfall records used in synthesis, the number of streamflow stations, the names for these raingages, and the periods of record for these rainfall records. The order of cards naming the raingages must agree with the order in which the synthetic flood records for each streamflow station are grouped. The number of streamflow stations which may be included in this program is unlimited.

Cards containing the synthetic annual flood records are in the formats for program E675, the log-Pearson Type III frequency analysis (Isherwood and others, 1976, section C, p. 6); the header and data cards for this program must be included for each station. These cards may be punched or be in card images on 9-track tape or disk. Normally, these cards will be created by program E784 - RRSIMLOG.

Limitations

From 2 to 10 synthetic records for each streamflow station may be included. The synthetic record cannot contain more than 100 annual floods.

Cataloged Procedures

Two cataloged procedures are available:

1. For annual flood records on punch cards:

```
/*RELAY  PUNCH RE2
//xxxxxxxx JOB (-------)
/*PROCLIB  WRD.PROCLIB
// EXEC RRIDSYN
//J503.SYSIN DD *
     - Type 1 card
     - Type 2 card
//J503.TAPE DD *
     - Program E675 header card
     - Program E675 data cards
//
$$$
```

2. For annual flood records in card images on tape or disk:

The tape or disk number must be indicated on a setup card:

```
/*SETUP     xxxxxx/9  for tape
/*SETUP     xxxxxx/D  for disk
```

The tape or disk volume-serial number xxxxxx, data set name, disposition of the data set, and tape or disk drive unit number must be indicated as follows:

```
//J503.TAPE DD VOL=SER=xxxxxx,DSN=name,
//  UNIT=uuuu,DISP=(OLD,DELETE) [,LABEL=(n,SL)]
```

where uuuu = TAPE9 for tape and 2314 or 3330 for disk, and

n = 1,2,... for label number on the tape.

The disposition may alternatively be KEEP or PASS instead of DELETE if the data set is respectively used in another job or passed to a subsequent step in the same job.

Card Input

Column	Description
	Card 1
1	Card type - '1'
2-3	Number of long-term rainfall records (right justified)
4-6	Number of streamflow stations (right justified)
	Card 2
1	Card type - '2'
2-16	Name of rainfall station (abbreviated if necessary), left justify
17-19	Number of years of rainfall record, right justify

One type 1 card is required. The number of type 2 cards required will be equal to the number of rainfall stations used in synthesis.

The header and data cards for program E675 must be arranged in the order of their association with the order of rainfall stations given by the type 2 cards.

Diagnostic Messages

Control cards

1. NO TYPE 1 CARD - JOB ABORTED

2. NO TYPE 2 CARD - FOR SET 'set number' - JOB ABORTED

An insufficient number of type 2 cards (indicated in cols. 2-3 of type 1 card) were included.

Program E675 cards

If the option card is included, it will be ignored.

1. NO STATION NAME CARD FOR SET 'set number' - JOB ABORTED

Either no station name card was included in the set of data or an alphabetic character was not punched in column 1 of the card.

2. INSUFFICIENT NUMBER OF PROGRAM E675 DATA CARDS - JOB ABORTED

The number of cards should be the quotient of the number of years of rainfall recorded divided by ten and rounded upward to nearest integer.

Example of Setting Up Job

The long-term rainfall records for Memphis, TN (71 years), Meridian, MS (68 years), and Vicksburg, MS (67 years) have been used to synthesize annual flood records for Shell Creek near Tupelo, MS (station identifier 02435930) and Nichols Creek near Quincy, MS (station identifier 02437550). The annual flood records are the third data set on tape 001105; the data set name (DSN) is MISS.SYN.FLOOD.RECORDS.

In the line printer output which follows the job card deck listing below, the test statistic T2 must be less than 0.743 in order to show the hypothesis of identical distributions is met at the 1 percent level of significance and less than 0.461 for the hypothesis to be met at the 5 percent level of significance.

Note the optional listing of selected skew coefficients, annual peaks to be deleted, and that peak discharge base discharge need not be listed on the program E675 header card.

PROGRAMMER _____ DIVISION _____
LOCATION _____ PHONE _____

U. S. DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
COMPUTER CODING FORM

PROGRAM NO. _____
PROJECT _____

SHEET ____ OF ____

PROGRAM IDENTIFICATION: _____
PROGRAM INFORMATION: _____

STATEMENT IDENTIFICATION

```
1  //*RELAY  PUNCH REZ
2  //xxxxxxxx JOB (--------)
3  //*PROCLIB  WRD.PROCLIB
4  //*SETUP    001105/9
5  //  EXEC RRIDSYN
6  //J503.SYSIN DD *
7  1 3  2
8  2MEMPHIS              71
9  2MERIDIAN             68
10 2VICKSBURG            67
11 //J503.TAPE DD VOL=SER=001105,DSN=MISS.SYN.FLOOD.RECORDS,
12 //  UNIT=TAPE9,DISP=(OLD,DELETE),LABEL=(3,SL)
13 //
14 $$$
15
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```

11-5

FORM 9—1634 A
JULY 1967

0 = ZERO Ø = ALPHA O 1 = ONE I = ALPHA I 2 = TWO Z = ALPHA Z / = SLASH | = VERT. BAR - = MINUS _ = HORZ. BAR

PROGRAM CODING FORM

ANALYSIS OF SYNTHETIC ANNUAL PEAKS FOR 2 CALIBRATIONS IN MISSISSIPPI
TO TEST HYPOTHESIS THAT SYNTHESIS PEAKS HAVE SAME DISTRIBUTION USING
CRAMER-VON MISES TEST FOR IDENTICAL DISTRIBUTIONS--
 CONOVER, 1971, NON PARMAMETRIC STATS. P 311.
TEST STATISTIC,T2, VS. W95 = .461 AT 5% SIGN. LEVEL,AND VS. W99 = .743 AT 1% SIGN. LEVEL

1 STATION 02435930 SHELL CREEK NR TUPELO MS

BETWEEN MEMPHIS TN	AND VICKSBURG MS	DISTRIBUTIONS IDENTICAL	T2 =	0.460
BETWEEN MEMPHIS TN	AND MERIDIAN MS	DISTRIBUTIONS NOT IDENTICAL AT 1% SIGN. LEVEL	T2 =	1.731
BETWEEN VICKSBURG MS	AND MERIDIAN MS	DISTRIBUTIONS IDENTICAL	T2 =	0.397

2 STATION 02437550 NICHOLS CREEK NR QUINCY MS

BETWEEN MEMPHIS TN	AND VICKSBURG MS	DISTRIBUTIONS NOT IDENTICAL AT 5% SIGN. LEVEL	T2 =	0.732
BETWEEN MEMPHIS TN	AND MERIDIAN MS	DISTRIBUTIONS NOT IDENTICAL AT 1% SIGN. LEVEL	T2 =	2.509
BETWEEN VICKSBURG MS	AND MERIDIAN MS	DISTRIBUTIONS NOT IDENTICAL AT 5% SIGN. LEVEL	T2 =	0.528

NORMAL END OF JOB

TEST FOR IDENTICAL DISTRIBUTIONS OF RAINFALL RECORDS

Program J504

Cataloged Procedure RRIDTEST

Description

Records of total annual precipitation (or evaporation) and maximum annual precipitation for selected durations which are punched on cards by program G159 - RRDATASAM (Section 10) may be tested for identical distribution using program J504 - RRIDTEST. The Cramer-von Mises test for identical distributions (Conover, 1971, p. 314-316) is used to test the hypothesis of identical distribution of two or more records of the same kind of annual events, e.g., two or more records of annual 30-minute maximum rainfall. The printed output from the program will indicate if the hypothesis of identical distributions is not acceptable at the one or five percent level of significance (with t statistic respectively, $T2 > 0.743$ and $0.461 < T2 \leq 0.743$).

The data to be tested are separated, first, into groups according to the rainfall duration, e.g., 5-minutes, 30-minutes,..., annual total. The data within each group are separated into sets according to the period of record, e.g., long-term or short-term calibration data, or type of data, e.g., annual rainfall or annual evaporation.

Finally, the data in each set are separated by sites. Thus, the data might be arranged as follows:

```
Annual rainfall totals
  Long-term records
       Site 1
         .
         .
         .
       Site 5
  Calibration records
       Site a
         .
         .
         .
       Site f
Thirty-minute maximum annual rainfall
  Calibration records
       Site I
         .
         .
         .
       Site III
```

There are 2 groups containing respectively 2 and 1 sets of data for 5, 6, and 3 sites in each set.

Five control cards (types 1-5) are required to define the number of groups, the number of sets, the number of sites and lengths of record for each site, and the station identifier and name. The content of each type of control card is as follows:

TYPE	DESCRIPTION
1	Number of groups
2	Number of sets in each group and general description of the data in the group
3	Description of the data in each set
4	Number of sites in the set and the length of each record in years
5	Station identifier and name for each site in a set

A type 5 and data cards containing the annual events are required for each site in a set and group. These cards must be in the order of records indicated by the lengths of record listed on the type 4 card. All types 3, 4, 5, and data cards of a particular set are preceded by a type 2 card. All type 2, 3, 4, 5, and data cards of a particular group are preceded by a type 1 card.

Limitations

1. From two to ten sites in a set may be tested and indicated on the type 4 card. An unlimited number of sets (indicated on type 2 card) may be included in a job. The data for a site is limited to 100 or less annual events.

2. At present, the program is limited to card input.

3. At least two sets of data must be used.

Cataloged Procedure

```
/*RELAY  PUNCH RE2

//xxxxxxxx JOB (-------)

/*PROCLIB  WRD.PROCLIB

// EXEC RRIDTEST
```

```
//J504.SYSIN DD *

     - Type 1 card
     - Type 2 card
     - Type 3 card                                    One Kind
     - Type 4 card                                      Of
     - Type 5 card    One set for each record         Data
     - Data cards

     - Repeat of type 3, 4, 5, and data cards for
       one kind of data

     - Repeat of types 2-5 and data cards for another
       kind of data

//
```

Input Cards

Columns	Description
	Card 1
1	Card type - '1'
2-3	Number of groups (right justified)
4-80	Blank
	Card 2
1	Card type - '2'
2-5	Number of sets
6-40	Description of data in group
41-80	Blank
	Card 3
1	Card type - '3'
2-46	Description of data in set
47-80	Blank
	Card 4
1	Card type - '4'
2-4	Number of sites (2-10), right justified

Columns	Description
	Card 4 - continued
5-8 • • • 41-44	Ten 4-column fields containing the length of record in years for each site of the set to be analyzed (right justified)
45-80	Blank
	Card 5
1	Card type - '5'
2-16	Station identifier (right justified)
17-65	Station name
66-80	Blank
	Data cards
1-70	Ten 7-column fields containing data either right justified with decimal point implicity defined or with decimal point punched.
71-80	May be blank or contain the identifier used by program E675 log-Pearson Type III frequency analyses.

Example of Setting Up Job

Tests for identical distribution of annual and 15-minute maximum annual rainfalls (2 groups) are to be made. Both long-term and calibration data (2 sets) are available for annual rainfalls but only calibration data (1 set) are available for 5-minute maximum annual rainfalls.

The following table indicates the number of years of record available for each site:

Number			Station	Years	
Group	Set	Site	Name	of Record	Description
1	1	1	Dallas, TX	58	Annual rainfall
		2	Shreveport, LA	60	Long term
		3	Abilene, TX	62	
	2	1	Palestine, TX	17	
		2	Houston, TX	15	Calibration
		3	Amarillo, TX	16	
		4	Austin, TX	10	
					5-minute annual maximum rainfall
2	1	1	Dallas, TX	16	
		2	Austin, TX	10	Calibration
		3	Houston, TX	15	

The tests will indicate whether the records for the sites within each set are identically distributed. A coding form showing entries to run program J504 for these tests and a print listing results of the tests follow:

U. S. DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

COMPUTER CODING FORM

PROGRAMMER ____ DIVISION ____ PROGRAM NO. ____ SHEET ____
LOCATION ____ PHONE ____ PROJECT ____ ____ OF ____

PROGRAM IDENTIFICATION: ____
PROGRAM INFORMATION: ____

STATEMENT IDENTIFICATION

```
/*RELAY   PUNCH REZ
//XXXXXXXX JØB (-------)
/*PRØCLIB  WRD.PRØCLIB
// EXEC RRIDTEST
//J504.SYSIN DD *
/ 2
2      2ANNUAL RAINFALL TØTALS
3LØNGTERM RAINFALL DATA
4  3  58  60  62
5DALLAS, TEXAS
   38.09  31.17  27.85  27.83  45.88  55.98  28.81  34.08  35.26  32.42   13960AT
      - five more data cards
5SHREVEPØRT, LA
      - six data cards
5ABILENE,TEXAS
      - seven data cards
3CALIBRATIØN RAINFALL DATA
4  4  17  15  16  10
      - one type-5 and data cards for Palestine, Houston, Amarillo, and Austin, Texas
2     1ANNUAL MAX RAINFALL FØR 5 MINUTES
3CALIBRATIØN RAINFALL DATA
4  3  16  10  15
5DALLAS, TX          100 * RAINFALL    5-MINUTE DURATIØN    1
      19     97      83     79      84      69      82      76     94      64
     118     85      81     95     144
      - one type-5 and data cards for Houston and Austin, Texas
//
$$$
```

FORM 9—1634 A
JULY 1967

0 = ZERO   Ø = ALPHA O   1 = ONE   I = ALPHA I   2 = TWO   Z = ALPHA Z   / = SLASH | = VERT. BAR   - = MINUS   _ = HORZ. BAR

PROGRAM CODING FORM

GPO : 1968 O - 286-594

CRAMER-VON MISES TEST
FOR
IDENTICAL DISTRIBUTIONS

HYPOTHESIS OF IDENTICAL DISTRIBUTION NOT MET AT INDICATED LEVEL OF SIGNIFICANCE	IF TEST STATISTIC
5%	0.461<T2<0.743
1%	T2>0.743

ANALYSIS OF 2 GROUPS
OF RAINFALL RECORDS

GROUP 1 - ANNUAL RAINFALL TOTALS

CONTAINING 2 SETS OF DATA

SET 1 - LONGTERM RAINFALL DATA
CONTAINING DATA FOR 3 SITES

BETWEEN DALLAS, TEXAS	AND SHREVEPORT, LA	DISTRIBUTIONS NOT IDENTICAL AT 1% SIGN. LEVEL	T2 =	2.210
BETWEEN DALLAS, TEXAS	AND ABILENE,TEXAS	DISTRIBUTIONS NOT IDENTICAL AT 1% SIGN. LEVEL	T2 =	3.435
BETWEEN SHREVEPORT, LA	AND ABILENE,TEXAS	DISTRIBUTIONS NOT IDENTICAL AT 1% SIGN. LEVEL	T2 =	7.121

SET 2 - CALIBRATION RAINFALL DATA
CONTAINING DATA FOR 4 SITES

BETWEEN PALESTINE,TEXAS	AND HOUSTON, TEXAS	DISTRIBUTIONS IDENTICAL	T2 =	0.291
BETWEEN PALESTINE,TEXAS	AND AMARILLO, TEXAS	DISTRIBUTIONS NOT IDENTICAL AT 1% SIGN. LEVEL	T2 =	1.466
BETWEEN PALESTINE,TEXAS	AND AUSTIN, TEXAS	DISTRIBUTIONS NOT IDENTICAL AT 5% SIGN. LEVEL	T2 =	0.543
BETWEEN HOUSTON, TEXAS	AND AMARILLO, TEXAS	DISTRIBUTIONS NOT IDENTICAL AT 1% SIGN. LEVEL	T2 =	1.637
BETWEEN HOUSTON, TEXAS	AND AUSTIN, TEXAS	DISTRIBUTIONS NOT IDENTICAL AT 1% SIGN. LEVEL	T2 =	0.804
BETWEEN AMARILLO, TEXAS	AND AUSTIN, TEXAS	DISTRIBUTIONS NOT IDENTICAL AT 1% SIGN. LEVEL	T2 =	1.118

GROUP 2 - ANNUAL MAX RAINFALL FOR 5 MINUTES

CONTAINING 1 SETS OF DATA

SET 1 - CALIBRATION RAINFALL DATA
CONTAINING DATA FOR 3 SITES

BETWEEN DALLAS. TX	AND HOUSTON, TX	DISTRIBUTIONS NOT IDENTICAL AT 5% SIGN. LEVEL	T2 =	0.708
BETWEEN DALLAS. TX	AND AUSTIN, TX	DISTRIBUTIONS IDENTICAL	T2 =	0.271
BETWEEN HOUSTON, TX	AND AUSTIN, TX	DISTRIBUTIONS NOT IDENTICAL AT 5% SIGN. LEVEL	T2 =	0.691

NORMAL END OF JOB

CALIBRATION OF NATURAL BASIN MODEL

Program A634

Cataloged Procedure RRCALB75

Description

The optimum magnitudes of 1 to 10 model parameters of the natural basin rainfall/runoff model are determined by program A634, using as input data measured discharge, rainfall, and evaporation, collected during the calibration period. Statistical tests are included in the program to indicate whether a significant calibration has been obtained. Any impervious areas are assumed to be uniformly distributed over the basin.

The following options may be used in calibration:

1. Any number (0 to 10) of parameters may be selected for optimization. Their initial magnitudes and acceptable upper and lower bounds may be designated.

2. The optimization may be done in phases, wherein the parameters relating to volume of runoff and/or to peak discharge are determined in distinct phases.

3. The number of trial steps in searching for an optimum may be selected for each phase.

4. Individual storms which are in the data set may be included or excluded from the optimization process.

5. In multi-peak storms, a maximum of three peaks may be included or excluded from the optimization process.

6. The base flow may be subtracted from the total runoff in a flood event by designating a discharge rate.

7. A line printer plot of the observed and computed discharge hydrographs and of the total and excess rainfall hyetographs may be obtained.

The print output from the program provides the following information: summary of data retrieval and of input cards, station identifications, pervious and impervious drainage areas, list of storms including dates, observed runoff, total rainfall, and base flow, and initial parameter magnitudes and those to be optimized; after completion of each phase of optimization, the final parameter magnitudes are given, the error in fitting the runoff volumes or peak discharges is listed, the results of each calibration phase is summarized by listing for each storm total rainfall, rainfall excess observed and synthesized, and the observed and synthesized runoff and peak discharges are compared in a line printer plot; under specified circumstances a statistical test summary is printed; finally, hydrographs and hyetographs may optionally be plotted on the line

Precautions

1. The input rainfall, discharge, and evaporation data to program A634 are established on a temporary disk file via the DD (data definition) card //H268.SYSIN DD * in the cataloged procedure. These data have to be retrieved from the disk files as card input is impossible.

2. The same days of unit rainfall and discharge must be stored in the Current Unit Values File, even if the unit data are zero.

3. For model calibration, the following previously executed jobs are essential: (a) Entering data in the unit and daily values files and (b) editing the data using programs A604--RREDIT75 and G159--RRDATASM.

4. Only one basin can be calibrated by the execution of this cataloged procedure.

Cataloged Procedure

```
/*RELAY  PUNCH RE2

//xxxxxx JOB (-------)

/*PROCLIB  WRD.PROCLIB

// EXEC RRCALB75,CREGION=region

//H268.SYSIN DD *

     - Type X card

     - Program H268 input cards

//A634.SYSIN DD *

     - Program A634 input cards

//

$$$
```

Type X card.--Use of this card indicates that the retrieval cards are to be used to create a card image file for use by interim program A604.

Program H268 input cards.--These cards identify the unit and daily rainfall, daily evaporation, and unit discharge records to be used in the calibration. See Section 8 for format. The recommended order of the cards identifying the stations is daily rainfall, unit discharge, unit rainfall, and daily evaporation. A password/agency identification (type Z) card may be needed. Details on this card are found in Section 8.

Program A604 card images.--Use of the X card (format below) signifies that the H268 retrieval cards are used to create a card image file as input to program A604, part of the catalog procedure. These card images are transparent to the user. Program H268 prints the card images if a X card is used.

Specifications.--The default time of three minutes for execution of the program A604 step should be sufficient for most jobs. The time can be increased by adding RTIME=time to the EXEC card. The default time for program A634 is five minutes; this time can be increased by adding CTIME=time to the EXEC card.

Specification of the region for program A634 (CREGION parameter on EXEC card) is mandatory. The region is determined as follows:

$$\text{region} = \left(298 + \frac{24}{\Delta t}Y + 3n\right) \quad \text{in K bytes}$$

where

Δt = unit rainfall time interval in minutes,

Y = number of unit rainfall days, and

n = number of years of daily rainfall data.

The region must be between 306K and 756K. If it is less than 306K, then use 306K. The program will execute if the region is greater than 756K; however, additional computer costs are incurred.

This cataloged procedure contains programs H268, DSK268, A604, and A634. Programs DSK268 and A604 are transparent to the user.

Input Cards

A. Type X card

This card precedes station retrieval cards needed in the H268 step of this cataloged procedure.

Column	Description
1-6	Enter 'XCALIB'
7-80	Blank.

Input Cards - Program A634

Card Types 1 through 5 are mandatory

A. Card Type '1'

Column	Description
1	Card type - '1'
2-16	Unit discharge station identifier, right justified.
17-65	Unit discharge station name. This field may be left blank if desired.
66-68	Unit discharge recording time interval, i.e., 5, 10, 15, or 30 minute interval, right justified.
69-74	Drainage area in units of square miles. Punch value to desired accuracy, right justified.
75-80	Impervious area in percent, right justified.

B. Card Type - '2'

Column	Description
1	Card type - '2'
2-16	Unit rainfall station identifier, right justified.
17-65	Unit rainfall station name.
66-68	Unit rainfall recording time interval, right justified.
69-79	Blank.
80	Number of phases desired. Default is 3. Two phases (volume and routing optimizations) are suggested for first calibration for a site.

C. Card Type - '3'

Column	Description
1	Card type - '3'
2-16	Daily rainfall station identifier, right justified.
17-65	Daily rainfall station name.
66-77	Beginning and ending dates for record period for the daily precipitation and daily evaporation data. Periods for both types of data must agree. Date is listed as last two-digits of water year, month, and, day.
78-80	Blank.

D. Card Type - '4'

Column	Description
1	Card type - '4'
2-16	Daily evaporation station identifier, right justified.
17-65	Daily evaporation station name.
66-68	Number of unit discharge days or unit precipitation days for period of record (mandatory), right justified.
69-71	NRDELS - Optinal number of time increments beyond peak computation that computation of runoff volume is to be made. Use only if hydrograph separation options A and B are not used.
72-80	Blank.

E. Card Type - '5'

Column	Description
1	Card type - '5'

Card type 5.--continued

Column	Descripiton
2-9	8-digit user identification; usually the streamflow station number (may be left blank).
10-11	Number of storms within record period. A storm is a set of consecutive unit data days.
12-80	Optional storm indicator card fields. Leave blank if Option A or B cards are used to define hydrograph separation; it is recommended to use Option B cards to do calibrations. On succeeding card fields from column 12 to number of storms (maximum 69 storms) indicate followirg: Punch '1' - Storm to be included in calibration Punch '0' - Storm not to be included in calibration. At least one storm must be specified by entering a '1' in cols. 11 and 12 if this option is used.

SPECIAL NOTES FOR CARDS 1-5

1. If any numeric fields are left blank the program assumes zero for that field.

2. If the name fields are left blank, the program will read the name, if available, from the retrieved data.

3. The recording time interval for the discharge and precipitation must be the same on card types 1 and 2.

4. The period of record given on card '3' must correspond to both the daily precipitation and daily evaporation data, i.e., start and end points of daily data must be the same. It may be necessary to generate evaporation data using program H266 (RRGENEVP).

5. If the recording-interval or drainage-area fields on a card are left blank, the program will attempt to obtain this information from the retrieved records.

6. Required information on cards 1 to 5 is as follows:

Station numbers - punch numbers as recorded in WRD Station Header File. Program checks for station number match while reading the files.

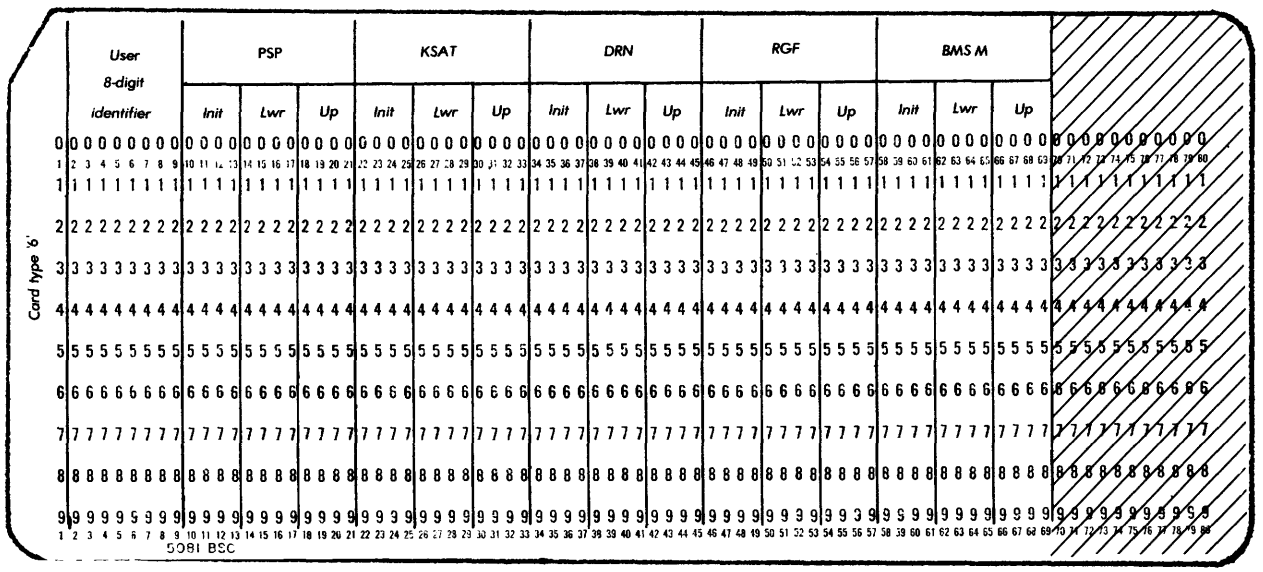
7. Number of unit days on card type 4 is used by program to set array space for the unit data.

8. NRDELS - Required by program if flood event options A or B cards are not (card type 4).

9. Storm indicator fields - must be given on card '5' if hydrograph separation options A or B cards are not used.

Optional card input (card types 6, 7, and 8 may be omitted)

F. Card Type - '6'

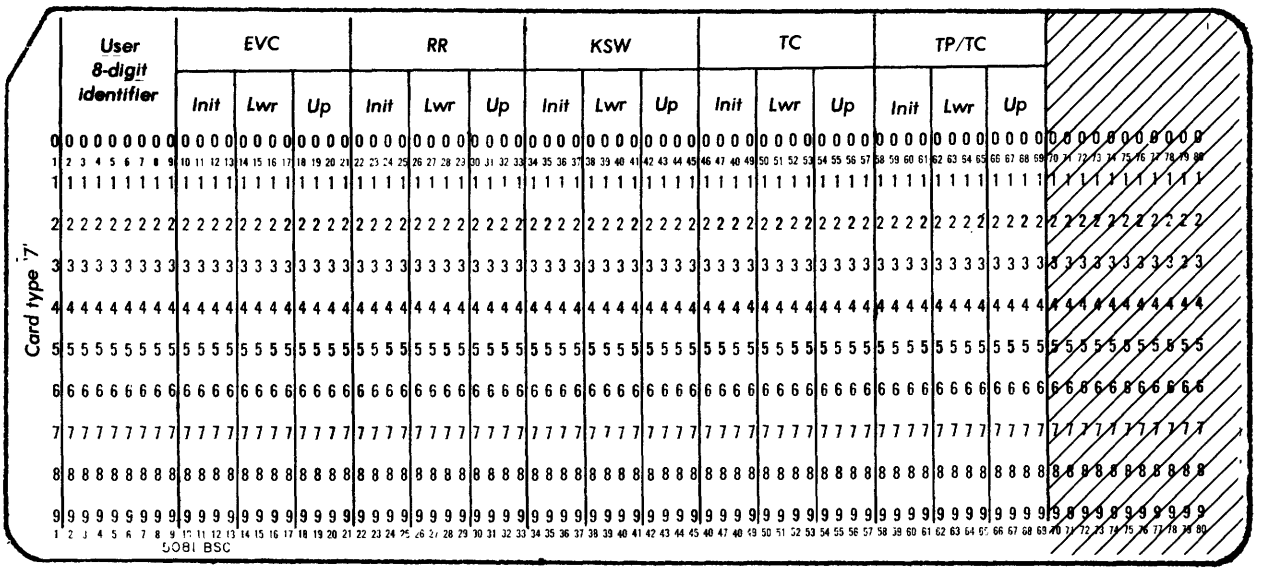


Column	Description
1	Card type '6'
2-9	8-digit user identifier.
10-69	Initial, lower, and upper magnitudes of first 5 parameters of 10 parameter model: (1) PSP-suction at wetting front, (2) KSAT-hydraulic conductivity of the transmission zone, (3) DRN-drainage rate between soil zones, (4) RGF-range factor - variation of variables within infiltration equation, and (5) BMSM field capacity of active soil zone.

Card type 6.--continued.

Column	Description
	For each parameter, 12 columns of space are given: 4 columns to express initial values, 4 columns to express lower boundary, and 4 columns to express upper boundary.
70-80	Blank.

G. Card Type - '7'



Column	Description
1	Card type - '7'
2-9	8-digit user identifier station number.
10-69	Initial, lower, and upper magnitudes of last 5 parameters of 10 parameter model: (6) EVC-coefficient to convert observed evaporation to potential evapotranspiration, (7) RR-ratio of infiltration to daily rainfall, (8) KSW-storage routing coefficient (in hours), (9) TC-base length of triangular translation hydrograph (in minutes), and (10) TP/TC-ratio of translation hydrograph peak time to base length of translation hydrograph.

Card type 7.--continued

Column	Description
	Three 4-column fields are used to express starting value, lower boundary and upper boundary for each parameter.
70-80	Blank.

SPECIAL NOTES CONCERNING CARDS 6 AND 7

1) If the cards are not supplied, the program will use the following default parameter values.

Parameter	Start	Lower Boundary	Upper Boundary
1) PSP	3.0	0.3	4.0
2) KSAT	0.1	.01	.5
3) DRN	1.0	.99	1.01
4) RGF	10.	2.0	20.
5) BMSM	4.0	1.0	20.
6) EVC	.75	.74	.76
7) RR	.9	.89	.91
10) TP/TC	.5	.49	.51

Parameters 3, 6, 7, and 10 held fixed at starting values during optimization.

Parameters 8 and 9 starting values are defaulted on the basis of drainage area using the following relations:

8) KSW (START) = square root of drainage area

9) TC (START) = 60 times KSW

Lower and upper default values are:

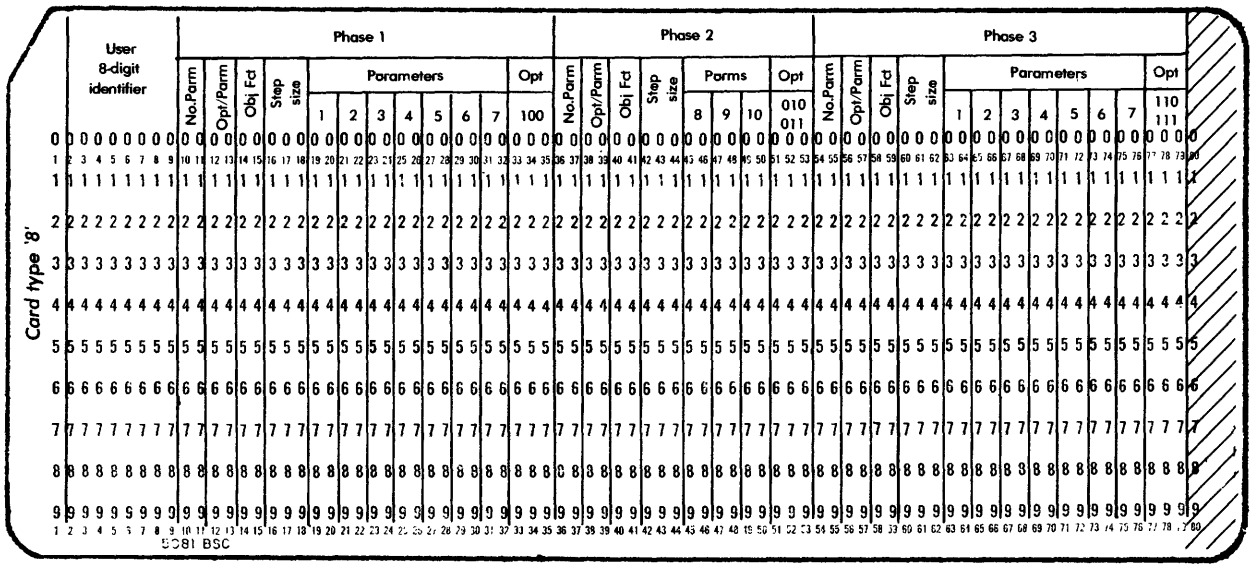
KSW - 0.001 and 100

TC - 5 and 144 times the unit time interval

2) If desired, one or both cards 6 and 7 may be supplied with the program; however, if either card is supplied all fields on that card must have entries.

3) If the upper limit of TC, specified on card type 7 is less than 2.5 times the initial magnitude and greater than or equal to 1.1 times initial magnitude, then the upper limit will be reset in program A634 to a default magnitude. The default magnitude is sufficient to insure an ample range in TC for optimization purposes. A message in the program is printed if the upper limit is reset.

H. Card Type - '8'



Column	Description
1	Card type - '8'
2-9	8-digit user identification station number.
10-35	Phase 1 parameters (model optimization of volume). Always first step in three-step calibration (objective function = '1').
A) 10-11	Total number of parameters to be used, generally 4 to 7, right justify.
B) 12-13	Number optimization per parameter; 5-10 recommended for trial runs.
C) 14-15	Objective function, always '1' (volume optimization), right justified.
D) 16-18	Step size parameter multiplier (recommended 0.05).
E) 19-32	The parameter numbers (1 through 7) cols. 19-20, 21-22, etc. If one or more parameters are omitted, make entries in leftmost 2-column fields (right justify).
F) 33-35	Optimization - always '100'.

H. Card Type 8.--Continued

Column	Description
36-53	Phase 2 parameters (model optimization of routing). Second step in calibration (objective function = '4').
A) 36-37	Total number of parameters to be used - generally 3 (parameters 8, 9, and 10), right justify.
B) 38-39	Number of optimization per parameter - 5-10 recommended.
C) 40-41	Objective function - always '4' (routing optimization), right justify.
D) 42-44	Step size parameter multiplier (0.05 recommended).
E) 45-50	The parameter numbers (8 through 10) to be included, in cols. 45-46, 47-48, and/or 49-50. If one or more parameters omitted, make entries in leftmost 2-column fields (right justify).
F) 51-53	Optimization option - punch either '010' to indicate peak computation only or '011' to indicate peak computation and a line printer plot of storm hydrograph with synthetic discharges volume adjusted.
54-79	Phase 3 parameters (model optimization of flood peaks). Third step in calibration (objective function = '2'). If phase 3 is run, a statistical summary of calibration is printed.
A) 54-55	Total number of parameter to be used, parameters 1 through 7.
B) 56-57	Number of optimization per parameter; 5-10 recommended, right justify.
C) 58-59	Objective function - always '2'.
D) 60-62	Step size parameter multiplier (0.05 recommended).

H. Card Type 8.--Continued

Column	Description
E) 63-76	The parameter numbers (1 through 7) to be included, in cols. 63-64, 65-66, etc. If one or more parameters are omitted, make entries in leftmost 2-column fields (right justify).
F) 77-79	Optimization option - punch either '110' to indicate computation of peaks and volumes or '111' for computation of peaks and volumes with a line printer plot of storm hydrograph. The line printer hydrograph plot shows observed and synthetic discharge hydrographs and unit rainfall and rainfall excess.
G) 80	Code any character if base flows are to be subtracted from observed discharges plotted on hydrographs. Option is operational only if optimization is executed.

SPECIAL NOTES.-

1) If card 8 is omitted the following default values are used.

PHASE 1 - OPTIMIZATION

A) Number of parameters = 4

B) Number optimizations per parameter = 7

C) Objective function = 1

D) Step size multiplier = 0.05

E) Parameters to be optimized = 1, 2, 4, 5

Parameters held constant = 3, 6, 7

F) Option = 100

PHASE 2 - OPTIMIZATION

A) Number of parameters = 2

B) Number optimizations per parameter = 5

C) Objective function = 4

D) Step size multiplier = 0.05

E) Parameters to be optimized = 8, 9
Parameter held constant = 10

F) Option = 010 (no hydrograph plots; phase 3 is omitted)

2) It is generally recommended that the parameter DRN be fixed at 1.0 and not be optimized in phases 1 and 3.

3) It is generally recommended that the parameter TP/TC be fixed at 0.5 and not be optimized in phase 2.

REQUIRED CARD INPUT

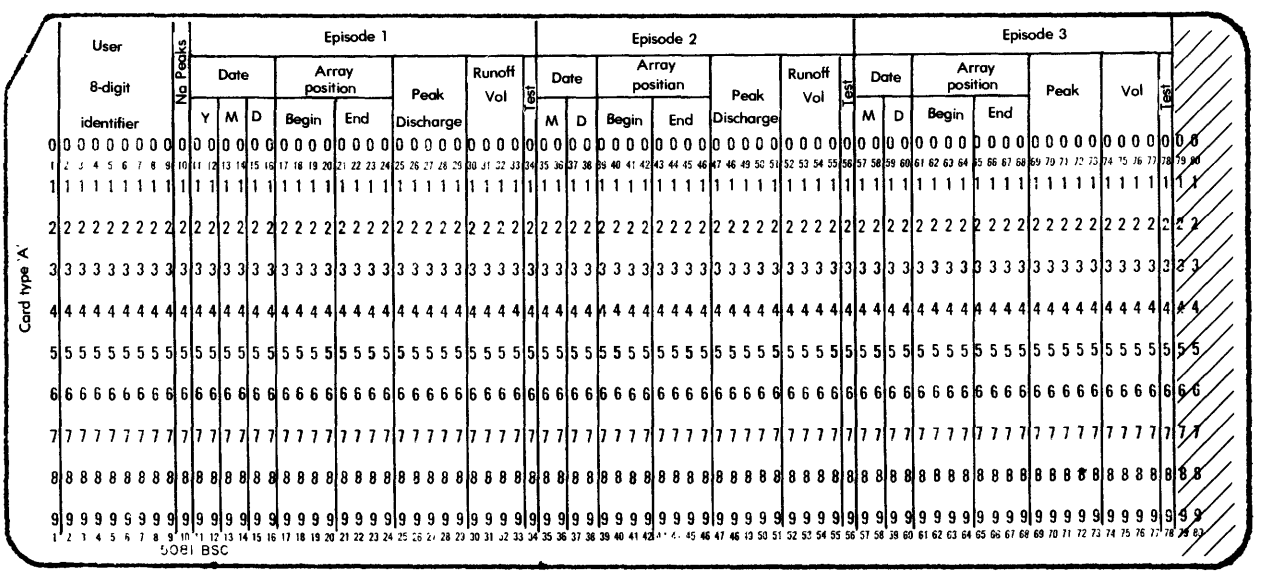
In addition to card types 1 to 8, if storm indicator fields (cols. 12-80, card 5) are not designated, program requires that each storm event be defined by one of the following options:

Option A -- The user furnishes estimates of runoff volumes and peak discharges for up to 3 episodes in the storm event. All unit data must be available.

Option B -- The user furnishes starting and ending information for rainfall and runoff definition and low base flow separation. The program will compute estimates of runoff volumes and peak discharges for up to 3 episodes in the storm event.

I. Card Type - 'A'

If option A is to be used for a given storm event the following card format is required.



Column	Description
1	Card type - 'A'
2-9	8-digit user identifier station number.
10	Number of flood peaks or episodes to be used for given storm event. NOTE: Maximum number is 3.
11-34	STORM EPISODE (1)
A) 11-16	Date of given peak (calendar year, month and day).
B) 17-20	Beginning array position number of the episode (minimum =1), right justify.
C) 21-24	Endng array position number of the episode, right justify. NOTE: The array positions are referenced to the first recording interval in the first day of the storm. For example, if a storm consists of three days and the recording interval is 5 minutes (288 RPD) then the array positions for this storm can range from 1 to 864. (864 = 3 days x 288 RPD).
D) 25-29	Observed flood peak in cfs corrected for base flow.
E) 30-33	Computed flood volume in inches. May be punched with or without decimal. If no decimal is punched, program assumes rainfall volume to the nearest 1/1000 i.e., if field punched as 1234 program assumes 1.234 inches.
F) 34	Is flood peak to be included in optimization? Punch '1' if flood peak is to be used. Punch '0' if flood peak is not to be used.
35-56	Storm episode number 2 (see note).
57-78	Storm episode number 3 (see note).

Card Type A.--continued

Column	Description
	NOTE: Storm episodes 2 and 3 use same card format as episode 1 except calendar year is not included in date fields.
79-80	Blank.

An example of option A for a 3-day storm period using 15 minute data (96 observations per day) is shown on the next page.

The 2 episodes used define the important peaks and volumes of the event (i.e. number of peaks, col. 10 = 2).

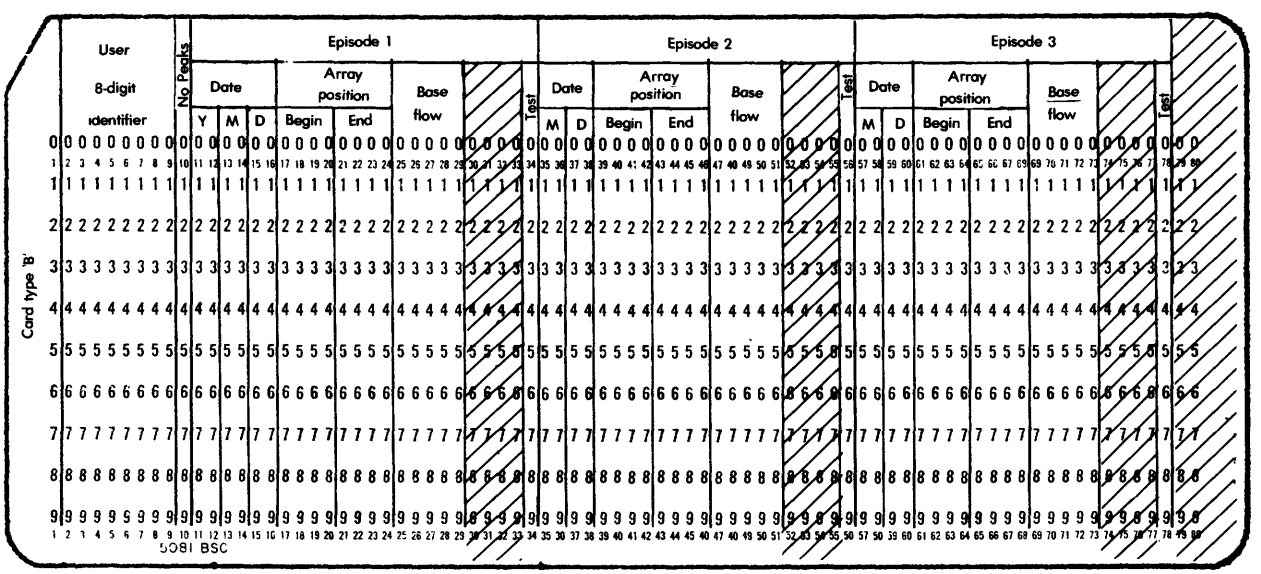
The start and end point array positions of the 2 episodes were selected so as to satisfy the following criteria:

1. Encompass the rainfall associated with the volume estimate.

2. Include the peak of the simulated discharge trace.

J. Card Type - 'B'

If option 'B' is to be used for a given storm event use the following format:



Column	Description
1	Card type - 'B'
2-9	8-digit user identifier station number.

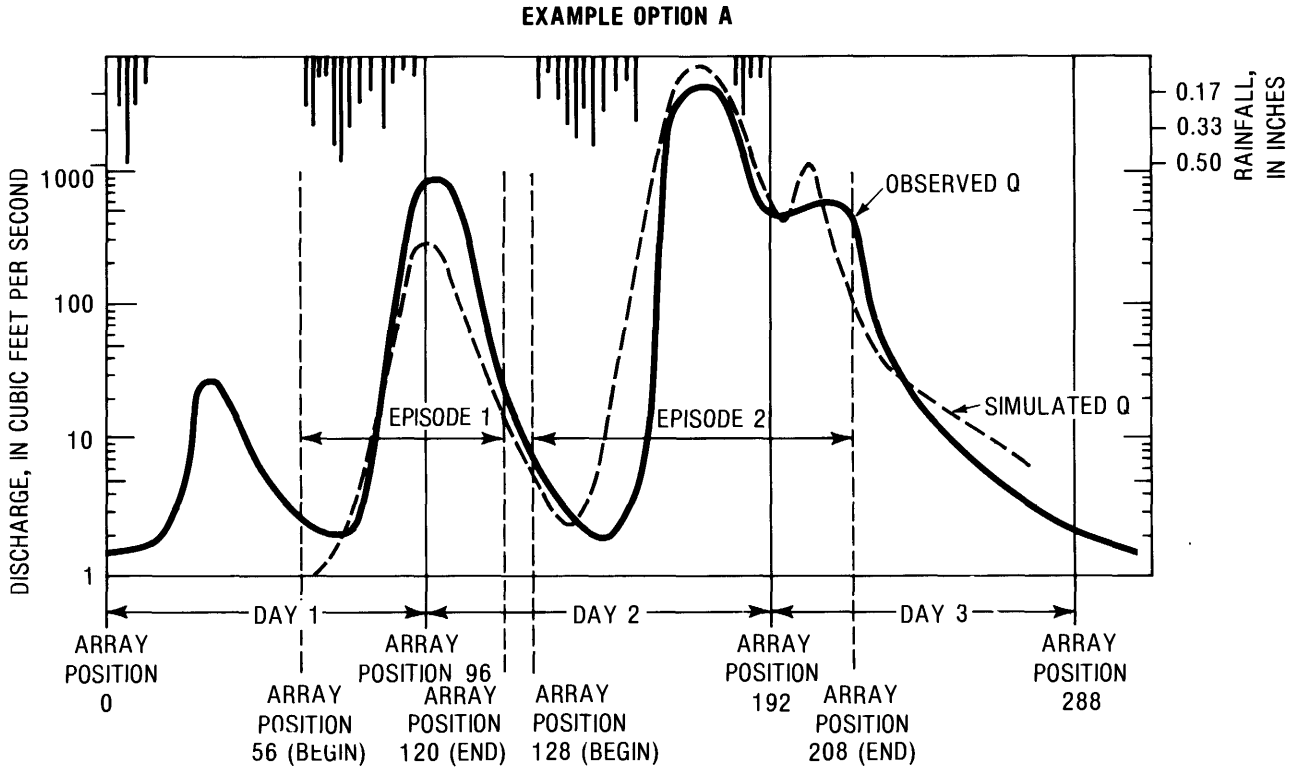


Figure 13-1. Graph showing separation of storm hydrograph and hyetograph into episodes using Option A.

Card type B.--continued

Column	Description
10	Number of flood peak episodes defined for given flood event. The maximum is 3
11-34	Storm episode (1)
A) 11-16	Date of given peak (calendar year, month, and day).
B) 17-20	Beginning array position number of the episode (minimum = 1), right justify.
C) 21-24	Ending array position number of the episode, right justify. NOTE: The array positions are referenced to the first recording interval of the first day of the storm. For example, any episode ending at noon on the second day of a storm that has 10-minute recording intervals would have an end array position of 216 (216 = 144 recordings on first day + 72 recordings to noon on second day).
D) 25-29	Selected base flow in cfs for the event. If the field is left blank the program assumes zero base flow.
E) 30-33	Blank
F) 34	Flood episode test option. Punch '1' if storm peak to be used. Punch '0' if storm peak not to be used.
35-56	Storm episode number 2.
57-78	Storm episode number 3. NOTE: Storm episodes 2 and 3 use the same format as episode 1 except the calendar year is not included in the date field.

An example of option 'B' for a 3-day storm period using 15 minute data (96 RPD) is shown on the next page.

In this example, episodes 1 and 2 include the major peaks of the storm event. The array begin and end points and base flow values were selected in such a manner to: 1) include the rainfall associated with the volume, 2) include the peak associated with the rainfall, 3) depict a net hydrograph area representative of the storm runoff.

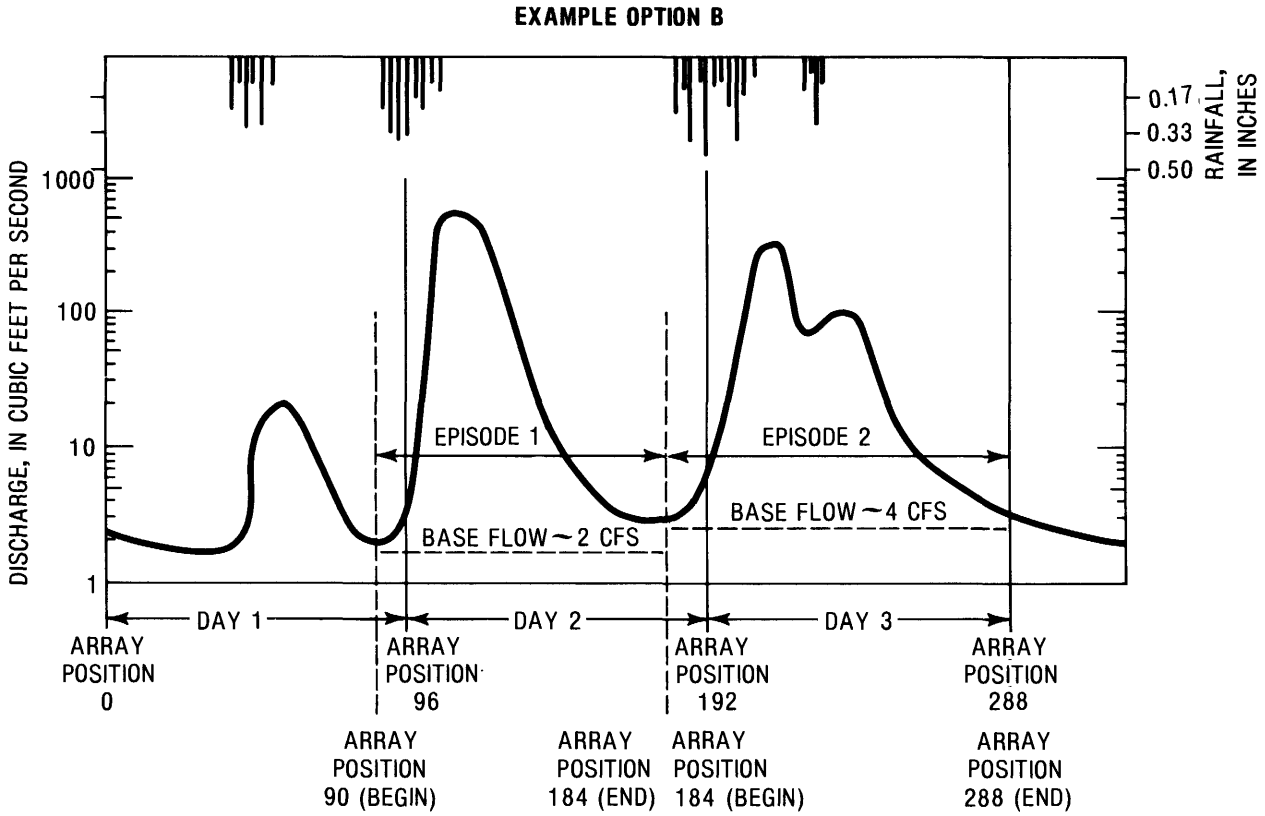


Figure 13-2. Graph showing separation of storm hydrograph and hyetograph into episodes using Option B.

SPECIAL NOTES CONCERNING CARD TYPES A & B.-

(1) There may be a mixture of A and B cards for any calibration. However, the observed discharge plotted on hydrographs for storms defined by option A should be disregarded.

(2) The total number of A and B cards must be equal to the storm events.

(3) The cards must be in chronological order.

Diagnostic Messages

Card reading procedure:

1. ERROR IN DATA SPECIFIED ON CARD TYPE 3
   DATE START = DATE END = 'date'
   STA. NO. = 'station number' NOT PROCESSED

   Program checks beginning and ending dates on card 3 for invalid month, day, or year.

2. ERROR IN NUMBER STORMS SPECIFIED ON
   CARD TYPE = 5, STATION NOT PROCESSED
   STATION NO. 'station identifier' STORMS 'number of storms'

   The program gives a preliminary check to the number storms specified. (Value must be greater than zero).

3. Number Flood Peaks (Card A or B)

   NUMBER OF FLOOD PEAKS SPECIFIED ON CARD 'A' or 'B' IS NOT WITHIN ALLOWABLE 1 TO 3 RANGE NUMBER SPECIFIED = 'number of peaks' STA. 'station identifier' NOT PROCESSED.

   On flood event definition cards, type 'A' or 'B', the maximum number of flood episodes for a given flood event is 3.

4. Required Card Check (Card 1 to 5)

   INSUFFICIENT CARD DATA SUPPLIED FOR CALIBRATION TO BE COMPLETED, CARDS 1, 2, 3, 4, AND 5 REQUIRED
   STATION NOT PROCESSED ST. NO. 'station identifier'

   Program requires that card types 1 to 5 be included for each data run.

5. Number Unit Days (Card 4) or Punch Interval Specified (Card 1)

   ERROR IN EITHER THE NUMBER UNIT DAYS OR THE PUNCH INTERVAL OF THE DATA FOR STA. 'station identifier' NUMBER UNIT DAYS 'number of unit days' PUNCH INTERVAL 'punch interval'

Both variables are extremely critical to program as they are used in setting the array sizes for the program.

6. Error in Storm Definition Card A or B

   ERROR ON CARD A OR B FOR STA. _fhihtre :Maehtptan_
   STORM NUMBER 'storm number' EPISODE NUMBER 'episode number'
   STA. NOT PROCESSED

   Program A634 checks all variables on card A or B for values greater than or equal to zero.

7. Card 5 Not Given Before A and B Storm Definition Cards

   CARD 5 CONTAINING NUMBER STORMS NOT GIVEN BEFORE CARD TYPE
   A OR B STATION = 'station identifier' NOT PROCESSED

   The number storms specified on card 5 is used to set sizes of many arrays required on the storm definition cards A or B.

(Retrieval Of Unit and Daily Data):

1. Punch interval of data record and card do not match

   OBSERVATION TIME INTERVAL SPECIFIED ON CARD 'card type'
   DOES NOT MATCH THE TIME INTERVAL FOR TAPE = 'tape number'
   STATION 'station identifier' NOT PROCESSED.

   Program requires that the time intervals specified must agree. This is very critical since the large arrays for the unit data have set up on the basis of the card specified punch interval.

2. Card and tape data period check (unit data)

   GIVEN DATA FROM TAPE RECORD = 'date' NOT WITHIN PERIOD
   SPECIFIED ON CARD = 'date' TO 'date' STATION 'station identifier'
   PARM CD 'parameter code' NOT PROCESSED.

   The record period on card is used to set up the daily time span of soil moisture accounting by the model. The unit storm dates should be within this time span.

3. Water year date error - (daily data)

   WATER YEAR RECORD ON TAPE NOT WITHIN PERIOD SPECIFIED ON CARD TAPE
   WATER YEAR = 'year'
   CARD PERIOD 'date' TO 'date'
   STATION = 'station identifier' PARM 'parameter code' NOT PROCESSED

   The boundaries of the daily data array is computed from the date period specified in the read card subroutine.

4. Number of storms read from card and the tape or disk do not agree

   NUMBER STORMS COMPUTED FROM TAPE DO NOT AGREE WITH NUMBER INDICATED ON CARD, NUMBER FROM TAPE = 'number of storms' NUMBER FROM CARD = 'number of storms'. STA 'station identifier' NOT PROCESSED.

   The program computes from the dates on tape or disk, the number of actual contiguous storm periods. This number is then tested against the number specified on card 5.

5. Number unit precipitation and unit discharge days or -100 daily indicators do not agree

   NUMBER STORM DAYS READ FROM TAPE FOR DISCHARGE AND PRECIPITATION DO NOT MATCH, NUMBER UNIT DISCH. DAYS = 'number of unit discharge days' NUMBER PRECIP. DAYS = 'number of unit precipitation days' NUMBER -100 DAYS (DAILY PRECIP.) = 'number of days' STA. = 'station identifier' NOT PROCESSED.

   The program counts the total number of unit discharge, unit precipitation, and -100 daily precipitation indicators. Each count must agree before the programs will attempt to continue station calibration.

Additional diagnostic messages which are self explanatory may be printed.

Explanation of diagnostic messages from program H268 and A604 are respectively described in sections 8 and 9.

Examples of Setting Up Jobs

A model for Caney Creek near Monticello, FL, station number 02326598 is to be calibrated for the period Oct. 1, 1970, through Sept. 30, 1974.

The following other stations are to be used:

Data	Station No.	Station Name
Unit rainfall	02326598	Caney Creek near Monticello, FL
Daily rainfall	02326598	Caney Creek near Monticello, FL
Daily evaporation	304637087082701	Milton Exp Station near Milton, FL WB5793

The unit-time interval is 15 minutes (96 readings per day). The drainage area is 2.54 square miles and the impervious area, uniformly dispersed over basin, is 0.01 percent.

There are 20 flood events in the calibration period; three of these events (4, 16, and 18) have multiple peaks. The base flow discharge (option

on card B) is furnished for all events except for events numbered 3, 11, and 17 for which flood runoff volume and the peak discharge less the base flow (option card A) are furnished. Three peaks are not used in calibration (first episode in storm 4, storm 7, and storm 17).

The optimization will be run for the first 2 phases, as this job is the first attempt to calibrate model for this basin (no statistical summary will be printed). In phase 1, the parameters affecting runoff volume will be optimized and in phase 2 the parameters affecting hydrograph shape will be optimized using the following initial magnitudes and lower and upper bounds:

Parameter		To be	Magnitudes		
Number	Name	optimized	Lower bound	Initial	Upper bound
1	PSP	Yes	0.1	3.0	10.0
2	KSAT	Yes	.01	.1	1.0
3	DRN	No	.05	1.0	2.0
4	RGF	Yes	2.0	10.0	30.0
5	BMSM	Yes	1.0	4.0	40.0
6	EVC	Yes	.6	.75	1.0
7	RR	No	.6	.87	1.0
8	KSW	Yes	.3	1.2	25.0
9	TC	Yes	30.0	200	500
10	TP	No	.2	.5	1.0

No phase 3 optimization will be run.

The number of trial steps per parameter in the optimization is 7.

PROGRAMMER	DIVISION	U. S. DEPARTMENT OF THE INTERIOR GEOLOGICAL SURVEY
LOCATION	PHONE	**COMPUTER CODING FORM**

PROGRAM NO.

PROJECT

SHEET ___ OF ___

PROGRAM IDENTIFICATION:

PROGRAM INFORMATION:

STATEMENT IDENTIFICATION

```
/*RELAY  PUNCH REZ
//xxxxxxxx JØB (-------)
/*PRØCLIB  WRD.PRØCLIB
// EXEC RRCALB75
//H268.SYSIN DD *
XCALIB
D303052083562401            00045000061970100619740925PASS
U       02326598            00060000111970100619740925PASS
U303052083562401            00045000061970100619740925PASS
D304637087082701            00050000061970100619740925PASS
//A634.SYSIN DD *
1       02326598CANEY CR NR MØNTICELLØ, FL                        15  2.54  0.01
2303052083562401CANEY CR NR MØNTICELLØ, FL                        15           2
3303052083562401CANEY CR NR MØNTICELLØ, FL                       7010067740925
4304637087082701MILTØN EXP STA NR MILTØN, FL                WB5793 36
50232659820
602326598 3.0 0.110.0 0.10.01 1.0 1.00.05 2.010.0 2.030.0 4.0 1.040.0
7023265980.75 0.6 1.00.87 0.6 1.0 1.2 0.325.0200.30.0500. 0.5 0.2 1.0
802326598 5 7 1.05 1 2 4 5 6   100 2 7 4.05 810 011
B02326598171 2 7  14  54  6.0   1
B02326598171 5 8  56 100  4.0   1
A02326598272 2 7   1  52 73.0 .261
B02326598172 330  12  88 15.0   0 331 88 134 30.0   1
B02326598172 5 8   5 102  4.0   1
B02326598172 825  62 118 10.0   1
B023265981721027  52  96  3.0   0
```

FORM 9—1634 A
JULY 1967

0 = ZERO Ø = ALPHA O 1 = ONE I = ALPHA I 2 = TWO Ƶ = ALPHA Z / = SLASH | = VERT. BAR - = MINUS _ = HORZ. BAR

PROGRAM CODING FORM

U. S. DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

COMPUTER CODING FORM

PROGRAMMER ______ DIVISION ______
LOCATION ______ PHONE ______
PROGRAM NO. ______
PROJECT ______
SHEET 2 OF 2

PROGRAM IDENTIFICATION: ______
PROGRAM INFORMATION: ______
STATEMENT IDENTIFICATION

```
B023265981721125  16  98  3.0    1
B023265981721221  22  86  5.0    1
B02326598173 2 1  82 157  8.0    1
A02326598173 2 9   1 122370.0 .201
B02326598173 331  82 152  8.0    1
B02326598173 4 3  12 144 10.0    1
B02326598173 5 8  42  96  4.0    1
B02326598173 526  70 113  4.0    1
B02326598273 530   2  46  6.0    1  530 60   98 15.0    1
A02326598173 8 6  52  96 96.0 .191
B0232659827312 6  52  96 10.0    11226 106 162  17.0    1
B02326598174 4 5   2  48  5.0    1
B02326598174 9 6 120 200 16.0    1
//
$$$
```

FORM 9—1634 A
JULY 1967

0 = ZERO   Ø = ALPHA O   1 = ONE   I = ALPHA I   2 = TWO   Ƶ = ALPHA Z   / = SLASH   ‖ = VERT. BAR   - = MINUS   _ = HORZ. BAR

PROGRAM CODING FORM

GPO : 1968 O - 286-594

PROGRAM H268 , REVISED DEC 1975

RETRIEVE, PRINT, PUNCH AND/OR PASS UNIT AND DAILY VALUES FOR RAINFALL-RUNOFF MODELING PROGRAMS

MESSAGES - RETRIEVALS MADE AND ATTEMPTED, AND ERRORS FOLLOW:

DAILY VALUES DATA RETRIEVAL: STATION= 02326598 PARAMETER= 45 STATISTIC= 6
THE WATER YEARS LISTED BELOW WERE RETRIEVED, PASSED:
1971 1972 1973 1974

UNIT VALUES DATA RETRIEVAL: STATION= 02326598 PARAMETER= 60 STATISTIC= 11
THE DATES LISTED BELOW WERE RETRIEVED, PASSED:

FEB. 7, 1971(96)	MAY 8, 1971(96)	MAY 9, 1971(96)	FEB. 7, 1972(96)	MAR. 30, 1972(96)
MAR. 31, 1972(96)	MAY 8, 1972(96)	MAY 9, 1972(96)	AUG. 25, 1972(96)	AUG. 26, 1972(96)
OCT. 27, 1972(96)	OCT. 28, 1972(96)	NOV. 25, 1972(96)	NOV. 26, 1972(96)	DEC. 21, 1972(96)
FEB. 1, 1973(96)	FEB. 2, 1973(96)	FEB. 9, 1973(96)	FEB. 10, 1973(96)	MAR. 31, 1973(96)
APR. 1, 1973(96)	APR. 3, 1973(96)	APR. 4, 1973(96)	MAY 8, 1973(96)	MAY 9, 1973(96)
MAY 26, 1973(96)	MAY 27, 1973(96)	MAY 30, 1973(96)	MAY 31, 1973(96)	AUG. 6, 1973(96)
DEC. 26, 1973(96)	DEC. 27, 1973(96)	APR. 5, 1974(96)	SEP. 5, 1974(96)	SEP. 6, 1974(96)
SEP. 7, 1974(96)				

UNIT VALUES DATA RETRIEVAL: STATION= 02326598 PARAMETER= 45 STATISTIC= 6
THE DATES LISTED BELOW WERE RETRIEVED, PASSED:

FEB. 7, 1971(96)	MAY 8, 1971(96)	MAY 9, 1971(96)	FEB. 7, 1972(96)	MAR. 30, 1972(96)
MAR. 31, 1972(96)	MAY 8, 1972(96)	MAY 9, 1972(96)	AUG. 25, 1972(96)	AUG. 26, 1972(96)
OCT. 27, 1972(96)	OCT. 28, 1972(96)	NOV. 25, 1972(96)	NOV. 26, 1972(96)	DEC. 21, 1972(96)
FEB. 1, 1973(96)	FEB. 2, 1973(96)	FEB. 9, 1973(96)	FEB. 10, 1973(96)	MAR. 31, 1973(96)
APR. 1, 1973(96)	APR. 3, 1973(96)	APR. 4, 1973(96)	MAY 8, 1973(96)	MAY 9, 1973(96)
MAY 26, 1973(96)	MAY 27, 1973(96)	MAY 30, 1973(96)	MAY 31, 1973(96)	AUG. 6, 1973(96)
DEC. 26, 1973(96)	DEC. 27, 1973(96)	APR. 5, 1974(96)	SEP. 5, 1974(96)	SEP. 6, 1974(96)
SEP. 7, 1974(96)				

DAILY VALUES DATA RETRIEVAL: STATION=304637087082701 PARAMETER= 50 STATISTIC= 6
THE WATER YEARS LISTED BELOW WERE RETRIEVED, PASSED:
1971 1972 1973 1974

PROGRAM DSK268 REVISED 04-01-75

CREATES A TEMPERARY ISAM FILE FOR RAINFALL-RUNOFF PROGRAMS

SUMMARY OF RECORDS ENTERED INTO ISAM FILE:

STA=	02326598	PARM=	45	STAT=	6	RPD=	1	RECORDS WRITTEN=	4
STA=	02326598	PARM=	45	STAT=	6	RPD=	96	RECORDS WRITTEN=	36
STA=	02326598	PARM=	60	STAT=	11	RPD=	96	RECORDS WRITTEN=	36
STA=	304637087082701	PARM=	50	STAT=	6	RPD=	1	RECORDS WRITTEN=	4

END PROGRAM DSK268

********** TAPE WRITE - CARD PUNCH SUMMARY **********

DAILY RECORD(WATER YR.) WRITTEN ON MAG TAPE, I.D. =	02326598	45	6 WATER YR = 1971
DAILY RECORD(WATER YR.) WRITTEN ON MAG TAPE, I.D. =	02326598	45	6 WATER YR = 1972
DAILY RECORD(WATER YR.) WRITTEN ON MAG TAPE, I.D. =	02326598	45	6 WATER YR = 1973
DAILY RECORD(WATER YR.) WRITTEN ON MAG TAPE, I.D. =	02326598	45	6 WATER YR = 1974

********** TAPE WRITE - CARD PUNCH SUMMARY **********

UNIT RECORD WRTTEN ON MAG TAPE,I.D. = 02326598 60 11, DATE = 1971 2 7 START = 1 NUMB. VALUES 96
UNIT RECORD WRTTEN ON MAG TAPE,I.D. = 02326598 60 11, DATE = 1971 5 8 START = 1 NUMB. VALUES 96
UNIT RECORD WRTTEN ON MAG TAPE,I.D. = 02326598 60 11, DATE = 1971 5 9 START = 1 NUMB. VALUES 96
UNIT RECORD WRTTEN ON MAG TAPE,I.D. = 02326598 60 11, DATE = 1972 2 7 START = 1 NUMB. VALUES 96
UNIT RECORD WRTTEN ON MAG TAPE,I.D. = 02326598 60 11, DATE = 1972 3 30 START = 1 NUMB. VALUES 96
UNIT RECORD WRTTEN ON MAG TAPE,I.D. = 02326598 60 11, DATE = 1972 3 31 START = 1 NUMB. VALUES 96
UNIT RECORD WRTTEN ON MAG TAPE,I.D. = 02326598 60 11, DATE = 1972 5 8 START = 1 NUMB. VALUES 96
UNIT RECORD WRTTEN ON MAG TAPE,I.D. = 02326598 60 11, DATE = 1972 5 9 START = 1 NUMB. VALUES 96
UNIT RECORD WRTTEN ON MAG TAPE,I.D. = 02326598 60 11, DATE = 1972 8 25 START = 1 NUMB. VALUES 96
UNIT RECORD WRTTEN ON MAG TAPE,I.D. = 02326598 60 11, DATE = 1972 8 26 START = 1 NUMB. VALUES 96
UNIT RECORD WRTTEN ON MAG TAPE,I.D. = 02326598 60 11, DATE = 1972 10 27 START = 1 NUMB. VALUES 96
UNIT RECORD WRTTEN ON MAG TAPE,I.D. = 02326598 60 11, DATE = 1972 10 28 START = 1 NUMB. VALUES 96
UNIT RECORD WRTTEN ON MAG TAPE,I.D. = 02326598 60 11, DATE = 1972 11 25 START = 1 NUMB. VALUES 96
UNIT RECORD WRTTEN ON MAG TAPE,I.D. = 02326598 60 11, DATE = 1972 11 26 START = 1 NUMB. VALUES 96
UNIT RECORD WRTTEN ON MAG TAPE,I.D. = 02326598 60 11, DATE = 1972 12 21 START = 1 NUMB. VALUES 96
UNIT RECORD WRTTEN ON MAG TAPE,I.D. = 02326598 60 11, DATE = 1973 2 1 START = 1 NUMB. VALUES 96
UNIT RECORD WRTTEN ON MAG TAPE,I.D. = 02326598 60 11, DATE = 1973 2 2 START = 1 NUMB. VALUES 96
UNIT RECORD WRTTEN ON MAG TAPE,I.D. = 02326598 60 11, DATE = 1973 2 9 START = 1 NUMB. VALUES 96
UNIT RECORD WRTTEN ON MAG TAPE,I.D. = 02326598 60 11, DATE = 1973 2 10 START = 1 NUMB. VALUES 96
UNIT RECORD WRTTEN ON MAG TAPE,I.D. = 02326598 60 11, DATE = 1973 3 31 START = 1 NUMB. VALUES 96
UNIT RECORD WRTTEN ON MAG TAPE,I.D. = 02326598 60 11, DATE = 1973 4 1 START = 1 NUMB. VALUES 96
UNIT RECORD WRTTEN ON MAG TAPE,I.D. = 02326598 60 11, DATE = 1973 4 3 START = 1 NUMB. VALUES 96
UNIT RECORD WRTTEN ON MAG TAPE,I.D. = 02326598 60 11, DATE = 1973 4 4 START = 1 NUMB. VALUES 96
UNIT RECORD WRTTEN ON MAG TAPE,I.D. = 02326598 60 11, DATE = 1973 5 8 START = 1 NUMB. VALUES 96
UNIT RECORD WRTTEN ON MAG TAPE,I.D. = 02326598 60 11, DATE = 1973 5 9 START = 1 NUMB. VALUES 96
UNIT RECORD WRTTEN ON MAG TAPE,I.D. = 02326598 60 11, DATE = 1973 5 26 START = 1 NUMB. VALUES 96
UNIT RECORD WRTTEN ON MAG TAPE,I.D. = 02326598 60 11, DATE = 1973 5 27 START = 1 NUMB. VALUES 96

********** TAPE WRITE - CARD PUNCH SUMMARY **********

DAILY RECORD(WATER YR.) WRITTEN ON MAG TAPE, I.D. = 304637087082701 50 6 WATER YR = 1971

DAILY RECORD(WATER YR.) WRITTEN ON MAG TAPE, I.D. = 304637087082701 50 6 WATER YR = 1972

DAILY RECORD(WATER YR.) WRITTEN ON MAG TAPE, I.D. = 304637087082701 50 6 WATER YR = 1973

DAILY RECORD(WATER YR.) WRITTEN ON MAG TAPE, I.D. = 304637087082701 50 6 WATER YR = 1974

```
USGS RURAL RAINFALL-RUNOFF MODEL - PGM A634
*** CURRENT VERSION OF PGM A634 HANDLES       5,10,15,30, AND 60 MINUTE DATA ***
PROCESSING DATE = 76/07/15
LAST REVISION 04/01/76

READ INPUT CARDS FOR NEW STATION

 COL 1 TEST CD TYPE= 1
CARD 1          02326598CANEY CK NR MONTICELLO, FLORIDA                    15    2.54    0.01
CARD 2          02326598CANEY CK NR MONTICELLO, FLORIDA                    15            2
CARD 3          02326598CANEY CK NR MONTICELLO, FLORIDA                  7010 174 930
CARD 4   30463708708270 1MILTON EXP STA NR MILTON, FLORIDA (WB5793)       36   0
FROM CARD 5, NO. OF STORMS = 20 00000000000000000000
FROM CARD 6, PSP: START=  3.000  LOW=  0.100  HIGH= 10.000
            KSAT:         0.100        0.010        1.000
             DRN:         1.000        0.050        2.000
             RGF:        10.000        2.000       30.000
            BMSM:         4.000        1.000       40.000
FROM CARD 7, EVC:.        0.750        0.600        1.000
              RR:         0.870        0.600        1.000
             KSW:         1.200        0.300       25.000
              TC:       200.000       30.000      500.000
           TP/TC:         0.500        0.200        1.000
FROM CARD 8:      --PHASE 1 --      - PHASE 2 -     -- PHASE 3 --
    ND. PARMS. =       5                2               0
    OPT/PARM.  =       7                7               0
    OBJ. FUNC. =       1                4               0
    STEPSIZE   =     .05               .05             .00
    PARAMETERS = 1 2 4 5 6 0 0        8  9  0        0 0 0 0 0 0 0
    OPTS.      =     100               011             000
CARD B-NO. PEAKS =1 71 2 7  14  54  6.0    1
CARD B-NO. PEAKS =1 71 5 8  56 100  4.0    1
CARD A-NO. PEAKS =1 72 2 7   1  52   81.2601
CARD B-NO. PEAKS =2 72 330  12  88   15    0 331  88 134   30    1
CARD B-NO. PEAKS =1 72 5 8   5 102  4.0    1
CARD B-NO. PEAKS =1 72 825  62 118   10    1
CARD B-NO. PEAKS =1 721027  52  96  3.0    0
CARD B-NO. PEAKS =1 721125  16  98  3.0    1
CARD B-NO. PEAKS =1 721221  22  86  5.0    1
CARD B-NO. PEAKS =1 73 2 1  82 157  8.0    1
CARD A-NO. PEAKS =1 73 2 9   1 122   68.2001
CARD B-NO. PEAKS =1 73 331  82 152  8.0    1
CARD B-NO. PEAKS =1 73 4 3  12 144   10    1
CARD B-NO. PEAKS =1 73 5 8  42  96  4.0    1
CARD B-NO. PEAKS =1 73 526  70 113  4.0    1
CARD B-NO. PEAKS =2 73 530   2  46  6.0    1 530  60  98   15    1
CARD A-NO. PEAKS =1 73 8 6  52  96  101.1900
CARD B-NO. PEAKS =2 7312 6  52  96   10    11226 106 162   17    1
CARD B-NO. PEAKS =1 74 4 5   2  48  5.0    1
CARD B-NO. PEAKS =1 74 9 6 120 200   16    1
```

DISCHARGE STATION: 02326598CANEY CK NR MONTICELLO, FLORIDA
UNIT PRECIP. STATION: 02326598CANEY CK NR MONTICELLO, FLORIDA
DAILY PRECIP. STATION: 02326598CANEY CK NR MONTICELLO, FLORIDA
PAN-EVAPO STATION: 304637087082701MILTON EXP STA NR MILTON, FLORIDA (WB5793)

DRAINAGE AREA= 2.54 SQ.MI. PERCENT IMPERVIOUS AREA= 0.01 %
UNIT DATA IS IN 15 MIN INCREMENTS

THE PERIOD OF RECORD IS FROM 10 -1-70 (DAY=1) TO 9-30-74 (DAY=1461) AND IS CONTINUOUS

THE RECORD INCLUDES 20 SEQUENCES OF UNIT-DATA THAT DEFINE THE FOLLOWING FLOOD EVENTS

SEQUENCE	PEAK AND VOLUME OPTION	EVENT	DATE	PEAK DISCHARGE (CFS)	STORM RUNOFF (IN)	STORM RAINFALL (IN)	BASE FLOW
1	B	1*	2/ 7/71	93	0.21	1.91	6.0
2	B	1*	5/ 8/71	153	0.31	2.49	4.0
3	A	1*	2/ 7/72	81	0.26	1.53	0.0
4	B	1	3/30/72	183	0.25	1.96	15.0
		2*	3/31/72	123	0.21	1.37	30.0
5	B	1*	5/ 8/72	91	0.32	3.13	4.0
6	B	1*	8/25/72	379	0.61	3.23	10.0
7	B	1	10/27/72	138	0.22	2.87	3.0
8	B	1*	11/25/72	160	0.27	2.33	3.0
9	B	1*	12/21/72	79	0.20	2.28	5.0
10	B	1*	2/ 1/73	378	0.67	3.07	8.0
11	A	1*	2/ 9/73	68	0.20	2.41	0.0
12	B	1*	3/31/73	837	1.72	3.87	8.0
13	B	1*	4/ 3/73	347	2.49	5.16	10.0
14	B	1*	5/ 8/73	77	0.19	2.15	4.0
15	B	1*	5/26/73	117	0.24	1.67	4.0
16	B	1*	5/30/73	65	0.17	1.56	6.0
		2*	5/30/73	70	0.15	1.44	15.0
17	A	1	8/ 6/73	101	0.19	0.63	0.0
18	B	1*	12/ 6/73	48	0.13	1.18	10.0
		2*	12/26/73	82	0.20	1.84	17.0
19	B	1*	4/ 5/74	113	0.22	1.51	5.0
20	B	1*	9/ 6/74	894	1.35	6.22	16.0

NOTE: A INDICATES THAT PEAK AND VOLUME FIGURES WERE SUPPLIED BY USER

B INDICATES THAT PEAK AND VOLUME FIGURES WERE COMPUTED FROM UNIT DATA
C INDICATES THAT PEAK AND VOLUME FIGURES WERE COMPUTED FROM UNIT DATA AS IN M0004 VERSION,
IE, FROM START OF EPISODE TO PEAK + 0 INCREMENTS OF UNIT DURATION
* INDICATES THOSE EVENTS USED IN CALIBRATION OF MODEL
PEAK DISCHARGE(S) AND STORM RUNOFF (VOL.) HAVE BASE FLOW(S) SUBTRACTED

BEGINNING OF STAGE - PHASE 1

INITIAL PARAMETER VALUES ARE:

1	3.000000 *
2	0.100000 *
3	1.000000
4	10.000000 *
5	4.000000 *
6	0.750000 *
7	0.870000
8	1.200000
9	200.000000
10	0.500000

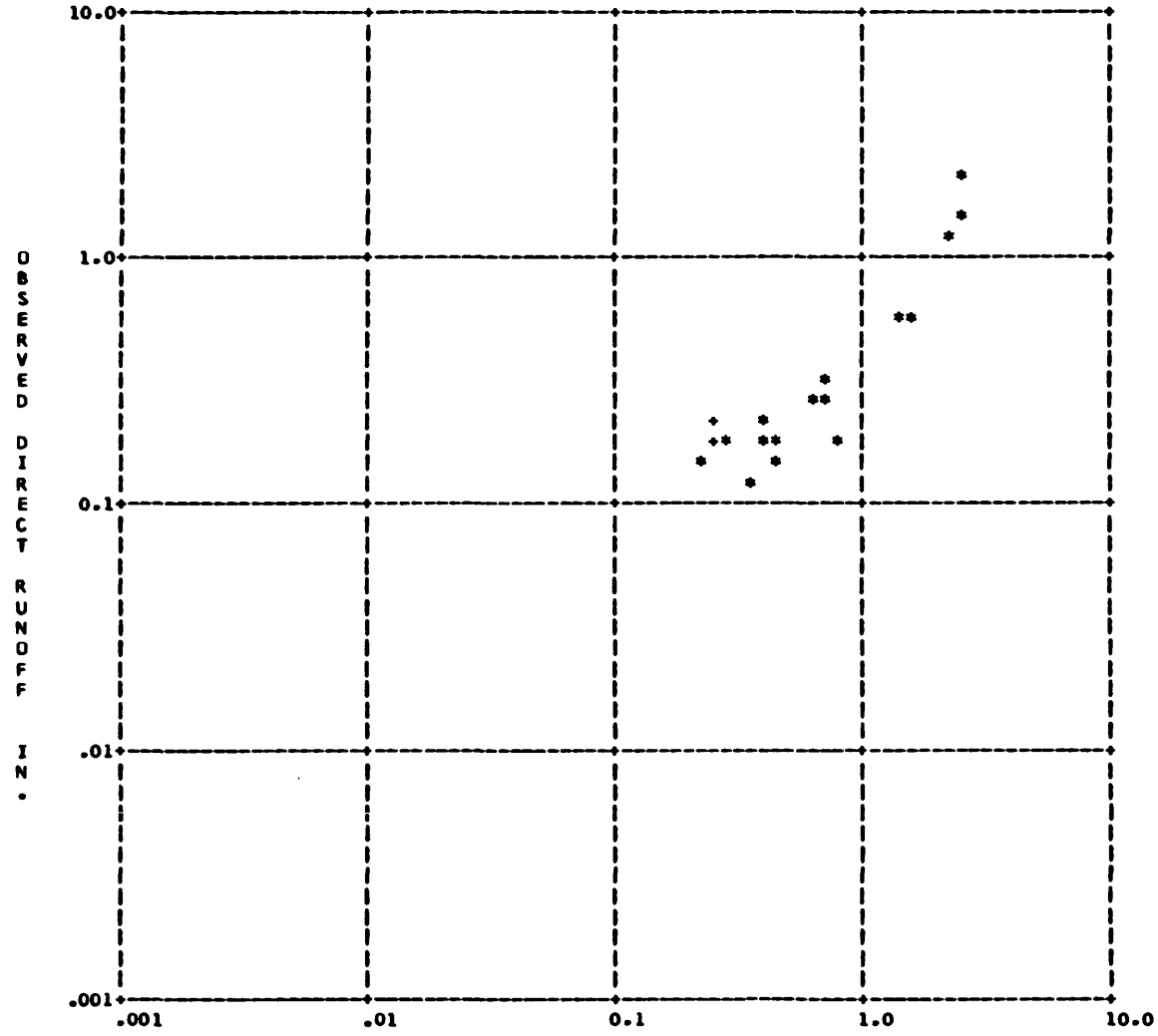
* - PARAMETERS TO BE OPTIMIZED
INITIAL STEP-SIZE INCREMENTS***
0.150000 0.005000 0.500000 0.200000 0.037500

THE MAXIMUM NUMBER OF TRYCTS IS 35
AT THE START OF EACH STAGE STEP-SIZE = 5 % OF THE VECTOR SIZE.

BEGINNING OF STAGE
PHASE 1 - OPTIMIZATION OF PARAMETERS AFFECTING RUNOFF VOLUME
VOLUME OBJECTIVE FUNCTION= 1.0510622E+01
ROOT MEAN SQ. ERROR LOG BASE 10 = 0.314369 (AVE. PERCENT = 78.9)
PARAMETER VALUES ARE
PSP= 3.000
KSAT= 0.100
DRN= 1.000
RGF= 10.000
BMSM= 4.000
EVC= 0.750
RR= 0.870

DATE	STORM RAINFALL	DIRECT RUNOFF	SIM DIRECT RUNOFF	PROPORTION OF STORM RAINFALL INFILTRATED
* 2/ 7/71	1.91	0.21	0.31	0.89
* 5/ 8/71	2.49	0.31	0.64	0.88
* 2/ 7/72	1.53	0.26	0.41	0.83
3/30/72	1.96	0.25	0.20	0.87
* 3/31/72	1.37	0.21	0.48	0.85
* 5/ 8/72	3.13	0.32	0.73	0.90
* 8/25/72	3.23	0.61	1.61	0.81
10/27/72	2.87	0.22	1.12	0.92
*11/25/72	2.33	0.27	0.73	0.88
*12/21/72	2.28	0.20	0.25	0.91
* 2/ 1/73	3.07	0.67	1.49	0.78
* 2/ 9/73	2.41	0.20	0.41	0.92
* 3/31/73	3.87	1.72	2.72	0.55
* 4/ 3/73	5.16	2.49	2.78	0.52
* 5/ 8/73	2.15	0.19	0.26	0.91
* 5/26/73	1.67	0.24	0.25	0.86
* 5/30/73	1.56	0.17	0.24	0.89
* 5/30/73	1.44	0.15	0.46	0.89
8/ 6/73	0.63	0.19	0.08	0.70
*12/ 6/73	1.18	0.13	0.38	0.89
*12/26/73	1.84	0.20	0.80	0.89
* 4/ 5/74	1.51	0.22	0.26	0.86
* 9/ 6/74	6.22	1.35	2.50	0.78

* - EVENTS USED IN CALIBRATION



NUMBER OF POINTS PLOTTED = 20
NUMBER OF MULTIPLE POINTS = 2
NUMBER OF POINTS OFF GRID = 0
NUMBER OF POINTS OMITTED = 3

*** NOTE ***
PLOT ROUTINE EXCLUDES
POINTS NOT INCLUDED
IN CALIBRATION

TRCT	OBJ. FUNC.	PSP	KSAT	DRN	RGF	BMSM	EVC	RR	KSW	TC	TP/TC
0	10.51062	3.00000	0.10000	1.00000	10.00000	4.00000	0.75000	0.87000	1.20000	200.00000	0.50000
1	9.86043	3.15000	0.10000	1.00000	10.00000	4.00000	0.75000	0.87000	1.20000	200.00000	0.50000
2	9.05143	3.15000	0.10500	1.00000	10.00000	4.00000	0.75000	0.87000	1.20000	200.00000	0.50000
3	8.65739	3.15000	0.10500	1.00000	10.50000	4.00000	0.75000	0.87000	1.20000	200.00000	0.50000
4	8.54999	3.15000	0.10500	1.00000	10.50000	4.20000	0.75000	0.87000	1.20000	200.00000	0.50000
5	8.23271	3.15000	0.10500	1.00000	10.50000	4.20000	0.78750	0.87000	1.20000	200.00000	0.50000
6	6.81982	3.60000	0.10500	1.00000	10.50000	4.20000	0.78750	0.87000	1.20000	200.00000	0.50000
7	5.28612	3.60000	0.12000	1.00000	10.50000	4.20000	0.78750	0.87000	1.20000	200.00000	0.50000
8	4.89766	3.60000	0.12000	1.00000	12.00000	4.20000	0.78750	0.87000	1.20000	200.00000	0.50000
9	4.61563	3.60000	0.12000	1.00000	12.00000	4.80000	0.78750	0.87000	1.20000	200.00000	0.50000
10	2.69358	3.60000	0.12000	1.00000	12.00000	4.80000	0.90000	0.87000	1.20000	200.00000	0.50000
14	2.03860	3.60000	0.12000	1.00000	12.00000	6.60000	0.90000	0.87000	1.20000	200.00000	0.50000

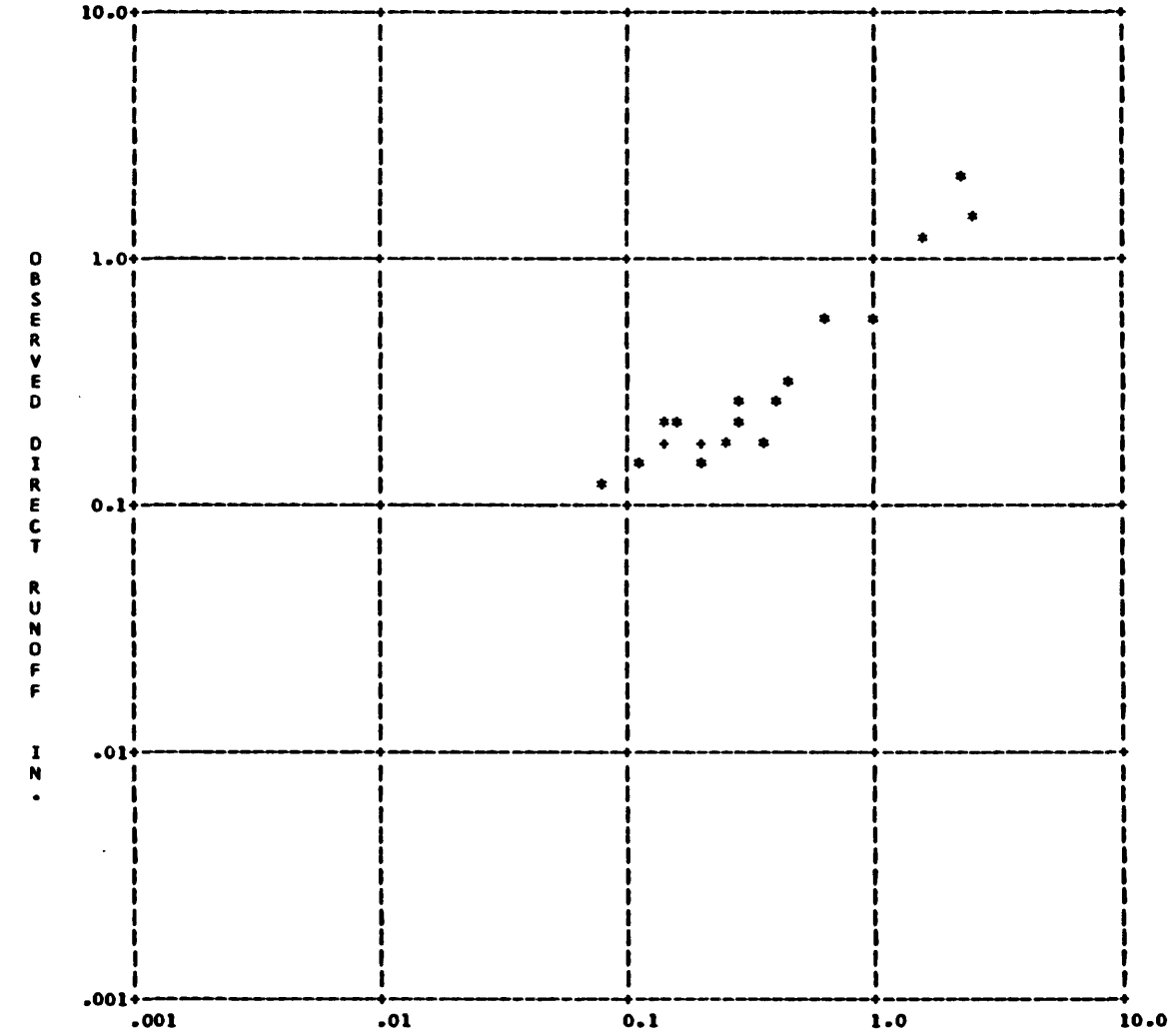
B1= 3.338098
B2= 0.983714
NEW ORTHONORMAL BASIS***
0.17974-0.98371 0.00000 0.00000 0.00000
0.00599 0.00109-0.99998-0.00000-0.00000
0.59914 0.10947 0.00371-0.79311-0.00000
0.77889 0.14232 0.00482 0.60806-0.05760
0.04494 0.00821 0.00028 0.03508 0.99834
START OF STAGE STEP-SIZE INCREMENTS***
0.650930 0.290094 0.009830 0.678107 0.063932

CONTINUATION OF STAGE
PHASE 1 - OPTIMIZATION OF PARAMETERS AFFECTING RUNOFF VOLUME

VOLUME OBJECTIVE FUNCTION= 2.0385961E+00
ROOT MEAN SQ. ERROR LOG BASE 10 = 0.138449 (AVE. PERCENT = 32.4)
PARAMETER VALUES ARE
PSP= 3.600
KSAT= 0.120
DRN= 1.000
RGF= 12.000
BMSM= 6.600
EVC= 0.900
RR= 0.870

	DATE	STORM RAINFALL	DIRECT RUNOFF	SIM DIRECT RUNOFF
*	2/ 7/71	1.91	0.21	0.15
*	5/ 8/71	2.49	0.31	0.41
*	2/ 7/72	1.53	0.26	0.30
	3/30/72	1.96	0.25	0.15
*	3/31/72	1.37	0.21	0.37
*	5/ 8/72	3.13	0.32	0.45
*	8/25/72	3.23	0.61	1.03
	10/27/72	2.87	0.22	0.77
*	11/25/72	2.33	0.27	0.31
*	12/21/72	2.28	0.20	0.14
*	2/ 1/73	3.07	0.67	0.64
*	2/ 9/73	2.41	0.20	0.28
*	3/31/73	3.87	1.72	2.53
*	4/ 3/73	5.16	2.49	2.47
*	5/ 8/73	2.15	0.19	0.20
*	5/26/73	1.67	0.24	0.15
*	5/30/73	1.56	0.17	0.12
*	5/30/73	1.44	0.15	0.22
	8/ 6/73	0.63	0.19	0.02
*	12/ 6/73	1.18	0.13	0.09
*	12/26/73	1.84	0.20	0.21
*	4/ 5/74	1.51	0.22	0.16
*	9/ 6/74	6.22	1.35	1.73

* - EVENTS USED IN CALIBRATION



NUMBER OF POINTS PLOTTED = 20
NUMBER OF MULTIPLE POINTS = 2
NUMBER OF POINTS OFF GRID = 0
NUMBER OF POINTS OMITTED = 3

*** NOTE ***
PLOT ROUTINE EXCLUDES
POINTS NOT INCLUDED
IN CALIBRATION

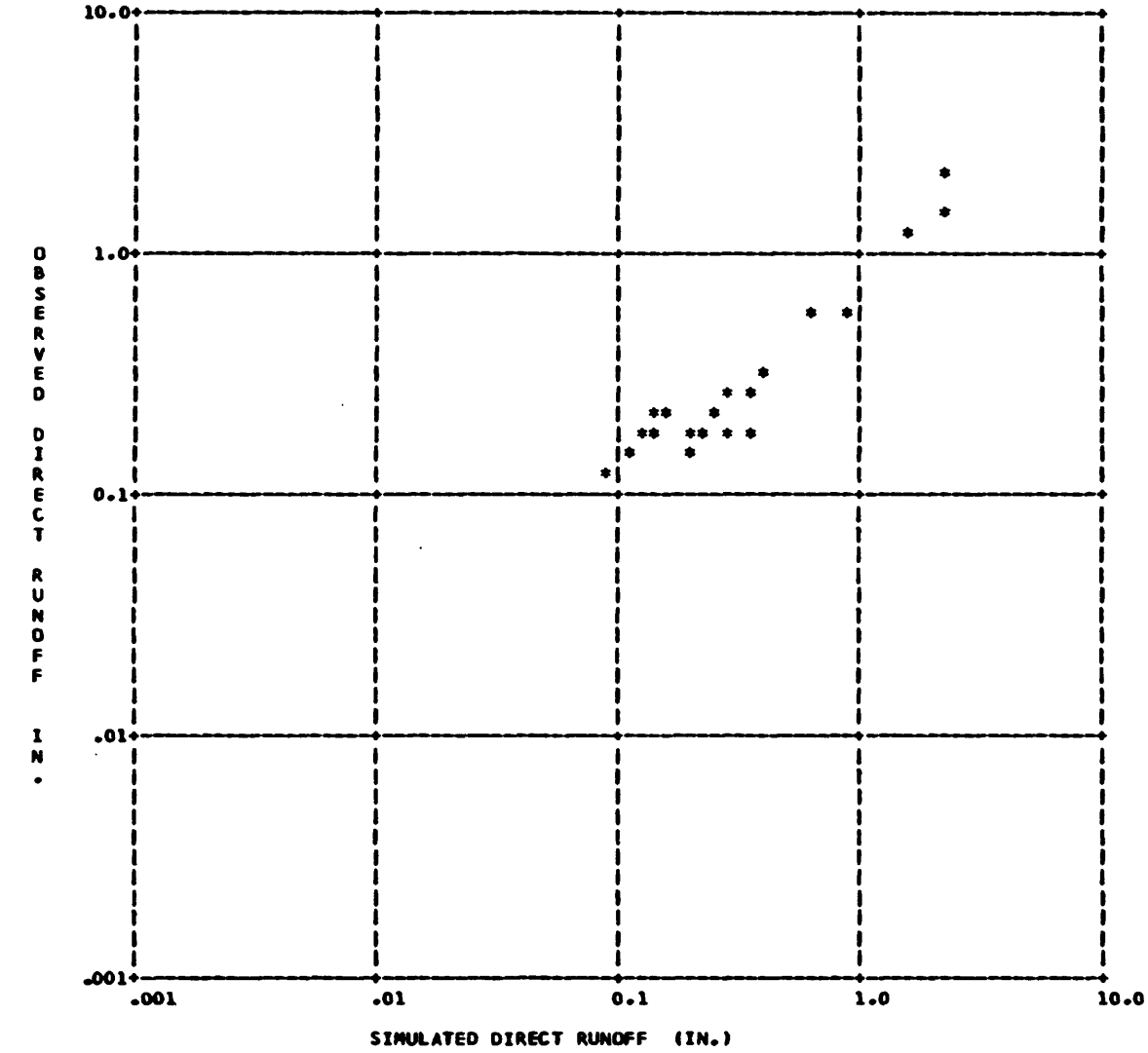
TRCT	OBJ. FUNC.	PSP	KSAT	DRN	RGF	BMSM	EVC	RR	KSW	TC	TP/TC
19	2.03860	3.60000	0.12000	1.00000	12.00000	6.60000	0.90000	0.87000	1.20000	200.00000	0.50000
27	2.01152	3.60000	0.12491	1.00000	11.99998	6.59998	0.90000	0.87000	1.20000	200.00000	0.50000
29	1.97201	3.60000	0.12491	1.00000	11.99998	6.60182	0.86809	0.87000	1.20000	200.00000	0.50000
30	1.86279	3.62925	0.12589	1.00000	12.09748	6.72857	0.87540	0.87000	1.20000	200.00000	0.50000
33	1.84551	3.62925	0.12589	1.00000	11.96303	6.83165	0.88135	0.87000	1.20000	200.00000	0.50000

END OF ROUND--RESULTS OF LAST SUCCESSFUL TRIAL
PHASE 1 - OPTIMIZATION OF PARAMETERS AFFECTING RUNOFF VOLUME

VOLUME OBJECTIVE FUNCTION= 1.8455070E+00
ROOT MEAN SQ. ERROR LOG BASE 10 = 0.131730 (AVE. PERCENT = 30.8)
PARAMETER VALUES ARE
PSP= 3.629
KSAT= 0.126
DRN= 1.000
RGF= 11.963
BMSM= 6.832
EVC= 0.881
RR= 0.870

	DATE	STORM RAINFALL	DIRECT RUNOFF	SIM DIRECT RUNOFF
*	2/ 7/71	1.91	0.21	0.15
*	5/ 8/71	2.49	0.31	0.39
*	2/ 7/72	1.53	0.26	0.27
	3/30/72	1.96	0.25	0.15
*	3/31/72	1.37	0.21	0.37
*	5/ 8/72	3.13	0.32	0.43
*	8/25/72	3.23	0.61	0.98
	10/27/72	2.87	0.22	0.74
*	11/25/72	2.33	0.27	0.29
*	12/21/72	2.28	0.20	0.14
*	2/ 1/73	3.07	0.67	0.63
*	2/ 9/73	2.41	0.20	0.29
*	3/31/73	3.87	1.72	2.50
*	4/ 3/73	5.16	2.49	2.43
*	5/ 8/73	2.15	0.19	0.20
*	5/26/73	1.67	0.24	0.15
*	5/30/73	1.56	0.17	0.12
*	5/30/73	1.44	0.15	0.21
	8/ 6/73	0.63	0.19	0.02
*	12/ 6/73	1.18	0.13	0.10
*	12/26/73	1.84	0.20	0.24
*	4/ 5/74	1.51	0.22	0.16
*	9/ 6/74	6.22	1.35	1.64

* - EVENTS USED IN CALIBRATION



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NUMBER OF MULTIPLE POINTS = 0
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NUMBER OF POINTS OMITTED = 3

*** NOTE ***
PLOT ROUTINE EXCLUDES
POINTS NOT INCLUDED
IN CALIBRATION

BEGINNING OF STAGE - PHASE 2

INITIAL PARAMETER VALUES ARE:

1	3.629250
2	0.125890
3	1.000000
4	11.963028
5	6.831651
6	0.881345
7	0.870000
8	1.200000 *
9	200.000000 *
10	0.500000

* - PARAMETERS TO BE OPTIMIZED

INITIAL STEP-SIZE INCREMENTS***

0.060000 9.999999

THE MAXIMUM NUMBER OF TRYCTS IS 14

AT THE START OF EACH STAGE STEP-SIZE = 5 % OF THE VECTOR SIZE.

BEGINNING OF STAGE

PHASE 2 - OPTIMIZATION OF PARAMETERS AFFECTING HYDROGRAPH SHAPE

PEAK OBJECTIVE FUNCTION= 1.0538654E+00

ROOT MEAN SQ. ERRDR LOG BASE 10 = 0.099545 (AVE. PERCENT = 23.1)

PARAMETER VALUES ARE

KSW= 1.200

TC= 200.000

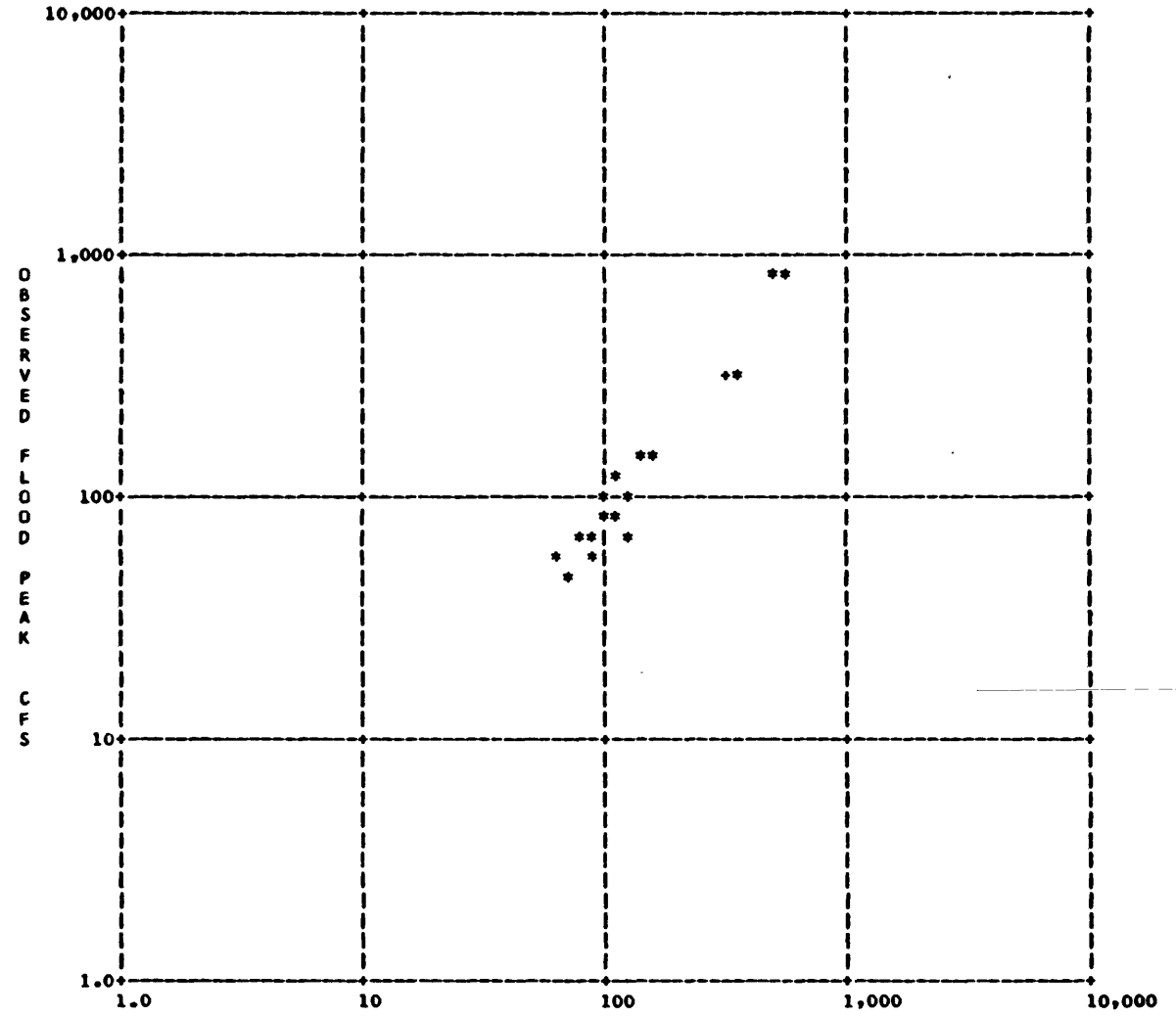
TP= 100.000

TIME AREA HISTOGRAM

0.0112 0.0337 0.0562 0.0787 0.1012 0.1237 0.1437 0.1312 0.1087 0.0862 0.0637 0.0412 0.0200

	DATE	STORM RAINFALL	DIRECT RUNOFF	PEAK DISCHARGE	SIM PEAK W/ VOL. ADJ	SIM PEAK DISCHARGE
*	2/ 7/71	1.91	0.21	93	113	81
*	5/ 8/71	2.49	0.31	153	166	214
*	2/ 7/72	1.53	0.26	81	127	132
	3/30/72	1.96	0.25	183	122	72
*	3/31/72	1.37	0.21	123	120	211
*	5/ 8/72	3.13	0.32	91	103	136
*	8/25/72	3.23	0.61	379	347	559
	10/27/72	2.87	0.22	138	126	429
*	11/25/72	2.33	0.27	160	151	160
*	12/21/72	2.28	0.20	79	90	63
*	2/ 1/73	3.07	0.67	378	352	332
*	2/ 9/73	2.41	0.20	68	69	98
*	3/31/73	3.87	1.72	837	541	785
*	4/ 3/73	5.16	2.49	347	392	381
*	5/ 8/73	2.15	0.19	77	97	100
*	5/26/73	1.67	0.24	117	132	83
*	5/30/73	1.56	0.17	65	92	68
*	5/30/73	1.44	0.15	70	89	120
	8/ 6/73	0.63	0.19	101	109	10
*	12/ 6/73	1.18	0.13	48	72	55
*	12/26/73	1.84	0.20	82	89	106
*	4/ 5/74	1.51	0.22	113	106	79
*	9/ 6/74	6.22	1.35	894	622	757

NUMBER USED IN CALIBRATION



NUMBER OF POINTS PLOTTED = 20
NUMBER OF MULTIPLE POINTS = 2
NUMBER OF POINTS OFF GRID = 0
NUMBER OF POINTS OMITTED = 3

*** NOTE ***
PLOT ROUTINE EXCLUDES
POINTS NOT INCLUDED
IN CALIBRATION

TRCT	OBJ. FUNC.	PSP	KSAT	DRN	RGF	BMSM	EVC	RR	KSW	TC	TP/TC
0	1.05387	3.62925	0.12589	1.00000	11.96303	6.83165	0.88135	0.87000	1.20000	200.00000	0.50000
1	1.00828	3.62925	0.12589	1.00000	11.96303	6.83165	0.88135	0.87000	1.26000	200.00000	0.50000
2	0.96985	3.62925	0.12589	1.00000	11.96303	6.83165	0.88135	0.87000	1.26000	210.00000	0.50000
3	0.95954	3.62925	0.12589	1.00000	11.96303	6.83165	0.88135	0.87000	1.44000	210.00000	0.50000

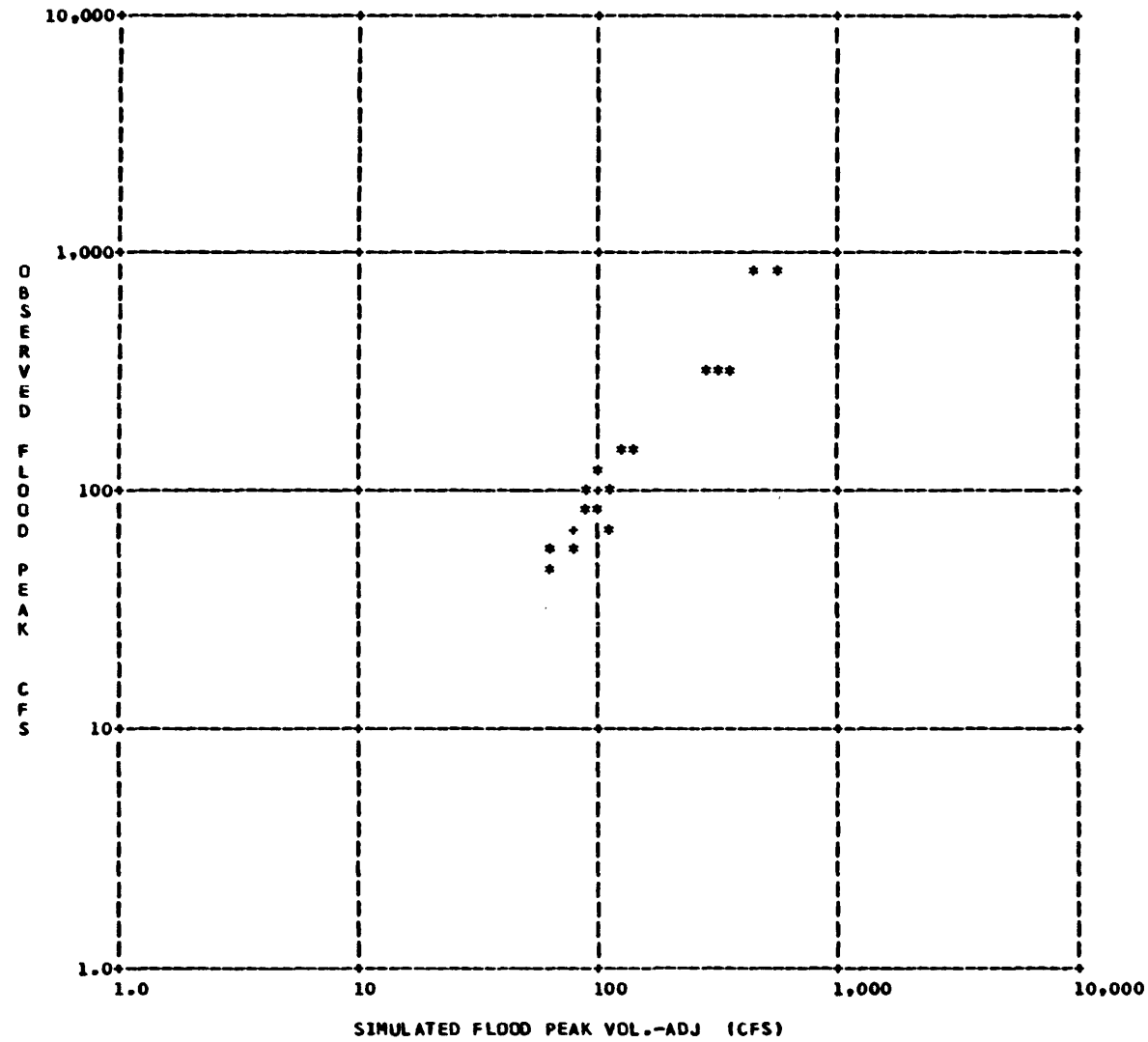
B1=10.002879
B2= 0.999712
NEW ORTHONORMAL BASIS***
0.02399-0.99971
0.99971 0.02399
START OF STAGE STEP-SIZE INCREMENTS***
10.498704 0.323907

CONTINUATION OF STAGE
PHASE 2 - OPTIMIZATION OF PARAMETERS AFFECTING HYDROGRAPH SHAPE
PEAK OBJECTIVE FUNCTION= 9.5954245E-01
ROOT MEAN SQ. ERROR LOG BASE 10 = 0.094986 (AVE. PERCENT = 22.0)
PARAMETER VALUES ARE
KSW= 1.440
TC= 210.000
TP= 105.000

TIME AREA HISTOGRAM
0.0102 0.0306 0.0510 0.0714 0.0918 0.1122 0.1327 0.1327 0.1122 0.0918 0.0714 0.0510
0.0306 0.0102

	DATE	STORM RAINFALL	DIRECT RUNOFF	PEAK DISCHARGE	SIM PEAK W/ VOL. ADJ	SIM PEAK DISCHARGE
*	2/ 7/71	1.91	0.21	93	102	73
*	5/ 8/71	2.49	0.31	153	148	192
*	2/ 7/72	1.53	0.26	81	116	120
	3/30/72	1.96	0.25	183	110	65
*	3/31/72	1.37	0.21	123	108	190
*	5/ 8/72	3.13	0.32	91	92	122
*	8/25/72	3.23	0.61	379	313	505
	10/27/72	2.87	0.22	138	113	384
*	11/25/72	2.33	0.27	160	137	145
*	12/21/72	2.28	0.20	79	82	57
*	2/ 1/73	3.07	0.67	378	320	301
*	2/ 9/73	2.41	0.20	68	64	91
*	3/31/73	3.87	1.72	837	488	708
*	4/ 3/73	5.16	2.49	347	383	373
*	5/ 8/73	2.15	0.19	77	88	91
*	5/26/73	1.67	0.24	117	120	75
*	5/30/73	1.56	0.17	65	84	61
*	5/30/73	1.44	0.15	70	80	108
	8/ 6/73	0.63	0.19	101.0	98.3	9.4
*	12/ 6/73	1.18	0.13	48	64	49
*	12/26/73	1.84	0.20	82	83	99
*	4/ 5/74	1.51	0.22	113	97	72
*	9/ 6/74	6.22	1.35	894	574	700

* - EVENTS USED IN CALIBRATION



NUMBER OF POINTS PLOTTED = 20
NUMBER OF MULTIPLE POINTS = 2
NUMBER OF POINTS OFF GRID = 0
NUMBER OF POINTS OMITTED = 3

*** NOTE ***
PLOT ROUTINE EXCLUDES
POINTS NOT INCLUDED
IN CALIBRATION

TRCT	OBJ. FUNC.	PSP	KSAT	DRN	RGF	BMSM	EVC	RR	KSW	TC	TP/TC
5	0.95954	3.62925	0.12589	1.00000	11.96303	6.83165	0.88135	0.87000	1.44000	210.00000	0.50000
11	0.94789	3.62925	0.12589	1.00000	11.96303	6.83165	0.88135	0.87000	1.35905	210.00194	0.50000

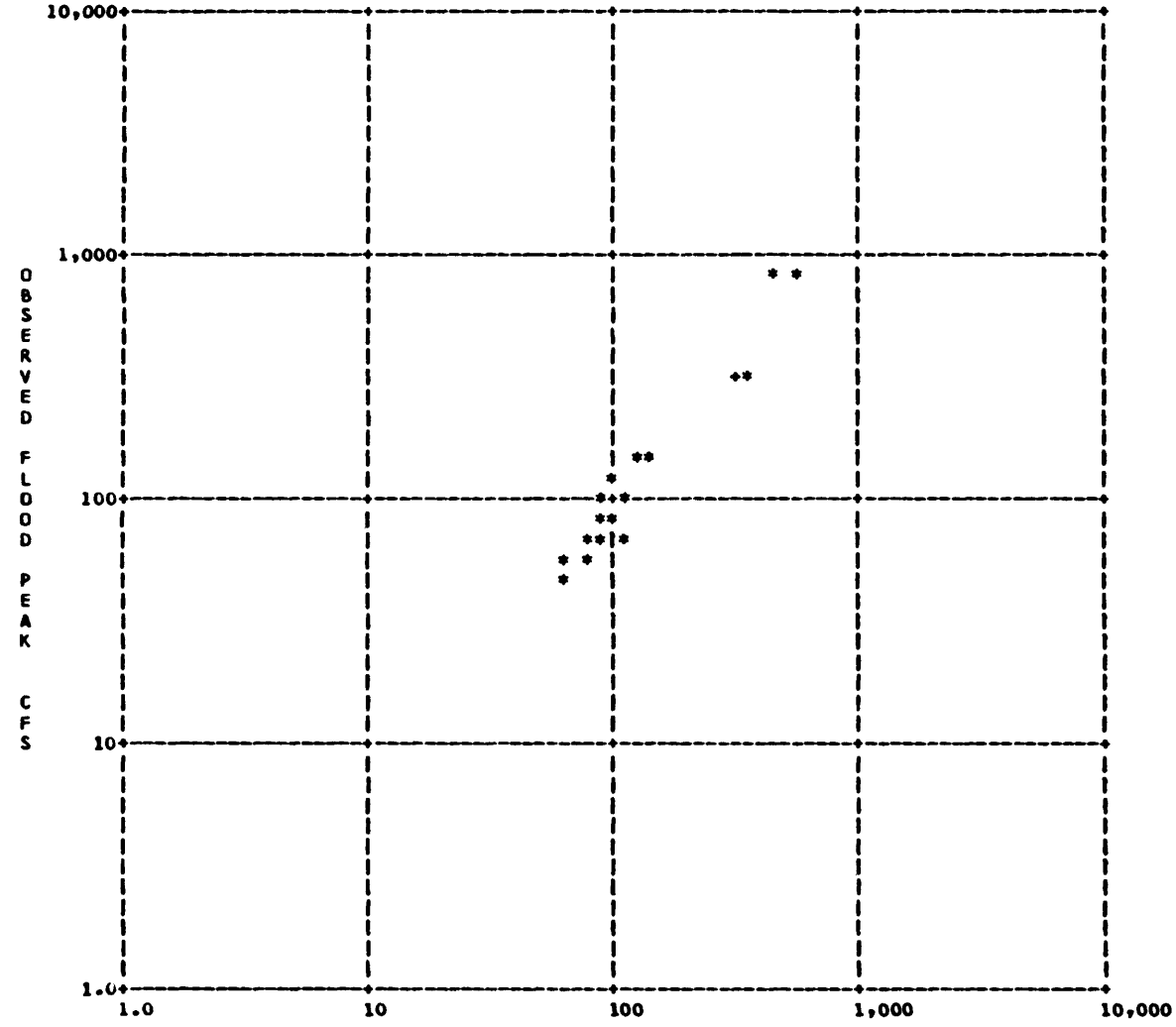
END OF ROUND--RESULTS OF LAST SUCCESSFUL TRIAL
PHASE 2 - OPTIMIZATION OF PARAMETERS AFFECTING HYDROGRAPH SHAPE

PEAK OBJECTIVE FUNCTION= 9.4789312E-01
ROOT MEAN SQ. ERROR LOG BASE 10 = 0.094407 (AVE. PERCENT = 21.9)
PARAMETER VALUES ARE
KSW= 1.359
TC= 210.002
TP= 105.001

TIME AREA HISTOGRAM
0.0102 0.0306 0.0510 0.0714 0.0918 0.1122 0.1327 0.1327 0.1122 0.0918 0.0714 0.0510
0.0306 0.0102

DATE	STORM RAINFALL	DIRECT RUNOFF	PEAK DISCHARGE	SIM PEAK W/ VOL. ADJ	SIM PEAK DISCHARGE
* 2/ 7/71	1.91	0.21	93	105	75
* 5/ 8/71	2.49	0.31	153	153	197
* 2/ 7/72	1.53	0.26	81	119	123
3/30/72	1.96	0.25	183	113	67
* 3/31/72	1.37	0.21	123	111	196
* 5/ 8/72	3.13	0.32	91	95	126
* 8/25/72	3.23	0.61	379	322	518
10/27/72	2.87	0.22	138	116	395
*11/25/72	2.33	0.27	160	140	148
*12/21/72	2.28	0.20	79	84	59
* 2/ 1/73	3.07	0.67	378	328	309
* 2/ 9/73	2.41	0.20	68	65	93
* 3/31/73	3.87	1.72	837	499	725
* 4/ 3/73	5.16	2.49	347	385	375
* 5/ 8/73	2.15	0.19	77	90	93
* 5/26/73	1.67	0.24	117	123	77
* 5/30/73	1.56	0.17	65	86	63
* 5/30/73	1.44	0.15	70	83	111
8/ 6/73	0.63	0.19	101.0	101.0	9.7
*12/ 6/73	1.18	0.13	48	66	51
*12/26/73	1.84	0.20	82	84	101
* 4/ 5/74	1.51	0.22	113	99	74
* 9/ 6/74	6.22	1.35	894	587	715

* - EVENTS USED IN CALIBRATION



NUMBER OF POINTS PLOTTED = 20
NUMBER OF MULTIPLE POINTS = 2
NUMBER OF POINTS OFF GRID = 0
NUMBER OF POINTS OMITTED = 3

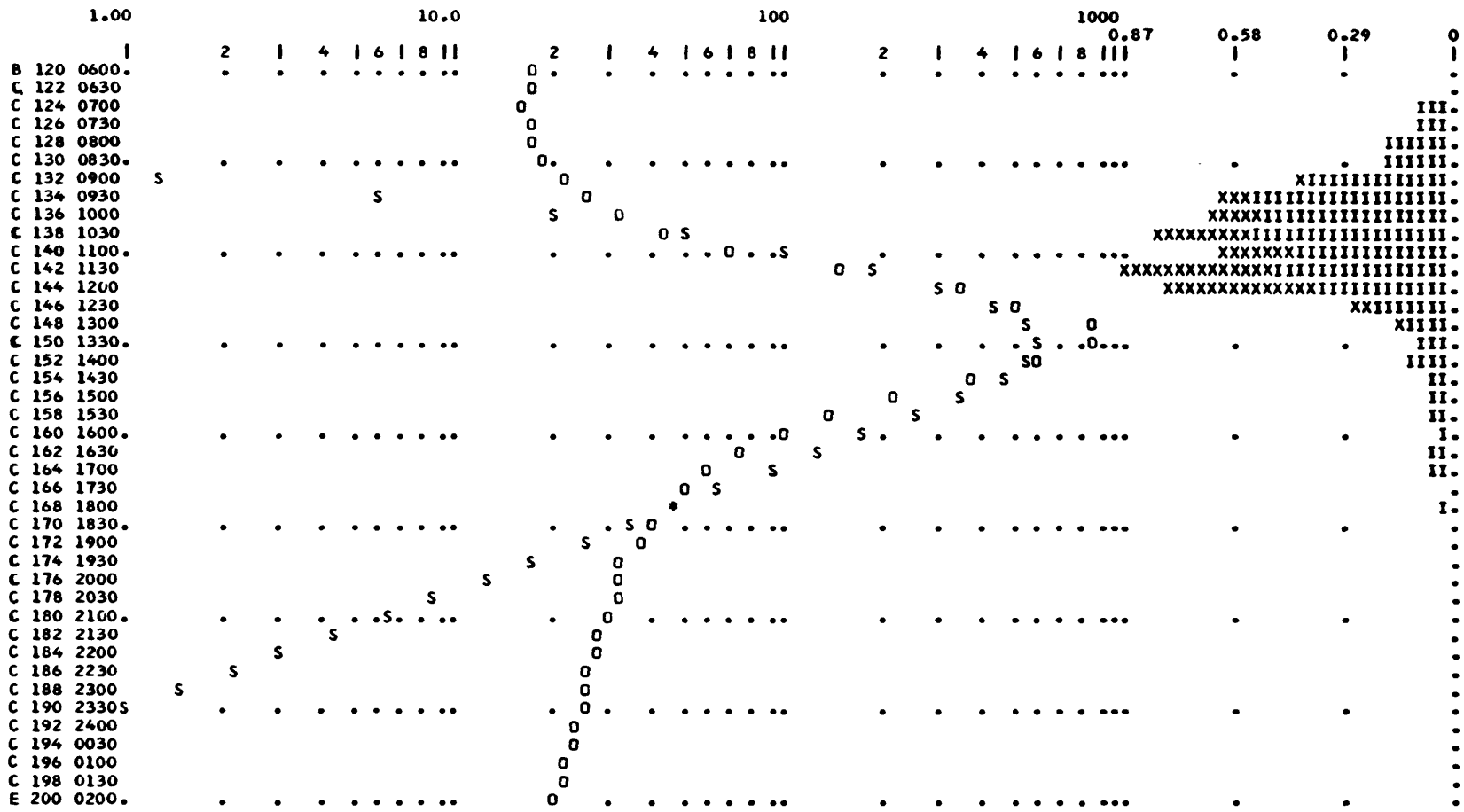
*** NOTE ***
PLOT ROUTINE EXCLUDES
POINTS NOT INCLUDED
IN CALIBRATION

PLOT OF OBSERVED AND COMPUTED DISCHARGE AND RAINFALL SHOWING COMPUTED
INFILTRATION AND EXCESS HAS BEEN REQUESTED (SIMOPT(3)=1 ON CARD 8 FOR PHASE 2 OR 3).
NOTE:
(1) COLUMN 1,
(A) IF=B BEGINNING OF HYDROGRAPH AS DEFINED BY SEPARATION POINT.
(B) IF=C CONTINUATION OF HYDROGRAPH.
(C) IF=E ENDING OF HYDROGRAPH AS DEFINED BY SEPARATION POINT.
(2) COLUMN 2-5,
NUMERICAL VALUE OF HYDROGRAPH ELEMENT -- NEW SEPARATION POINTS
MAY BE DEFINED DIRECTLY FROM PLOT.
(3) COLUMN 7-10,
TIME RELATIVE TO 24 HOUR CLOCK.

STATION NUMBER 02326598 CANEY CK NR MONTICELLO, FLORIDA 9/ 6/74 - 9/ 7/74

COMPUTED (S), OBSERVED (O), BOTH (*), DISCHARGE IN CFS
NOTE — COMPUTED HYDROGRAPH SCALED TO EQUAL VOLUME OF OBSERVED DIRECT RUNOFF

INFIL. (I) AND EXCESS (X) IN INCHES



CALIBRATION OF URBAN BASIN MODEL

Program G824

Cataloged Procedure RRURBAN1

Description

Optimum magnitudes for one to nine model parameters of the Urban Basin Rainfall/Runoff Model 1 are automatically determined in program G824 using as input, measured rainfall, discharge, and evaporation data collected during the calibration period. The program accepts precipitation data from one to five rainfall gages. A comparison of observed and computed peaks is statistically tested to determine if the correlation coefficient between the two is significant, whether the scope of the relationship between discharges is one to one, and if the means of the discharges are equal. These tests indicate whether the relationship between the observed and computed discharges is statistically significant, and whether the results of calibration are unbiased.

Presently, the program requires substantial computer time to run, the time being four to six times more than that for the natural basin (rural) model described in the previous section. It is recommended that the urban model be run class=F and that the natural basin model be used if an initial run is needed to screen data.

The program requires user definition of the longitudinal (spatial) distribution of pervious and of impervious areas in the basin by specifying translation hydrographs (time-area histograms).

The program does Thiessen weighting of total storm rainfalls if there are two or more sub-basins. The model also uses 0.05 inches of rainfall retention storage in the impervious areas. The program optimizes user selected parameter values, which are mean values applied to the entire basin, in the same way as values are determined in the calibration of the natural basin rainfall/runoff model (section 13).

The discharge hydrograph at the basin outlet is determined by use of two routing components - translation of the rainfall excess to the basin outlet and attenuation of the translated flow in a linear reservoir. If the distance of an area from the outlet is considered directly proportional to time of travel, then the translation can be made through use of a distance-area histogram, the the translation hydrograph, i.e., the distribution of area with time from the outlet. Thus, the volume of rainfall excess on a sub-area is delivered at the basin outlet logged by some time interval. If preliminary results of calibration indicate an improper response, the user may make some adjustments in the histograms. The effects of resistance to flow and temporary storage (channel storage) in delaying movement of rainfall excess down through the basin are simulated by the linear reservoir component.

The procedures for routing of rainfall excess in this urban model can account for more than one rain gage in the basin and of having heterogeneous

distribution of impervious areas. The program allows for the basin to be divided into subbasins in two ways. If there are m rain gages in or related to the basin, m subbasins are defined using Thiessen polygons. Next, if there are n types of noncontiguous impervious areas, n subareas are defined for the areas in which the imperviousness is homogeneously distributed. Taking into consideration the number of rain gages, n, and of impervious areas, m, the basin will contain mn subareas, A_i, i=1, ...,mn.

Each increment of the drainage area, A_i, is characterized by two routing parameters, the lag time T_i and a linear reservoir coefficient K_i. The lag time and the reservoir coefficient are assumed to be proportional to the distance D_i of the subarea A_i from the basin outlet. Hence,

$$T_i \propto D_i$$

$$K_i \propto D_i$$

Thus, the routing model can be thought of as an assemblage of incremental unit hydrographs, each relating to a subarea and each having characteristics (lag time, storage coefficient) dependent on its location relative to the outlet.

The combination of distributed input (rainfall) and distributed routing makes possible the simulation of the effects of rainfall variability and of variable urban development on flood hydrographs.

Definition of Time-Area Histogram

The routing procedure requires the definition of time-area histograms for both pervious and impervious areas. One histogram is required for each rain gage. Those subbasins which include both pervious and impervious areas must be represented by two histograms.

The time-area relations are input to the program as a sequence of 20 values of cumulative area (planimetric units) defined at 20 isochronal points.

The procedure to define the time-area relations is as follows:

1. Locate the rain gages on a map of the basin and define subbasins by the Thiessen polygon method. Identify each subbasin by a Roman numeral (I,II,...), starting from the subbasin nearest the outlet.

2. Delineate homogeneous areas of different land use and estimate imperviousness of each area, in percent, from aerial photographs, city zoning maps, and field inspection. Use capital Arabic letters (A,B,...), to identify each area of land use.

3. Measure the distance L from the outlet to the farthest point in the basin. With the outlet as the center point, draw concentric arcs across the basin at increments of 0.05 L. If the drainage network is highly irregular then adjustments should be made in drawing these arcs to more accurately reflect the distribution of subareas. Use numbers (1,2,...), to identify the concentric time bands of area starting with the band nearest the outlet.

4. The drainage area is subdivided in three ways: rain-gage subbasins, types of land use (imperviousness) areas, and distance (time) zones from outlet. Each subarea is identified by a symbol such as IIB12, meaning a subarea affected by rainfall at gage II, having an average imperviousness of type B, and lying in time zone 12.

5. The size of each subarea, such as IIB12, is planimetered. The size need not be measured in square miles but may be determined in some convenient planimetric unit inasmuch as only the relative proportion of area need be known.

6. A table is prepared detailing the distribution of areas pertaining to each rain gage, proportion of imperviousness, and travel time to basin outlet. (See table 14-1.)

Example.--The following figure and table illustrates an application of the above procedure to determine the appropriate time-area relations needed in model calibration. In this example, an urban basin of 4.25 square miles is depicted as being about 75 percent developed (fig. 14-1). Rainfall is measured at two subbasins, I and II. The developed portion of the basin consists of mixed residential and commercial properties as indicated by land use or city zoning classifications. The percentage of impervious cover for each classification was estimated by field investigation and inspection of areal photographs. The undeveloped portion of the basin is considered rural with zero percent impervious cover. Four land use categories are in subbasin I and seven are in subbasin II.

Land Use Category	Proportion of impervious area, in percent
A	0
B	25
C	20
D	95
E	15
F	30
G	35

The basin is always divided into 20 time zones, which are considered adequate to define distribution of areas in the basin. The distances between boundaries of these zones represent equal travel times (isochrones). All subareas within the basin should be identified with a symbol (subarea IIB12 in fig. 14-1) and planimetered. Sample computations are shown in table 14-1.

An alternate to planimetering the area is to use a grid-method sampling procedure.

Experience has shown that, often hydrologically, the effective impervious area is less than the measured impervious area.

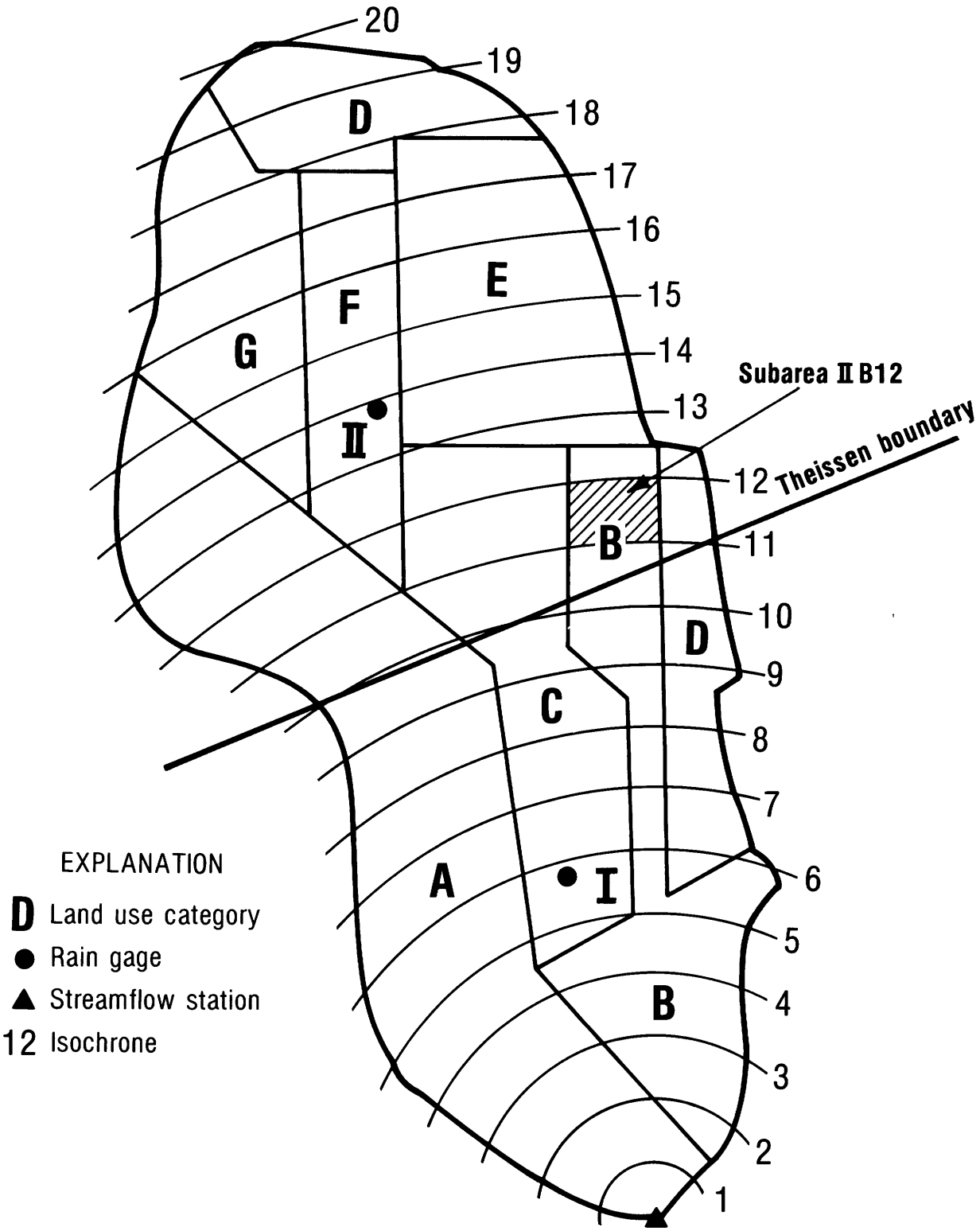


Figure 14-1. Sketch showing division of drainage area into subareas according to location of raingages, time of travel, and degrees of imperviousness.

Table 14-1.--Time-area relation for subbasins I and II.

Subbasin I

Time of Travel Band	Land use category A(0 %) 1/ Total Area	A(0 %) 1/ Per. Area	A(0 %) 1/ Imp. Area	B(25%) Total Area	B(25%) Per. Area	B(25%) Imp. Area	C(20%) Total Area	C(20%) Per. Area	C(20%) Imp. Area	D(95%) Total Area	D(95%) Per. Area	D(95%) Imp. Area	Time-area relations Cumulative area Pervious a)	Time-area relations Cumulative area Impervious b)
1	15	15	0	0	0	0	0	0	0	0	0	0	15	0
2	42	42	0	12	9	3							66	3
3	40	40	0	25	18.8	6.2							124.8	9.2
4	45	45	0	40	3.0	10.0	0	0	0				199.8	19.2
5	40	40	0	36	27	9	12	9.6	2.4	0	0	0	276.4	30.6
6	46	46	0	16	12	4	20	16	4	10	.5	9.5	350.9	48.1
7	42	42	0	8	6	2	20	16	4	16	.8	15.2	415.7	69.3
8	35	35	0	8	6	2	20	16	4	14	.7	13.3	473.7	88.6
9	31	31	0	12	9	3	20	16	4	15	.8	14.2	530.5	109.8
10	28	28	0	20	15	5	18	14.4	3.6	15	.8	14.2	588.7	132.7
11	0	0	0	8	6	2	1	.8	.2	10	.5	9.5	607.7	144.4
12	0	0	0	0	0	0	0	0	0	0	0	0	607.7	144.4
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0

a) This data goes on first pair of 'T' cards. Total area, subbasin I = 607.7 + 144.4 = 752.1 planimetric units
b) This data goes on second pair of 'T' cards.

NOTE: Not used in example.

1/ Number in parentheses indicates proportion of impervious area for specific land use category

Table 14-1 (cont.).--Time-area relation for subbasins I and II

Subbasin II

Time of Travel Band	Land Use Category											
	A(0%)			B(25%)			C(20%)			D(95%)		
	Total Area	Per. Area	Imp. Area	Total Area	Per. Area	Imp. Area	Total Area	Per. Area	Imp. Area	Total Area	Per. Area	Imp. Area
1	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0
10	4	4	0	0	0	0	1	.8	.2	0	0	0
11	35	35	0	14	10.5	3.5	30	24	6	0	0	0
12	42	42	0	21	15.8	5.2	35	28	7	0	0	0
13	50	50	0	10	7.5	2.5	30	24	.6	0	0	0
14	45	45	0	0	0	0	1	.8	.2	0	0	0
15	30	30	0	0	0	0	0	0	0	0	0	0
16	17	17	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	10	.5	9.5
19	0	0	0	0	0	0	0	0	0	55	2.8	52.2
20	0	0	0	0	0	0	0	0	0	25	1.2	23.8

Table 14-1 (cont.).--Time-area relation

Subbasin II--continued

Time of Travel Band	Land Use Category									Time-area relation	
	E(15%)			F(30%)			G(35%)			Cumulative Area	
	Total Area	Per. Area	Imp. Area	Total Area	Per. Area	Imp. Area	Total Area	Per. Area	Imp. Area	Pervious[a]	Impervious[b]
1	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	4.8	.2
11	0	0	0	1	.7	.3	0	0	0	75.0	4.6
12	0	0	0	7	4.9	2.1	0	0	0	165.7	18.9
13	12	10.2	1.8	28	19.6	8.4	2	1.3	.7	268.3	38.2
14	51	43.4	7.6	33	23.1	9.9	14	9.1	4.9	389.7	60.8
15	46	39.1	6.9	32	22.4	9.6	29	19.4	9.6	505.6	86.9
16	40	34.0	6.0	33	23.1	9.9	40	26.0	14.0	595.7	116.8
17	35	29.8	5.2	33	23.0	9.9	42	27.3	14.7	675.9	146.6
18	25	21.2	3.8	29	20.3	8.7	41	26.7	14.4	744.6	183.0
19	0	0	0	0	0	0	28	17.2	9.8	764.6	245.0
20	0	0	0	0	0	0	12	7.8	4.2	773.6	273.0

a) This data goes on third pair of 'T' cards. Total area, subbasin II = 773.6 + 273.0 = 1046.6 planimetric units.

b) This data goes on fourth pair of 'T'cards. Total basin area = 752.1 + 1046.6 = 1798.7 planimetric units.

NOTE: Not used in example.

Options and Output

1. One to nine parameters may be selected for optimization. Their initial magnitudes and acceptable upper and lower bounds may be designated.

2. The optimization may be done in phases, wherein the parameters relating to volume of runoff and to hydrograph shape are determined in distinct phases.

3. The number of trial steps in searching for an optimum may be selected for each phase.

4. Individual storms which are in the data set may be included or excluded from the optimization process.

5. In multi-peak events, up to three episodes may be included or excluded from the optimization process.

6. The base flow may be subtracted from the total runoff in a flood event by designating a discharge rate.

7. A line printer plot of the observed and computed discharge hydrographs and of the weighted total and excess rainfall hyetographs may be obtained if optionally selected. The base flow may also be subtracted from the observed discharge, if optionally selected.

8. In the line printer hydrograph plots, the user can optionally specify that the plot be done at the discharge recording interval.

9. Unit rainfall can be weighted based on data from nearby gages and adjusted by a constant multiplier, however, it is recommended this not be done unless necessary.

The printed output from the program provides the following information; summary of data retrieval and of input cards, station identifications, pervious and impervious drainage areas, list of storms including dates, observed peak discharge, observed runoff, total rainfall, base flow, and initial parameter magnitudes and those to be optimized; after completion of each phase of optimization, the final parameter magnitudes are given, the error in fitting the runoff volumes or peak discharges is listed, the results of each calibration phase is summarized by listing for each storm the total rainfall and the observed and synthesized excess rainfall, and the observed peak discharges are compared to synthetic peak discharges in a line printer plot; finally, a statistical summary is obtained and hydrographs and hyetographs may optionally be plotted on the line printer.

Precautions

1. The input data (unit and daily data for each subbasin) are established on a temporary disk file via the DD (data definition) card //J149.SYSIN DD * in the cataloged procedure, and the retrieved data must conform to a specific record order.

2. Card input of data is not acceptable with the cataloged procedure.

3. For model calibration, the following previously executed jobs are essential: (a) Site data must have been entered in the WRD Station Header File; (b) data are entered in the Unit and Daily Values Files using programs G490 and H572 mentioned in section 3; (c) the data should have been edited using programs A604--RREDIT75 and G159--RRDATASM.

4. It is re-emphasized that the time-area input data (T-cards) require 20 points for definition.

5. Program G824 requires that the discharge recording interval be equal to or greater than the precipitation and routing intervals, and that the ratio of discharge interval to either precipitation or routing interval be an integer multiple (no fractions).

Cataloged Procedure

Two sets of input cards are required to execute this cataloged procedure; one set is used to retrieve the data from the Current Unit and Daily Values Files using program J149, and the other set contains information needed to operate the model, program G824. Only one basin (discharge site) should be run per execution of the cataloged procedure.

```
/*RELAY  PUNCH RE2

//xxxxxxxx JOB  (-------)

//  EXEC RRURBAN1,R=xxxK

//J149.SYSIN DD *

     - Type 'U' card(s) for unit discharge record (always first for data)
     - Type 'U' card(s) for first unit rainfall record    } (first set of cards
     - Type 'D' card(s) for first daily rainfall record   }  for rain gage closest
     - Type 'D' card(s) for daily evaporation record      }  to gaging station)

               .
               .
               .

     - Type 'U' card(s) for last unit rainfall record     } (last set of cards
     - Type 'D' card(s) for last daily rainfall record    }  having proceeded in
     - Type 'D' card(s) for daily evaporation record      }  the upstream direction

               .
               .
               .

//G824.SYSIN DD *
```

```
      - Type '1' card
      - Type '2' card
      - Type '3' card    } first rain gage (gage closet to gaging station)
      - Type '4' card

              .
              .
              .

      - Type '2' card
      - Type '3' card    } last rain gage (having proceeded in the upstream
      - Type '4' card    } direction)
      - Type '5' card
      - Type '6' card
      - Type '7' card
      - Type '8' card
      - Type 'A' and 'B' cards
      - Types 'T' cards (in same order as rain gages)
      - Type 'W' cards (optional)

//

$$$
```

Specifications.--The default time of 5 minutes for execution of program J149 should be sufficient for most jobs. The time can be increased (or decreased) by adding TIME.J149=time to the EXEC card. The default time for program G824 is 15 minutes; this time can be increased (or decreased) by adding T=time to the EXEC card.

Specification of program G824 region (R parameter) on the EXEC card is mandatory because the region size is highly variable depending upon the amount of data and on whether hydrograph plots are obtained or not. The region is determined as follows:

Region (352 + X + Y) in K bytes

where, (a) without hydrograph plot;

X = 1.2 times number of unit discharge days-rounded upward.

(b) with a hydrograph plot;

X = 4.8 times number of unit discharge days-rounded upward.

(e) Y = 2.4 times number of years of daily rainfall plus number of years of daily evaporation-rounded upward.

The region must be between 356K and 756K. If region is less than 356K, use 356K. The program will run if the region is greater than 756K, however, the user incurs additional computer charges.

The program is limited to 110 unit discharge days if unit discharge is at 5-minute intervals.

Input Cards - Program J149

An optional input card may be necessary to retrieve from the Current Unit and Daily Values Files. If station data are stored in the WRD Station Header File with an agency code other than "USGS" and/or the data is password protected in the header file, then a Password-Agency Identification Card (Z card - Volume 1, Chapter IV, Section B, page B-22, WATSTORE User's Guide, Hutchison, 1975) may be required. If a Z card is required or used, it must precede the first 'D' or 'U' card (see below) in program J149, and is always the first card in input card stream. The format of the Z card is given in section 8.

Other cards identify the unit and daily rainfall, daily evaporation, and unit discharge records to be used in calibration. Two types of cards, 'U' and 'D' are required. The 'U' and 'D' cards respectively identify the unit and daily values records to be retrieved by specifying station identifiers, parameter code, statistics code and period of record. The formats of these cards are the same as those for program H268 (section 8), except for columns 55-72 which are blank.

One or more 'U' cards specify the periods of record for one unit values station (rainfall or discharge) to be retrieved from the unit values file. All 'U' cards pertaining to a rain gage or to a discharge station are grouped together chronologically. Similarly, one or more 'D' cards specify periods of record to be retrieved for one daily values station (rainfall or evaporation) from the Daily Values File for a rain gage or an evaporation station. The cards pertaining to each kind of record are grouped together chronologically.

The 'U' cards(s) for unit discharge record is placed first. Then, in the input card deck a set of 'U' and 'D' cards for each rainfall station and 'D' card(s) for the daily evaporation station for each rain gage subbasin are placed in the deck. The order of each set of subbasin cards preceeds in an upstream direction.

The order of the sets of 'U' cards and of 'D' cards pertaining to the unit rainfall stations and daily rainfall stations is important. The order of these sets of 'U' cards and 'D' cards must agree with each other and with the order in which the time-area histogram has been defined in regard to assigning subbasins to the rain gages. The 'D' card(s) for daily evaporation is repeated for each rain gage.

Note that the number and the order of unit and daily rainfall records must agree. In some instances these records may not have been obtained at the same gages, hence, the station identifiers for unit and daily rain gages need not agree.

Card Format for Program J149

Card type 'U' or 'D' - Unit and daily data

Column	Description
1	Card type - 'U' or 'D'; U = retrieve from Unit Values Current File. D = retrieve from Daily Values Current File.
2-16	15-digit station identifier (if 8-digit, right justify).
17-28	Blank.
29-33	Parameter code - '00045' rainfall, '00050' evaporation, '00060' discharge.
34-38	Statistic code - '00006' rainfall and evaporation '00011' discharge.
39-42	Beginning calendar year.
43-44	Beginning month.
45-46	Beginning day.
47-50	Ending calendar year.
51-52	Ending month.
53-54	Ending day.
55-72	Blank.
73-80	8-digit user specified identifier (if blank, then rightmost 8 cols. of cols. 2-16 are used).

Card Formats for Program G824

A. Card type '1' (Required).

Column	Description
1	Card type - '1'.
2-16	15-digit station identifier for unit discharge.
17-65	Unit discharge station name.
66-68	Unit time interval of recorded or retrieved discharge, right justify.
69-74	Drainage area in square miles (right justified; punch decimal point if needed).
75-77	Number of unit discharge days on file (or retrieved).
78-79	Blank.
80	Number of subbasins (rain gages); maximum of 5.

B. Card type '2' (Required).

Column	Description
1	Card type - '2'.
2-16	15-digit station identifier for unit rainfall.
17-65	Unit rainfall station name.
66-68	Unit time interval of recorded or retrieved unit rainfall.[1]/
69-74	Pervious area of subbasin in planimetric units (right justified; punch decimal point if needed).
75-80	Impervious area of subbasin in planimetric units (right justified; punch decimal point if needed).

[1]/ Must be same or smaller than unit discharge time interval and an integer ratio of the two, i.e.,

$$\frac{\text{unit discharge time interval}}{\text{unit rainfall time interval}} = 1,2,3,....$$

C. Card type '3' (Required).

Column	Description
1	Card type - '3'.
2-16	15-digit station identifier for daily rainfall.
17-65	Daily rainfall station name.
66-67	Beginning calendar year of daily data retrieved.
68-69	Beginning month of daily data retrieved.
70-71	Beginning day of daily data retrieved.
72-73	Ending calendar year of daily data retrieved.
74-75	Ending month of daily data retrieved.
76-77	Ending day of daily data retrieved.
78-80	Blank.

D. Card type '4' (Required).

Column	Description
1	Card type - '4'.
2-16	15-digit station identifier for daily evaporation.
17-65	Daily evaporation station name.
66-80	Blank.

NOTE.--Types 2 through 4 cards are repeated for each subbasin of interest (dates of data must agree for all subbasins), proceeding in the upstream direction.

E. Card type '5' (Required).

In some basins, the unit and/or daily rainfall must be adjusted so that data recorded at different sites are consistent. Columns 56 through 80, possibly in connection with type 'W' cards, indicate adjustment to be made.

Column	Description
1	Card type - '5'.
2-9	8-digit user specified station identifier.
10-11	Blank.
12-13	Number of time-area histograms to be used (maximum of 10).
14-16	Routing unit time interval to be used 1/.
17-22	Total basin drainage area in planimetric units 2/.
23-24	Number of parameters to be optimized (max. 9); usually 9 will be optimized.
25-55	Blank.
56-80	Options to adjust rainfall records and multiplicative adjustments to rainfall records may be defined in the following five 5-column fields. In the first column of the field, the option is declared; if the option (option=2) indicates a multiplicative adjustment, then the constant multiplier is entered in the remaining four columns of the field (right justified; decimal point punched, if needed). If blank, no multiplier will be applied.

The option is as follows:

option =
- 0 or blank, no adjustment,
- 1, adjustment based on weighted to recorded rainfall for each storm at each rain gage given on type 'W' cards,
- 2, a constant multiplier applied to all unit rainfall records for a gain gage 3/.

First unit rainfall gage

56	Option.
57-60	Multiplier if option in col. 56=2 3/.

Second unit rainfall gage

61	Option.
62-65	Multiplier if option in col. 61=2 3/.

Third unit rainfall gage

Card type 5.--continued

Column	Description
66	Option.
67-70	Multiplier if option in col. 66=2 3/.
	Fourth unit rainfall gage
71	Option.
72-75	Multiplier if option in col. 71-2 3/.
	Fifth unit rainfall gage
76	Option.
77-80	Multiplier if option in col. 76=2 3/.

1/ Must be the same or smaller than unit discharge time interval and an integer ratio of the two.

2/ Must agree with sum of cumulative planimetric units on all type-2 cards.

3/ Daily rainfall is also adjusted if station identifiers for unit rainfall and daily rainfall are the same.

F. Card type '6' (Required).

Column	Description	
1	Card type - '6'.	
2-9	8-digit user specified staion identifier.	
10-13	Initial magnitude	for PSP parameter.
14-17	Lower bound	
18-21	Upper bound	
22-25	Initial magnitude	for KSAT parameter.
26-29	Lower bound	
30-33	Upper bound	
34-37	Initial magnitude	for DRN parameter.
38-41	Lower bound	
42-45	Upper bound	

Card type 6.--continued

Column	Description	
46-49	Initial magnitude	for RGF parameter.
50-53	Lower bound	
54-57	Upper bound	
58-61	Initial magnitude	for BMSM parameter.
62-65	Lower bound	
66-69	Upper bound	
70-80	Blank.	

G. Card type '7' (Required).

Column	Description	
1	Card type - '7'	
2-9	8-digit user specified station identifier.	
10-13	Initial magnitude	for EVC parameter.
14-17	Lower bound	
18-21	Upper bound	
22-25	Initial magnitude	for RR parameter.
26-29	Lower bound	
30-33	Upper bound	
34-37	Initial magnitude	for KSW parameter.
38-41	Lower bound	
42-45	Upper bound	
46-49	Initial magnitude	for TC parameter.
50-53	Lower bound	
54-57	Upper bound	
58-80	Blank.	

Note.--Initial magnitude and lower and upper bounds on cards 6 and 7 should be right justified or decimal point should be punched.

Special note concerning cards 6 and 7.--Cards 6 and 7 are mandatory; however, if an initial parameter magnitude and/or its lower and/or upper bounds are left blank on either card, a warning message is printed out and the following default values apply.

PARAMETER	Initial magnitude	Lower bound	Upper bound
PSP	3.0	0.10	10.0
KSAT	0.1	0.01	1.0
DRN	1.0	0.99	1.01
RGF	10.0	1.0	40.0
BMSM	4.0	1.0	20.0
EVC	0.75	0.74	0.76
RR	0.90	0.89	0.91
KSW	Square root of drainage area	0.001	100.0
TC	60 times KSW	1.0	144 times unit discharge time interval

It is recommended not to rely on defaults, but to provide parameter values. Also on card 7, cols. 46-49, the initial value of TC should be less than 100 times the routing time given on card 5, cols. 14-16.

H. Card type '8' (Required).

Columns	Description
1	Card type - '8'.
2-9	8-digit user specified station identifier.
10-35	Phase 1 parameters (model optimization of volume). Always first step in three-step calibration (objective function = '1').
A) 10-11	Total number of parameters to be used - generally 7 (right justified).
B) 12-13	Number of optimizations per parameter (3-7 recommended for trial runs); right justified.
C) 14-15	Objection function - should always be '1' (volume optimization); right justified.

Card type 8.--continued

Columns	Description
D) 16-18	Step size parameter multiplier (recommended .05).
E) 19-32	Number of each parameter to be included in two-column pairs 19-20, 21-22,...,right justified; generally parameters 1 through 7. If one or more parameters are omitted, make entries in leftmost 2-column fields.
F) 33-35	Punch '100' to indicate volume computation only.
36-53	Phase 2 parameters (model optimization of routing). Second step in calibration (objective function = '4').
A) 36-37	Total number of parameters to be used; generally 2 (parameters 8, 9); right justified.
B) 38-39	Number of optimizations per parameter (3 to 7 recommended); right justified.
C) 40-41	Objective function - '4' (routing optimization); right justified.
D) 42-44	Step-size parameter multiplier (0.05 recommended).
E) 45-48	Number of each parameter (generally 8 and 9) to be included in 2-column pairs 45-46, 47-48 right justified; one or more parameters may b omitted.
F) 49-50	Blank.
G) 51-53	Code '010' to indicate routing computation.
54-77	Blank (Phase 3 done automatically).
78	Code a '1' to obtain hydrograph-hyetograph line printer plots. The plots are obtained only if requested and appear after the phase 3 operation (end of calibration).
79	Code a '1' to have base flow subtracted from observed discharges in hydrograph plots (col. 78 must be a '1') at end of phase 3.

Card type 8.--continued

Columns	Description
80	Code a '1' to have hydrograph plots at the same time interval as the unit discharge data. This column is normally left blank (plot interval dependent upon KSW). If column 80 is coded with a '1' to obtain plots at unit discharge interval (particularly if 5-minute data), insure the JOB card reflects an adequate number of job print lines.

REQUIRED CARD INPUT

In addition to card types 1 to 8, the program requires that each storm event be defined by one of the following options:

Option A -- The user furnishes estimates of runoff volumes and peak discharges for up to three episodes in the storm event.

Option B -- The user furnishes information for base flow separation. The program will work with runoff volumes and peak discharges for up to three episodes in the storm event.

I. Card Type - 'A'

If option A is to be used for a given storm event the following card format is used:

Columns	Description
1	Card type - 'A'
2-9	8-digit user specified station identifier
10	Number of flood peaks or episodes to be used for given storm event. NOTE: Maximum number is 3.
11-34	STORM EPISODE (1)
11-16	Date of given peak (calendar year, month, and day), 2 cols. each.
17-20	Beginning array position number of the episode (minimum = 1); right justified.
21-24	Ending array position number of the episode (right justified).

Card type A.--continued

Columns	Description
	NOTE: The array positions are referenced to the first recording interval in the first day of the storm. For example, if a storm consists of three days and the recording interval is 5 minutes (288 RPD) then the array positions for this storm can range from 1 to 864. (864 - 3 days x 288 RPD); also see Special Note (4) below.
25-29	Observed flood peak in cfs corrected for base flow (right justified).
30-33	User furnished flood volume in inches. Must be punched with decimal.
34	Punch '1' if flood peak is to be used in optimization. Punch '0' if flood peak not to be used.
35-56	Storm episode number 2 - see note.
57-78	Storm episode number 3 - see note.
	NOTE: Storm episodes 2 and 3 use same card field formats as episode 1 except calendar year is not included in date fields.
79-80	Blank or optional card sequence number.

J. Card type - 'B'

If option 'B' is to be used for a given storm event, use the following card format:

Columns	Description
1	Card type - 'B'
2-9	User specified 8-digit streamflow station number (optional).
10	Number of flood peak episodes defined for given flood event (max 3).
11-34	Storm episode (1)
A) 11-16	Date of given peak (calendar year, month, and day), 2 cols. each.

J. Card type B.--continued

Columns	Description
B) 17-20	Beginning array position number of the episode (minimum = 1); right justified.
C) 21-24	Ending array position number of the episode; right justified.
	NOTE: The array positions are referenced to the first recording interval of the first day of the storm. For example, an episode ending at noon on the second day of a storm that has 10-minute recording interval would have an end array position of 216 (216 = 144 recordings on first day + 72 recordings to noon on second day); also see Special Note (4).
D) 25-29	Selected base flow in cfs for the event; right justified. If the field is left blank the program assumes zero base flow.
E) 30-33	Not used.
F) 34	Flood episode test option: Punch "1" storm peak to be used in calibration, Punch "0" storm peak not to be used.
35-56	Storm episode number 2 - see note.
57-78	Storm episode number 3 - see note.
	NOTE: Storm episodes 2 and 3 use the same format as episode 1 except the calendar year in not included in the date field.
79-80	Blank or optional card sequence number.

SPECIAL NOTES CONCERNING CARD TYPES A & B.--

(1) There may be a mixture of A and B cards for any calibration.

(2) The total number of A and B cards must be equal to the storm events.

(3) The cards must be in chronological sequence.

(4) For storm events with multiple episodes, do not let array positions of subsequent arrays coincide or overlap any previous array positions.

K. Card type 'T' (Required).

A minimum of two cards is used if basin has one rain gage and no impervious area. A maximum of twenty cards may be used (two cards for pervious area and two cards for impervious area in each rain-gage subbasin; maximum of five rain-gage subbasins).

Each card contains 10 six-column fields for the definition of time-area histograms for pervious and impervious areas in each subbasin. All fields must have entries. Two cards are required for the pervious area and two cards for the impervious area in each subbasin, hence, 20 entries of subarea size, one per time zone, must be made for each subbasin. The order of the two-card sets must be the same as the order of retrieval of the rainfall records (rain gage or subbasin closest to gaging station first). The cards for the pervious area in each subbasin are placed before the cards for the impervious area.

Column	Description
1	Card type 'T'.
2-9	8-digit user specified station identifier.
10-15, 16-21 22-27, 28-33, 34-39, 40-45, 46-51, 52-57, 58-63, 64-69	Cumulative planimetric units (right justified); 10 fields per card.
70-78	Blank.
79-80	Blank or optional card sequence number.

NOTE: Assume two rain-gage subbasins (table 14-1), each subbasin having a pervious and an impervious area; eight 'T' cards are required (2 each for pervious and impervious area in each subbasin), and cols. 12-13 on card 5 must equal 4, i.e., 4 cumulative time-area histograms are defined by 20 points on eight 'T' cards). Pervious-area 'T' cards for each subbasin precede impervious-area 'T' cards.

L. Card type 'W' (optional).

If option(s) on type '5' card (cols. 56, 61, 66, 71, 76) is 1, then a type 'W' card must be supplied for each storm, i.e., one card per storm, for each rain gage. The sequence of the cards must correspond chronologically with storm dates.

Card type W.--continued

Columns	Description
1	Card type - 'W' (optional): used if option in cols. 56, 61, 66, 71, or 76 on card S=1.
2-9	8-digit User specified station identifier.
10-15	User supplied weighted rainfall based on nearby rain gages; right justified; Punch decimal if required. See note.
16-21	Total recorded rainfall for storm for gage for which data was retrieved; right justified; Punch decimal if required. See note.
22-78	Blank.
79-80	Blank or optional card sequence number.

NOTE: The ratio of weighted to recorded rainfall becomes a multiplier which is applied to the recorded data.

Diagnostic Messages

A. For retrieval program J149 (messages are generally self-explanatory)

MESSAGES - RETRIEVALS MADE AND ATTEMPTED AND ERRORS FOLLOW:

1. CONVERSION ERROR IN RETRIEVAL REQUEST CARD
2. ERROR CODE FOR HEADER RETRIEVAL
3. UNKNOWN DATA FILE REQUESTED
4. DATA NOT FOUND IN DAILY VALUES FILE
5. DAILY VALUES DATA RETRIEVAL: STATION='station identifier' PARAMETER= 'parameter code' STATISTIC='statistic code'
6. THE WATER YEARS LISTED BELOW WERE RETRIEVED:
7. DATA NOT FOUND IN UNIT VALUES FILE
8. UNIT VALUES DATA RETRIEVAL: STATION='station identifier' PARAMETER= 'parameter code' STATISTIC='statistic code'
9. THE DATES LISTED BELOW WERE RETRIEVED:

10. ERROR(S) HAVE OCCURRED AS NOTED DURING DATA RETRIEVAL.

11. CONDITION CODE=1 WILL BE PASSED TO PREVENT EXECUTION OF THE URBAN-MODEL PROGRAM.

B. Calibration program G824

1. TERMINAL ERROR - UNIT DISCHARGE DATA INDICATES 'number of flood events' FLOOD EVENTS BUT SEPARATION DATA SUPPLIED FOR ONLY 'number of flood events' SEQUENCES

2. UNIT RAINFALL FOR 'station identifier' INDICATES 'number of storm events' STORM EVENTS, WHILE UNIT DISCHARGE FOR 'station identifier' INDICATES 'number of flood events' FLOOD EVENTS, ABORT JOB

3. UNIT RAINFALL FOR 'station identifier' INDICATES 'number of storm events' STORM EVENTS, BUT HYDROGRAPHS REQUESTED FOR 'number of flood events' STORM EVENTS, ABORT JOB

4. LOWER BOUND FAILURE ON PARAMETER 'parameter number' X='magnitude of lower bound'

5. UPPER BOUND FAILURE ON PARAMETER 'parameter number' X='magnitude of upper bound'

6. Additional messages may be printed which are self-explanatory

Example of Setting up Job

An urban model calibration for Sugar Creek at Clifton Church Road near Atlanta, Georgia, station identifier 02203820, is to be run for the period Oct. 1, 1973, to March 31, 1976 (date to which data have been stored). Two rain gages are located in the basin: 1) one gage at the gaging station (identifier 02203820), and 2) the other in the upper half of the basin called 'AUX-RG at Glenwood Avenue near Atlanta, Georgia'; station identifier 334423084192000 (Lat., Long., Seq. no.). Forty-eight (48) unit discharge days and 48 unit rainfall days for each of the rain gages are on file in the unit values file, and data for 3 water years (1974-76) for each of the rain gages are on file in the daily values files. Also, daily evaporation data for the same 3 water years for the station at Athens, Georgia - station identifier 335700083190001 - are on file. All station identification data are in the WRD Station Header File. The unit data (discharge and rainfalls) are stored at 5-minute time intervals. The routing time interval has to be 5 minutes.

The basin drainage area is 8.67 square miles (52,947 planimetric units). The basin is divided into two subbasins.

Thiessen weighting and determination of pervious-impervious areas by a suitable method shows the distribution of area of the basin, in planimetric units, as follows:

Subbasin	Area, in planimetric units		
	Pervious	Impervious1/	Total
I (closest to gaging station)	11935	832	12767
II	31526	8654	40180
Entire basin			52947

1/ Effective impervious area determined from several trial runs of program G824.

Four (number of routings) accumulative time-area curves will be required (2 subbasins, each with pervious and impervious (effective) areas), therefore 8 type 'T' cards will be used (2 cards per routing, and defined by 20 points in accumulative planimetric units).

No 'W' cards (optional) will be used in this calibration (no weighting of basin unit rainfall data using nearby gages or adjusting by a constant is necessary).

Twenty-three storm events (periods) will be used in the calibration. Six of the events (numbers 2, 4, 9, 10, 15, 22) have multiple episodes (peaks). Only option 'B' cards will be used to define hydrograph separation points and base flow values. Four peaks are not used in the calibration stored in storm 15, storm 16, storm 18, and first in storm 22).

A total calibration (phase 1, phase 2, and phase 3 done automatically) will be done. In phase 1, the parameters affecting runoff volume are optimized; in phase 2, the parameters affecting hydrograph shape are optimized; in phase 3 (by default), the parameters affecting runoff volumes are reoptimized so as to obtain the best match of peak discharges. The following initial, lower, and upper parameter values are used.

PARAMETER			PARAMETER VALUES		
NUMBER	NAME	OPTIMIZED	INITIAL	LOWER	UPPER
1	PSP	Yes	4.7	1.0	10.0
2	KSAT	Yes	0.3	0.01	1.0
3	DRN	No	1.0	0.9	1.1
4	RGF	Yes	10.0	1.0	20.0
5	BMSM	Yes	5.5	1.0	15.0
6	EVC	Yes	0.75	0.7	0.85
7	RR	Yes	0.80	0.70	0.90
8	KSW	No	2.2	1.0	5.0
9	TC	Yes	200.	180.	250.

The number of optimizations per parameter is three and step-size is 0.10. Hydrograph plots will be obtained with base flows subtracted, and will be plotted at default plotting intervals.

The job card deck and example printout follow.

The region, in K bytes, is computed as follows:

Base:		= 352
Unit data, including plots:	4.8 x 48	= 231
Daily data, for rainfall and evaporation:	2.4x(3+3)=14.4	= 15
Total		= 598

PROGRAMMER ______ DIVISION ______ LOCATION ______ PHONE ______

U. S. DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

COMPUTER CODING FORM

PROGRAM NO. ______ PROJECT ______ SHEET 1 OF 2

PROGRAM IDENTIFICATION: ______

PROGRAM INFORMATION: ______

STATEMENT IDENTIFICATION

```
/*RELAY   PUNCH RE2
//xxxxxxxx JOB (-------)
/*PROCLIB  WRD.PROCLIB
// EXEC RRURBAN1,R=598K,T=25
//J149.SYSIN DD *
U       02203820            00060000111973100119760331
U       02203820            00045000061973100119760331
D       02203820            00045000061973100119760331
D335700083190001            00050000061973100119760331
U334423084192000            00045000061973100119760331
D334423084192000            00045000061973100119760331
D335700083190001            00050000061973100119760331
//G824.SYSIN DD *
1       02203820SUGAR CR AT CLIFTON CH RD NR ATLANTA, GA  (Q)      5  8.67 48  2
2       02203820SUGAR CR AT CLIFTON CH RD NR ATLANTA, GA  (URF-1)  5 11935    832
3       02203820SUGAR CR AT CLIFTON CH RD NR ATLANTA, GA  (DRF-1) 731001760331
4335700083190001ATHENS, GA  (DE-1)
2334423084192000AUX-RG AT GLENWOOD AVE NR ATLANTA, GA  (URF-2)      5 31526  8654
3334423084192000AUX-RG AT GLENWOOD AVE NR ATLANTA, GA  (DRF-2)     731001760331
4335700083190001ATHENS, GA  (DE-2)
502203820    4  5 52947 9
602203820 4.7 1.010.0 0.30.01 1.0 1.0 0.9 1.110.0 1.020.0 5.5 1.015.0
702203820 .75  .70.85 0.8 0.7 0.9 2.2 1.0 5.0 200 180 250
802203820 6 3  1.10 1 2 4 5 6 7 100 1 3 4.10 9   010                      11
B02203820173 1215  85  194    18     1                                     1
B02203820274  214  181 428    18     1 216 505 716   23    1               2
B02203820174  4 4  109 294    40     1                                     3
B02203820274  6 7  277 384    13     1 6 7 469 568   15    1               4
B02203820174  7 4  310 476    10     1                                     5
B02203820174  8 7  172 408    15     1                                     6
```

FORM 9—1634 A
JULY 1967

0 = ZERO Ø = ALPHA O 1 = ONE I = ALPHA I 2 = TWO Z = ALPHA Z / = SLASH | = VERT. BAR - = MINUS _ = HORZ. BAR

PROGRAM CODING FORM

GPO : 1968 O - 286-594

U. S. DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

COMPUTER CODING FORM

PROGRAMMER ____ DIVISION ____
LOCATION ____ PHONE ____

PROGRAM NO. ____
PROJECT ____

SHEET 2 OF 2

PROGRAM IDENTIFICATION: ____
PROGRAM INFORMATION: ____

STATEMENT IDENTIFICATION

```
 1  B022038201741215   85  234    15    1                                                 7
 2  B022038201741229   61  252    15    1                                                 8
 3  B02203820275 110  217  390    21    1 112 649 924  16   1                             9
 4  B02203820375 216   49  216    18    1 217 272 432  24   1 218 649 798   24          110
 5  B02203820175 324   97  232    14    1                                                11
 6  B02203820175 4 2  121  348    15    1                                                12
 7  B02203820175 5 3   85  204    13    1                                                13
 8  B02203820175 517  157  348    15    1                                                14
 9  B02203820275 610  217  420    16    1 611 460 612  40   0                            15
10  B02203820175 619  169  258    12    0                                                16
11  B02203820175 710  205  302    13    1                                                17
12  B02203820175 725  253  336    18    0                                                18
13  B02203820175 827  217  330    16    1                                                19
14  B02203820175 918   37  196    15    1                                                20
15  B02203820176 126   37  286    40    1                                                21
16  B02203820276 312  121  234    30    0 312 235 460  40   1                            22
17  B02203820176 316   85  564    80    1                                                23
18  T0220382     651  2415  4586  6879  8935  10738 11871 11935 11935 11935
19  T0220382  11935  11935 11935 11935 11935 11935 11935 11935 11935 11935
20  T0220382      52   203   379   485   635   774   829   832   832   832
21  T0220382     832   832   832   832   832   832   832   832   832   832
22  T0220382       0     0     0     0     0     0   923  2958  4957  7022
23  T0220382    9195 11457 13751 16014 18526 21466 24851 28098 30366 31526
24  T0220382       0     0     0     0     0     0    78   262   463   627
25  T0220382     780  1038  1592  2329  3170  4488  5673  6916  8070  8654
26  //
27  $$$
28
29
30
```

FORM 9—1634 A
JULY 1967

0 = ZERO Ø = ALPHA O 1 = ONE I = ALPHA I 2 = TWO Ƶ = ALPHA Z / = SLASH | = VERT. BAR - = MINUS _ = HORZ. BAR

PROGRAM CODING FORM

RETRIEVE UNIT AND DAILY VALUES FOR URBAN RAINFALL-RUNOFF MODELING PROGRAM

MESSAGES - RETRIEVALS MADE AND ATTEMPTED, AND ERRORS FOLLOW:

UNIT VALUES DATA RETRIEVAL: STATION= 02203820 PARAMETER= 60 STATISTIC= 11
THE DATES LISTED BELOW WERE RETRIEVED

DEC. 15, 1973(288)	FEB. 14, 1974(288)	FEB. 15, 1974(288)	FEB. 16, 1974(288)	APR. 4, 1974(288)	APR. 5, 1974(288)
JUNE 6, 1974(288)	JUNE 7, 1974(288)	JUNE 8, 1974(288)	JULY 3, 1974(288)	JULY 4, 1974(288)	AUG. 7, 1974(288)
AUG. 8, 1974(288)	DEC. 15, 1974(288)	DEC. 29, 1974(288)	DEC. 30, 1974(288)	JAN. 10, 1975(288)	JAN. 11, 1975(288)
JAN. 12, 1975(288)	JAN. 13, 1975(288)	FEB. 16, 1975(288)	FEB. 17, 1975(288)	FEB. 18, 1975(288)	FEB. 19, 1975(288)
MAR. 24, 1975(288)	APR. 2, 1975(288)	APR. 3, 1975(288)	MAY 3, 1975(288)	MAY 17, 1975(288)	MAY 18, 1975(288)
JUNE 10, 1975(288)	JUNE 11, 1975(288)	JUNE 12, 1975(288)	JUNE 19, 1975(288)	JULY 10, 1975(288)	JULY 11, 1975(288)
JULY 25, 1975(288)	JULY 26, 1975(288)	AUG. 27, 1975(288)	AUG. 28, 1975(288)	SEP. 18, 1975(288)	JAN. 26, 1976(288)
JAN. 27, 1976(288)	MAR. 12, 1976(288)	MAR. 13, 1976(288)	MAR. 15, 1976(288)	MAR. 16, 1976(288)	MAR. 17, 1976(288)

UNIT VALUES DATA RETRIEVAL: STATION= 02203820 PARAMETER= 45 STATISTIC= 6
THE DATES LISTED BELOW WERE RETRIEVED

DEC. 15, 1973(288)	FEB. 14, 1974(288)	FEB. 15, 1974(288)	FEB. 16, 1974(288)	APR. 4, 1974(288)	APR. 5, 1974(288)
JUNE 6, 1974(288)	JUNE 7, 1974(288)	JUNE 8, 1974(288)	JULY 3, 1974(288)	JULY 4, 1974(288)	AUG. 7, 1974(288)
AUG. 8, 1974(288)	DEC. 15, 1974(288)	DEC. 29, 1974(288)	DEC. 30, 1974(288)	JAN. 10, 1975(288)	JAN. 11, 1975(288)
JAN. 12, 1975(288)	JAN. 13, 1975(288)	FEB. 16, 1975(288)	FEB. 17, 1975(288)	FEB. 18, 1975(288)	FEB. 19, 1975(288)
MAR. 24, 1975(288)	APR. 2, 1975(288)	APR. 3, 1975(288)	MAY 3, 1975(288)	MAY 17, 1975(288)	MAY 18, 1975(288)
JUNE 10, 1975(288)	JUNE 11, 1975(288)	JUNE 12, 1975(288)	JUNE 19, 1975(288)	JULY 10, 1975(288)	JULY 11, 1975(288)
JULY 25, 1975(288)	JULY 26, 1975(288)	AUG. 27, 1975(288)	AUG. 28, 1975(288)	SEP. 18, 1975(288)	JAN. 26, 1976(288)
JAN. 27, 1976(288)	MAR. 12, 1976(288)	MAR. 13, 1976(288)	MAR. 15, 1976(288)	MAR. 16, 1976(288)	MAR. 17, 1976(288)

DAILY VALUES DATA RETRIEVAL: STATION= 02203820 PARAMETER= 45 STATISTIC= 6
THE WATER YEARS LISTED BELOW WERE RETRIEVED
1974 1975 1976

DAILY VALUES DATA RETRIEVAL: STATION=335700083190001 PARAMETER= 50 STATISTIC= 6
THE WATER YEARS LISTED BELOW WERE RETRIEVED
1974 1975 1976

UNIT VALUES DATA RETRIEVAL: STATION=334423084192000 PARAMETER= 45 STATISTIC= 6
THE DATES LISTED BELOW WERE RETRIEVED

DEC. 15, 1973(288)	FEB. 14, 1974(288)	FEB. 15, 1974(288)	FEB. 16, 1974(288)	APR. 4, 1974(288)	APR. 5, 1974(288)
JUNE 6, 1974(288)	JUNE 7, 1974(288)	JUNE 8, 1974(288)	JULY 3, 1974(288)	JULY 4, 1974(288)	AUG. 7, 1974(288)
AUG. 8, 1974(288)	DEC. 15, 1974(288)	DEC. 29, 1974(288)	DEC. 30, 1974(288)	JAN. 10, 1975(288)	JAN. 11, 1975(288)
JAN. 12, 1975(288)	JAN. 13, 1975(288)	FEB. 16, 1975(288)	FEB. 17, 1975(288)	FEB. 18, 1975(288)	FEB. 19, 1975(288)
MAR. 24, 1975(288)	APR. 2, 1975(288)	APR. 3, 1975(288)	MAY 3, 1975(288)	MAY 17, 1975(288)	MAY 18, 1975(288)
JUNE 10, 1975(288)	JUNE 11, 1975(288)	JUNE 12, 1975(288)	JUNE 19, 1975(288)	JULY 10, 1975(288)	JULY 11, 1975(288)
JULY 25, 1975(288)	JULY 26, 1975(288)	AUG. 27, 1975(288)	AUG. 28, 1975(288)	SEP. 18, 1975(288)	JAN. 26, 1976(288)
JAN. 27, 1976(288)	MAR. 12, 1976(288)	MAR. 13, 1976(288)	MAR. 15, 1976(288)	MAR. 16, 1976(288)	MAR. 17, 1976(288)

DAILY VALUES DATA RETRIEVAL: STATION=334423084192000 PARAMETER= 45 STATISTIC= 6
THE WATER YEARS LISTED BELOW WERE RETRIEVED
1974 1975 1976

DAILY VALUES DATA RETRIEVAL: STATION=335700083190001 PARAMETER= 50 STATISTIC= 6
THE WATER YEARS LISTED BELOW WERE RETRIEVED
1974 1975 1976

*** PGM 6824 HANDLES UP TO 5 SUB-BASINS AND UP TO 110 DAYS OF UNIT DATA.
** CARD TYPES 1-8,A OR B,AND T REQUIRED(W CARDS OPTIONAL).

IMAGES OF INPUT CARDS AND MESSAGES (IF APPLICABLE) FOLLOW:

IMAGES OF INPUT CARDS 1-8 FOLLOW:

```
1       02203820SUGAR CK AT CLIFTON CH RD NR ATLANTA, GA. (Q)      5  8.67 48  2
2       02203820SUGAR CK AT CLIFTON CH RD NR ATLANTA, GA. (URF-1)  5 11935   832
5       02203820SUGAR CK AT CLIFTON CH RD NR ATLANTA, GA. (URF-1)731001760331
433570008319000 1ATHENS,GA. (DE-1)
233442308419200 0AUX-RG AT GLENWOOD AVE NR ATLANTA, GA. (URF-2)     5 31526  8654
333442308419200 0AUX-RG AT GLENWOOD AVE NR ATLANTA, GA. (DRF-2)   731001760331
433570008319000 1ATHENS,GA. (DE-2)
502203820   4  5 52947 9
602203820 4.7 1.010.0 0.50.01 1.0 1.0 0.9 1.110.0 1.020.0 5.5 1.015.0
702203820 0.75 0.70.85 0.8 0.7 0.9 2.2 1.0 5.0 200 180 250
802203820 6 3 1.10 1 2 4 5 6 7  100 1 3 4.10 9    010                        11
```

IMAGES OF INPUT CARDS A OR B FOLLOW:,

```
B02203820173121 5  85 194   18    1                                          1
B02203820274021 4 181 426   18    10216 505 716   23    1                    2
B02203820174040 4 109 294   40    1                                          3
B02203820274060 7 277 384   13    10607 469 568   15    1                    4
B02203820174070 4 310 476   10    1                                          5
B02203820174080 7 172 408   15    1                                          6
B02203820174121 5  85 234   15    1                                          7
B02203820174122 9  61 252   15    1                                          8
B02203820275011 0 217 390   21    10112 649 924   16    1                    9
B02203820375021 6  49 216   18    10217 272 432   24    10218 649 798   24   110
B02203820175032 4  97 252   14    1                                          11
B02203820175040 2 121 348   15    1                                          12
B02203820175050 3  85 204   13    1                                          13
B02203820175051 7 157 348   15    1                                          14
B02203820275061 0 217 420   16    10611 460 612   40    0                    15
B02203820175061 9 169 258   12    0                                          16
B02203820175071 0 205 302   13    1                                          17
B02203820175072 5 253 336   18    0                                          18
B02203820175082 7 217 330   16    1                                          19
B02203820175091 8  37 196   15    1                                          20
B02203820175012 6  37 286   40    1                                          21
B02203620276031 2 121 234   30    00312 235 460   40    1                    22
B02203820176031 6  85 564   80    1                                          23
```

IMAGES OF INPUT CARDS TYPE-T FOLLOW:

```
T02203820   651  2415  4586  6879  8935 10738 11871 11935 11935 11935          1
T02203820 11935 11935 11935 11935 11935 11935 11935 11935 11935 11935          2
T02203820    52   203   379   485   635   774   829   832   832   832          3
T02203820   832   832   832   832   832   832   832   832   832   832          4
T02203820     0     0     0     0     0     0   923  2958  4957  7022          5
T02203820  9195 11457 13751 16014 18526 21466 24851 28098 30366 31526          6
T02203820     0     0     0     0     0     0    78   262   463   627          7
T02203820   780  1038  1592  2329  3170  4488  5673  6916  8070  8654          8
```

NOTE: NO INPUT W-TYPE CARDS USED.

```
USGS URBAN RR MODEL(G824)
MULTI-BASIN MOISTURE ACCOUNTING WITH   2 RAINGAGES FOR
DISCHARGE STATION:            02203820SUGAR CK AT CLIFTON CH RD NR ATLANTA, GA. (Q)
DRAINAGE AREA=    8.670 SQ. MI.
UNIT DISCHARGE IS DEFINED AT   5 MINUTE INTERVALS
ROUTING IS AT   5 MINUTE INTERVALS
THE CALIBRATION IS FROM 10 -1-73 TO   3-31-76


RAINGAGE NUMBER  1
UNIT PRECIP. STATION:          02203820SUGAR CK AT CLIFTON CH RD NR ATLANTA, GA. (URF-1)
DAILY PRECIP. STATION:         02203820SUGAR CK AT CLIFTON CH RD NR ATLANTA, GA. (DRF-1)
PAN-EVAP STATION:       335700083190001ATHENS,GA. (DE-1)
PERVIOUS DRAINAGE AREA=     1.954 SQ. MI.
IMPERVIOUS DRAINAGE AREA=   0.136 SQ. MI.
UNIT RAINFALL IS DEFINED AT  5 MINUTE INTERVALS - AND IS NOT ADJUSTED (NO W-CARDS)


RAINGAGE NUMBER  2
UNIT PRECIP. STATION:   334423084192000AUX-RG AT GLENWOOD AVE NR ATLANTA, GA. (URF-2)
DAILY PRECIP. STATION:  334423084192000AUX-RG AT GLENWOOD AVE NR ATLANTA, GA. (DRF-2)
PAN-EVAP STATION:       335700083190001ATHENS,GA. (DE-2)
PERVIOUS DRAINAGE AREA=     5.162 SQ. MI.
IMPERVIOUS DRAINAGE AREA=   1.417 SQ. MI.
UNIT RAINFALL IS DEFINED AT  5 MINUTE INTERVALS - AND IS NOT ADJUSTED (NO W-CARDS)
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USGS URBAN RR MODEL(G624)
CALIBRATION FOR STATION 02203820 SUGAR CK AT CLIFTON CH RD NR ATLANTA, GA. (Q)

THE DAILY RAINFALL RECORD IS CONTINUOUS

THE RECORD INCLUDES 23 SEQUENCES OF UNIT-DATA THAT DEFINE THE FOLLOWING FLOOD EVENTS

SEQUENCE	PEAK AND VOLUME OPTION	EVENT	DATE	PEAK DISCHARGE (CFS)	STORM RUNOFF (IN)	WEIGHTED STORM RAINFALL (IN)	INFILTR.
1	B	1*	12/15/73	289	0.13	0.90	0.86
2	B	1*	02/14/74	286	0.33	1.40	0.76
		2*	02/16/74	399	0.53	1.07	0.69
3	B	1*	04/04/74	1110	0.84	2.07	0.59
4	B	1*	06/07/74	387	0.21	1.10	0.81
		2*	06/07/74	124	0.08	0.62	0.88
5	B	1*	07/04/74	376	0.26	1.98	0.87
6	B	1*	08/07/74	655	0.64	2.56	0.75
7	B	1*	12/15/74	286	0.18	1.19	0.85
8	B	1*	12/29/74	342	0.31	1.30	0.76
9	B	1*	01/10/75	689	0.57	1.77	0.68
		2*	01/12/75	357	0.33	1.08	0.69
10	B	1*	02/16/75	431	0.23	1.05	0.79
		2*	02/17/75	492	0.30	0.95	0.68
		3*	02/18/75	520	0.35	1.00	0.64
11	B	1*	03/24/75	564	0.39	1.36	0.71
12	B	1*	04/02/75	588	0.50	1.97	0.74
13	B	1*	05/03/75	371	0.23	1.26	0.82
14	B	1*	05/17/75	399	0.37	1.24	0.70
15	B	1*	06/10/75	558	0.40	1.81	0.78
		2	06/11/75	536	0.33	0.94	0.65
16	B	1	06/19/75	276	0.11	0.72	0.85
17	B	1*	07/10/75	361	0.17	1.24	0.86
18	B	1	07/25/75	386	0.16	1.88	0.92
19	B	1*	08/27/75	516	0.33	2.32	0.86
20	B	1*	09/18/75	537	0.44	1.57	0.72
21	B	1*	01/26/75	960	1.20	3.20	0.62
22	B	1	03/12/76	247	0.09	0.74	0.88
		2*	03/12/76	560	0.62	1.52	0.60

23	B	1*	03/16/76	1260	2.44	5.34	0.54

NOTE: A INDICATES THAT PEAK AND VOLUME FIGURES WERE SUPPLIED BY USER
B INDICATES THAT PEAK AND VOLUME FIGURES WERE COMPUTED FROM UNIT DATA
* INDICATES THOSE EVENTS USED IN CALIBRATION OF MODEL
INFILTR. IS THE PROPORTION OF RAINFALL INFILTRATED (1-(RUNOFF/RAINFALL))
PEAK DISCHARGE(S) AND STORM RUNOFF (VOL) HAVE BASE FLOW(S) SUBTRACTED

USGS URBAN RR MODEL(G824)
CALIBRATION FOR STATION 02203820 SUGAR CK AT CLIFTON CH RD NR ATLANTA, GA. (Q)

BEGINNING OF STAGE - PHASE 1 (VOL)

INITIAL PARAMETER VALUES ARE:

1	4.700000	*
2	0.300000	*
3	1.000000	
4	10.000000	*
5	5.500000	*
6	0.750000	*
7	0.800000	*
8	2.200000	
9	200.000000	

* - PARAMETERS TO BE OPTIMIZED

THE MAXIMUM NUMBER OF TRYCOUNTS IS 18
AT THE START OF EACH STAGE OF OPTIMIZATION THE STEP-SIZE = 10 % OF THE VECTOR SIZE.

USGS URBAN RR MODEL(G824)
PHASE 1 : OPTIMIZATION OF PARAMETERS AFFECTING RUNOFF VOLUME.
STATION = 02203820 SUGAR CK AT CLIFTON CH RD NR ATLANTA, GA. (Q)

BEGINNING OF STAGE

VOLUME OBJECTIVE FUNCTION = 2.9296455E+00
ROOT MEAN SQ. ERROR LOG BASE 10 = 0.145567 (AVE. PERCENT = 34.1)

PARAMETER VALUES ARE
PSP= 4.700
KSAT= 0.300
DRN= 1.000
RGF= 10.000
BMSM= 5.500
EVC= 0.750
RR= 0.300

DATE	STORM RAINFALL	DIRECT RUNOFF	SIM DIRECT RUNOFF
*12/15/73	0.90	0.13	0.16
*02/14/74	1.40	0.33	0.26
*02/16/74	1.07	0.33	0.19
*04/04/74	2.07	0.84	0.46
*06/07/74	1.10	0.21	0.19
*06/07/74	0.62	0.08	0.10
*07/04/74	1.98	0.26	0.38
*08/07/74	2.56	0.64	0.64
*12/15/74	1.19	0.18	0.21
*12/29/74	1.30	0.31	0.24
*01/10/75	1.77	0.57	0.67
*01/12/75	1.08	0.33	0.22
*02/16/75	1.05	0.23	0.21
*02/17/75	0.95	0.30	0.21
*02/18/75	1.00	0.35	0.26
*03/24/75	1.36	0.39	0.33
*04/02/75	1.97	0.50	0.41
*05/03/75	1.26	0.23	0.26
*05/17/75	1.24	0.37	0.26
*06/10/75	1.81	0.40	0.43
06/11/75	0.94	0.33	0.18
06/19/75	0.72	0.11	0.11
*07/10/75	1.24	0.17	0.24
07/25/75	1.88	0.16	0.50
*08/27/75	2.32	0.33	0.54
*09/18/75	1.57	0.44	0.32
*01/26/75	3.20	1.20	0.71
03/12/76	0.74	0.09	0.13
*03/12/76	1.52	0.62	0.31
*03/16/76	5.34	2.44	1.73

* - EVENTS USED IN CALIBRATION
NOTE: STORM RAINFALL IS WEIGHTED (AND OR ADJUSTED).

TRYCT	OBJ. FUNC.	PSP	KSAT	DRN	RGF	BMSM	EVC	RR	KSW	TC
0	2.92965	4.70000	0.30000	1.00000	10.00000	5.50000	0.75000	0.80000	2.20000	200.00000
4	2.87784	4.70000	0.30000	1.00000	10.00000	6.05000	0.75000	0.80000	2.20000	200.00000
6	2.82740	4.70000	0.30000	1.00000	10.00000	6.05000	0.75000	0.88000	2.20000	200.00000
7	2.77662	4.46500	0.30000	1.00000	10.00000	6.05000	0.75000	0.88000	2.20000	200.00000
8	2.70890	4.46500	0.28500	1.00000	10.00000	6.05000	0.75000	0.88000	2.20000	200.00000
9	2.70332	4.46500	0.28500	1.00000	9.50000	6.05000	0.75000	0.88000	2.20000	200.00000
10	2.66850	4.46500	0.28500	1.00000	9.50000	7.70000	0.75000	0.88000	2.20000	200.00000
12	2.70852	UPPER BOUND FAILURE ; PARAMETER RR = 1.119999								
13	2.55079	3.76000	0.28500	1.00000	9.50000	7.70000	0.75000	0.88000	2.20000	200.00000
14	2.46432	3.76000	0.24000	1.00000	9.50000	7.70000	0.75000	0.88000	2.20000	200.00000
17	2.42741	3.76000	0.24000	1.00000	9.50000	7.70000	0.76875	0.88000	2.20000	200.00000

USGS URBAN RR MODEL(G824)
PHASE 1 : OPTIMIZATION OF PARAMETERS AFFECTING RUNOFF VOLUME.
STATION = 02203820 SUGAR CK AT CLIFTON CH RD NR ATLANTA, GA. (Q)

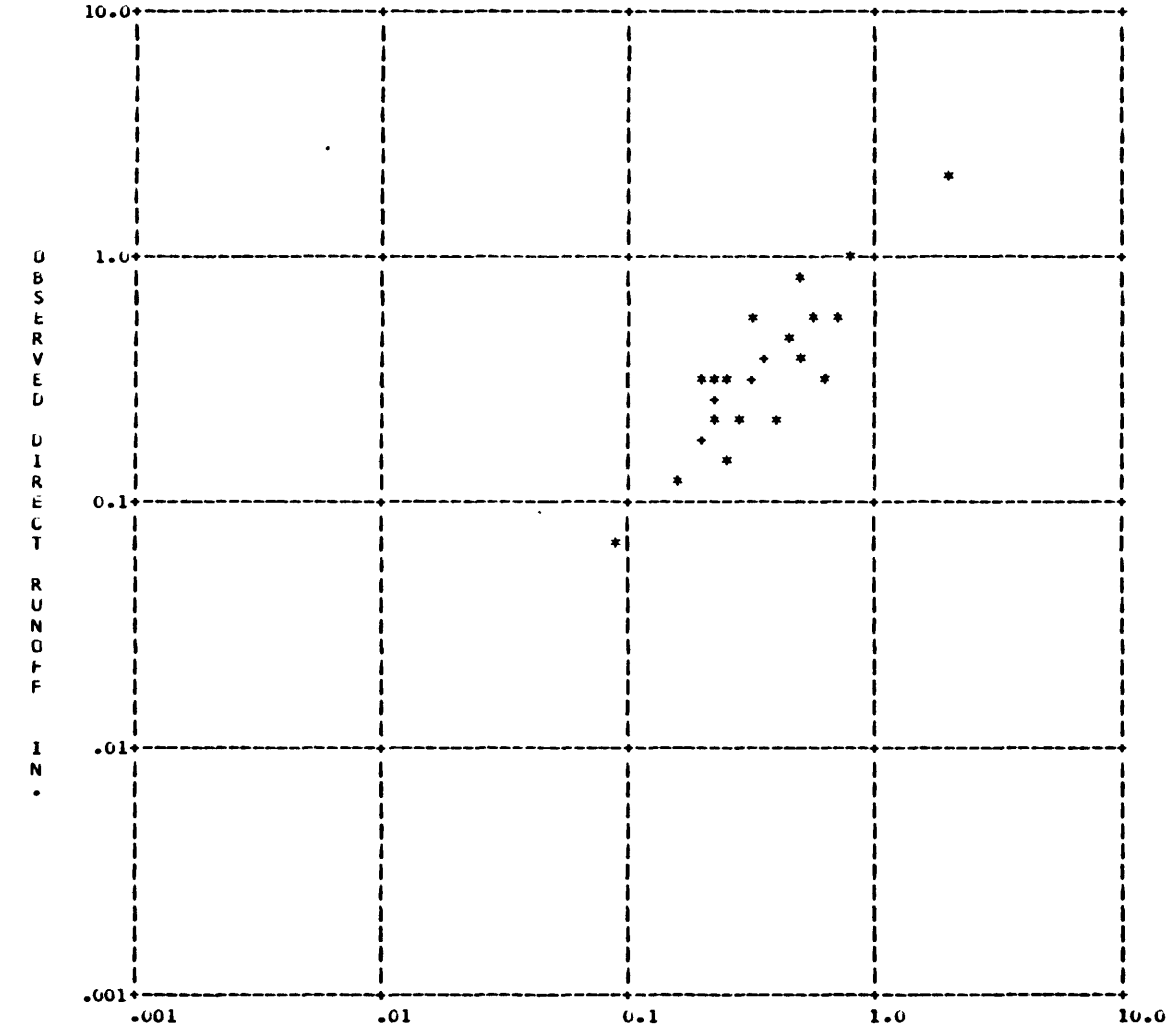
END OF ROUND--RESULTS OF LAST SUCCESSFUL TRIAL

VOLUME OBJECTIVE FUNCTION = 2.427406E+00
ROOT MEAN SQ. ERROR LOG BASE 10 = 0.132503 (AVE. PERCENT = 31.0)

PARAMETER VALUES ARE
PSP= 3.760
KSAT= 0.240
DRN= 1.000
RGF= 9.500
BMSM= 7.700
EVC= 0.769
RR= 0.880

DATE	STORM RAINFALL	DIRECT RUNOFF	SIM DIRECT RUNOFF
*12/15/73	0.90	0.13	0.16
*02/14/74	1.40	0.33	0.27
*02/16/74	1.07	0.33	0.21
*04/04/74	2.07	0.64	0.56
*06/07/74	1.10	0.21	0.21
*06/07/74	0.62	0.08	0.10
*07/04/74	1.98	0.26	0.40
*08/07/74	2.56	0.64	0.74
*12/15/74	1.19	0.18	0.21
*12/29/74	1.30	0.31	0.25
*01/10/75	1.77	0.57	0.58
*01/12/75	1.08	0.33	0.24
*02/16/75	1.05	0.23	0.23
*02/17/75	0.95	0.30	0.24
*02/18/75	1.00	0.35	0.33
*03/24/75	1.36	0.39	0.40
*04/02/75	1.97	0.50	0.48
*05/03/75	1.26	0.23	0.29
*05/17/75	1.24	0.37	0.33
*06/10/75	1.81	0.40	0.54
06/11/75	0.94	0.33	0.19
06/19/75	0.72	0.11	0.12
*07/10/75	1.24	0.17	0.26
07/25/75	1.88	0.16	0.64
*08/27/75	2.32	0.33	0.70
*09/18/75	1.57	0.44	0.36
*01/26/75	3.20	1.20	0.84
03/12/76	0.74	0.09	0.13
*03/12/76	1.52	0.62	0.35
*03/16/76	5.34	2.44	2.11

* - EVENTS USED IN CALIBRATION
NOTE: STORM RAINFALL IS WEIGHTED (AND OR ADJUSTED).



NUMBER OF POINTS PLOTTED = 26
NUMBER OF MULTIPLE POINTS = 4
NUMBER OF POINTS OFF GRID = 0
NUMBER OF POINTS OMITTED = 4

*** NOTE ***
PLOT ROUTINE EXCLUDES
POINTS NOT INCLUDED
IN CALIBRATION

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USGS URBAN RR MODEL(G824)
CALIBRATION FOR STATION        02203820 SUGAR CK AT CLIFTON CH RD NR ATLANTA, GA. (Q)

BEGINNING OF STAGE - PHASE 2 (ROUTING)

INITIAL PARAMETER VALUES ARE:
  1     3.759999
  2     0.240000
  3     1.000000
  4     9.500000
  5     7.699998
  6     0.768750
  7     0.880000
  8     2.200000
  9   200.000000 *
* - PARAMETERS TO BE OPTIMIZED

THE MAXIMUM NUMBER OF TRYCOUNTS IS    3
AT THE START OF EACH STAGE OF OPTIMIZATION THE STEP-SIZE =  10 % OF THE VECTOR SIZE.
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USGS URBAN RR MODEL(G824)
PHASE 2 : OPTIMIZATION OF PARAMETERS AFFECTING HYDROGRAPH SHAPE.
STATION = 02203820 SUGAR CK AT CLIFTON CH RD NR ATLANTA, GA. (Q)

BEGINNING OF STAGE

PEAK WITH VOLUME ADJ OBJECTIVE FUNCTION = 1.3284E+00
ROOT MEAN SQ. ERROR LOG BASE 10 = 0.098020 (AVE. PERCENT = 22.8)

PARAMETER VALUES ARE
KSW= 2.200
TC= 200.000

DATE	OBS. DIRECT RUNOFF	SIM. DIRECT RUNOFF	OBS. PEAK DISCHARGE	SIM. PEAK Q(VOL. ADJ.)	SIM. PEAK Q
*12/15/73	0.13	0.16	289	192	245
*02/14/74	0.33	0.27	286	256	209
*02/16/74	0.33	0.21	399	398	248
*04/04/74	0.84	0.56	1110	1189	786
*06/07/74	0.21	0.21	387	277	269
*06/07/74	0.08	0.10	124	91	119
*07/04/74	0.26	0.40	376	290	458
*08/07/74	0.64	0.74	653	819	947
*12/15/74	0.18	0.21	286	192	226
*12/29/74	0.31	0.25	342	295	235
*01/10/75	0.57	0.58	689	929	944
*01/12/75	0.33	0.24	357	392	288
*02/16/75	0.23	0.23	431	314	323
*02/17/75	0.30	0.24	492	443	349
*02/18/75	0.35	0.33	520	520	491
*03/24/75	0.39	0.40	564	587	601
*04/02/75	0.50	0.48	568	631	602
*05/03/75	0.23	0.29	371	262	338
*05/17/75	0.37	0.33	399	512	462
*06/10/75	0.40	0.54	558	640	870
06/11/75	0.33	0.19	536	438	257
06/19/75	0.11	0.12	278	110	127
*07/10/75	0.17	0.26	361	251	382
07/25/75	0.16	0.64	386	279	1127
*08/27/75	0.33	0.70	516	416	870
*09/18/75	0.44	0.36	537	530	428
*01/26/75	1.20	0.84	960	1062	746
03/12/76	0.09	0.13	247	104	164
*03/12/76	0.62	0.35	560	642	370
*03/16/76	2.44	2.11	1260	1391	1200

* - EVENTS USED IN CALIBRATION

TRYCT	OBJ. FUNC.	PSP	KSAT	DRN	RGF	BMSM	EVC	RR	KSW	TC
0	1.32839	3.76000	0.24000	1.00000	9.50000	7.70000	0.76875	0.88000	2.20000	200.00000
2	1.28749	3.76000	0.24000	1.00000	9.50000	7.70000	0.76875	0.88000	2.20000	190.00000
3	1.28749	LOWER BOUND FAILURE ; PARAMETER TC = 160.000031								

USGS URBAN RR MODEL(G824)
PHASE 2 : OPTIMIZATION OF PARAMETERS AFFECTING HYDROGRAPH SHAPE.
STATION = 02203820 SUGAR CK AT CLIFTON CH RD NR ATLANTA, GA. (Q)

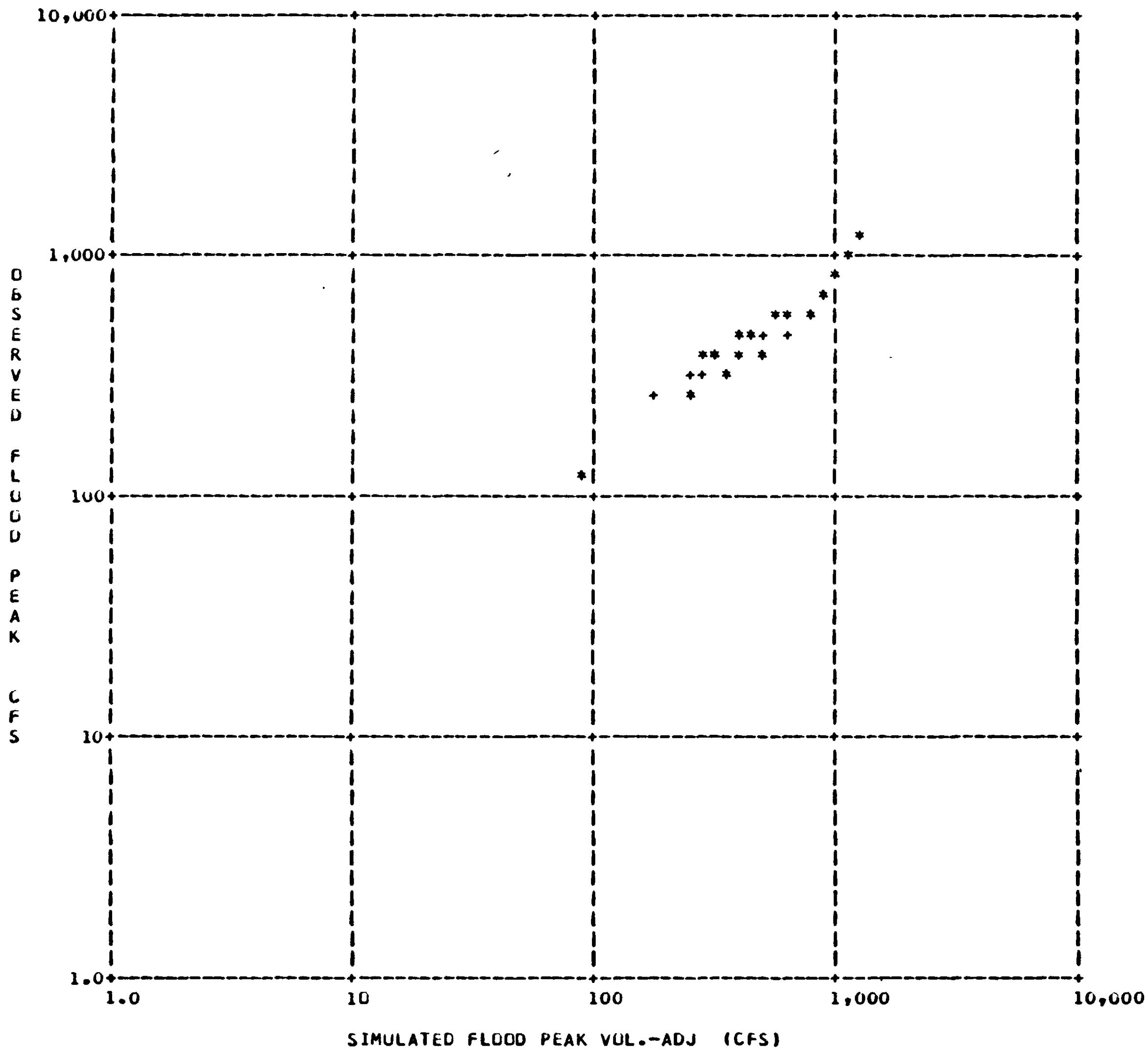
END OF ROUND--RESULTS OF LAST SUCCESSFUL TRIAL

PEAK WITH VOLUME ADJ OBJECTIVE FUNCTION = 1.2875E+00
ROOT MEAN SQ. ERROR LOG BASE 10 = 0.096500 (AVE. PERCENT = 22.4)

PARAMETER VALUES ARE
KSW= 2.200
TC= 190.000

DATE	OBS. DIRECT RUNOFF	SIM. DIRECT RUNOFF	OBS. PEAK DISCHARGE	SIM. PEAK Q(VOL. ADJ.)	SIM. PEAK Q
*12/15/73	0.13	0.16	289	194	248
*02/14/74	0.33	0.27	286	258	211
*02/16/74	0.33	0.21	399	407	254
*04/04/74	0.84	0.56	1110	1209	800
*06/07/74	0.21	0.21	387	282	274
*06/07/74	0.08	0.10	124	92	120
*07/04/74	0.26	0.40	376	299	471
*08/07/74	0.64	0.74	653	829	958
*12/15/74	0.18	0.21	286	194	229
*12/29/74	0.31	0.25	342	298	237
*01/10/75	0.57	0.58	689	945	961
*01/12/75	0.33	0.24	357	398	292
*02/16/75	0.23	0.23	431	318	327
*02/17/75	0.30	0.24	492	449	354
*02/18/75	0.35	0.33	520	530	501
*03/24/75	0.39	0.40	564	598	613
*04/02/75	0.50	0.48	588	646	616
*05/03/75	0.23	0.29	371	266	344
*05/17/75	0.37	0.33	399	523	473
*06/10/75	0.40	0.54	558	655	890
06/11/75	0.33	0.19	536	444	260
06/19/75	0.11	0.12	278	112	129
*07/10/75	0.17	0.26	361	256	388
07/25/75	0.16	0.64	386	286	1152
*08/27/75	0.33	0.70	516	425	890
*09/18/75	0.44	0.36	537	536	433
*01/26/75	1.20	0.84	960	1067	750
03/12/76	0.09	0.13	247	106	166
*03/12/76	0.62	0.35	560	656	378
*03/16/76	2.44	2.11	1260	1412	1218

* - EVENTS USED IN CALIBRATION

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NUMBER OF POINTS PLOTTED   =    26
NUMBER OF MULTIPLE POINTS =     5
NUMBER OF POINTS OFF GRID =     0
NUMBER OF POINTS OMITTED   =    4
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*** NOTE ***
PLOT ROUTINE EXCLUDES
POINTS NOT INCLUDED
IN CALIBRATION

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USGS URBAN RR MODEL(G824)
CALIBRATION FOR STATION        02203820 SUGAR CK AT CLIFTON CH RD NR ATLANTA, GA. (Q)

BEGINNING OF STAGE - PHASE 3 (PEAKS)

INITIAL PARAMETER VALUES ARE:
  1     3.759999 *
  2     0.240000 *
  3     1.000000
  4     9.500000 *
  5     7.699998 *
  6     0.768750 *
  7     0.880000 *
  8     2.200000 *
  9   190.000000
* - PARAMETERS TO BE OPTIMIZED

THE MAXIMUM NUMBER OF TRYCOUNTS IS  18
AT THE START OF EACH STAGE OF OPTIMIZATION THE STEP-SIZE =  10 % OF THE VECTOR SIZE.
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USGS URBAN RR MODEL(G824)
PHASE 3 : OPTIMIZATION OF PARAMETERS FOR PEAK DISCHARGES.
STATION = 02203820 SUGAR CK AT CLIFTON CH RD NR ATLANTA, GA. (Q)

BEGINNING OF STAGE

PEAK OBJECTIVE FUNCTION = 2.0980558E+00
TOTAL MODEL ERROR FOLLOWS:
ROOT MEAN SQ. ERROR LOG BASE 10 = 0.123186 (AVE. PERCENT = 28.7)

PARAMETER VALUES ARE
PSP= 3.760
KSAT= 0.240
DRN= 1.000
RGF= 9.500
BMSM= 7.700
EVC= 0.769
RR= 0.880
KSW= 2.200
TC= 190.000

DATE	STORM RAINFALL	DIRECT RUNOFF	SIM DIRECT RUNOFF	PEAK DISCHARGE	SIM PEAK DISCHARGE	BASE FLOW
*12/15/73	0.90	0.13	0.16	289	248	18.0
*02/14/74	1.40	0.33	0.27	286	211	18.0
*02/16/74	1.07	0.33	0.21	399	254	23.0
*04/04/74	2.07	0.84	0.56	1110	800	40.0
*06/07/74	1.10	0.21	0.21	387	274	13.0
*06/07/74	0.62	0.08	0.10	124	120	15.0
*07/04/74	1.98	0.26	0.40	376	471	10.0
*08/07/74	2.56	0.64	0.74	653	958	15.0
*12/15/74	1.19	0.18	0.21	286	229	15.0
*12/29/74	1.30	0.31	0.25	342	237	15.0
*01/10/75	1.77	0.57	0.58	689	961	21.0
*01/12/75	1.08	0.33	0.24	357	292	16.0
*02/16/75	1.05	0.23	0.23	431	327	18.0
*02/17/75	0.95	0.30	0.24	492	354	24.0
*02/18/75	1.00	0.35	0.33	520	501	24.0
*03/24/75	1.36	0.39	0.40	564	613	14.0
*04/02/75	1.97	0.50	0.48	588	616	15.0
*05/03/75	1.26	0.23	0.29	371	344	13.0
*05/17/75	1.24	0.37	0.33	399	473	15.0
*06/10/75	1.81	0.40	0.54	558	890	16.0
06/11/75	0.94	0.33	0.19	536	260	40.0
06/19/75	0.72	0.11	0.12	278	129	12.0
*07/10/75	1.24	0.17	0.26	361	388	13.0
07/25/75	1.88	0.16	0.64	386	1152	18.0
*08/27/75	2.32	0.33	0.70	516	890	16.0
*09/18/75	1.57	0.44	0.36	537	433	15.0
*01/26/75	3.20	1.20	0.84	960	750	40.0
03/12/76	0.74	0.09	0.13	247	166	30.0
*03/12/76	1.52	0.62	0.35	560	378	40.0
*03/16/76	5.34	2.44	2.11	1260	1218	80.0

* - EVENTS USED IN CALIBRATION
NOTE: STORM RAINFALL IS WEIGHTED (AND OR ADJUSTED).

TOTAL NUMBER OF CALIB. POINTS = 26

MEANS BASED ON CALIB. PTS. =	0.47	0.44	515.96	508.67	21.6

TRYCT	OBJ. FUNC.	PSP	KSAT	DRN	RGF	BMSM	EVC	RR	KSW	TC
0	2.09806	3.76000	0.24000	1.00000	9.50000	7.70000	0.76875	0.88000	2.20000	190.00000
3	2.06242	3.76000	0.24000	1.00000	10.50000	7.70000	0.76875	0.88000	2.20000	190.00000
6	2.24265	UPPER BOUND FAILURE ; PARAMETER RR = 0.960000								
7	2.04139	3.52500	0.24000	1.00000	10.50000	7.70000	0.76875	0.88000	2.20000	190.00000
8	2.01367	3.52500	0.22500	1.00000	10.50000	7.70000	0.76875	0.88000	2.20000	190.00000
9	1.92530	3.52500	0.22500	1.00000	13.50000	7.70000	0.76875	0.88000	2.20000	190.00000
13	1.89839	2.82000	0.22500	1.00000	13.50000	7.70000	0.76875	0.88000	2.20000	190.00000
15	2.08455	UPPER BOUND FAILURE ; PARAMETER RGF = 22.499985								
16	1.89645	2.82000	0.22500	1.00000	13.50000	7.83750	0.76875	0.88000	2.20000	190.00000
17	1.87214	2.82000	0.22500	1.00000	13.50000	7.83750	0.78750	0.88000	2.20000	190.00000

USGS URBAN RR MODEL(G824)
PHASE 3 : OPTIMIZATION OF PARAMETERS FOR PEAK DISCHARGES.
STATION = 02203820 SUGAR CK AT CLIFTON CH RD NR ATLANTA, GA. (Q)

END OF ROUND--RESULTS OF LAST SUCCESSFUL TRIAL

PEAK OBJECTIVE FUNCTION = 1.8721390E+00
TOTAL MODEL ERROR FOLLOWS:
ROOT MEAN SQ. ERROR LOG BASE 10 = 0.116365 (AVE. PERCENT = 27.1)

PARAMETER VALUES ARE
PSP= 2.820
KSAT= 0.225
DRN= 1.000
RGF= 13.500
BMSM= 7.837
EVC= 0.787
RR= 0.880
KSW= 2.200
TC= 190.000

DATE	STORM RAINFALL	DIRECT RUNOFF	SIM DIRECT RUNOFF	PEAK DISCHARGE	SIM PEAK DISCHARGE	BASE FLOW
*12/15/73	0.90	0.13	0.16	289	248	18.0
*02/14/74	1.40	0.33	0.27	286	211	18.0
*02/16/74	1.07	0.33	0.22	399	291	23.0
*04/04/74	2.07	0.84	0.56	1110	804	40.0
*06/07/74	1.10	0.21	0.21	387	274	13.0
*06/07/74	0.62	0.08	0.10	124	120	15.0
*07/04/74	1.98	0.26	0.40	376	471	10.0
*08/07/74	2.56	0.64	0.74	653	960	15.0
*12/15/74	1.19	0.18	0.21	286	229	15.0
*12/29/74	1.30	0.31	0.25	342	237	15.0
*01/10/75	1.77	0.57	0.58	689	960	21.0
*01/12/75	1.08	0.33	0.25	357	313	16.0
*02/16/75	1.05	0.23	0.24	431	341	18.0
*02/17/75	0.95	0.30	0.26	492	383	24.0
*02/18/75	1.00	0.35	0.38	520	561	24.0
*03/24/75	1.36	0.39	0.42	564	644	14.0
*04/02/75	1.97	0.50	0.50	588	664	15.0
*05/03/75	1.26	0.23	0.29	371	346	13.0
*05/17/75	1.24	0.37	0.34	399	477	15.0
*06/10/75	1.81	0.40	0.54	558	885	16.0
06/11/75	0.94	0.33	0.19	536	259	40.0
06/19/75	0.72	0.11	0.12	278	129	12.0
*07/10/75	1.24	0.17	0.26	361	386	13.0
07/25/75	1.88	0.16	0.63	386	1133	18.0
*08/27/75	2.32	0.33	0.68	516	871	16.0
*09/18/75	1.57	0.44	0.35	537	425	15.0
*01/26/75	3.20	1.20	0.86	960	766	40.0
03/12/76	0.74	0.09	0.13	247	167	30.0
*03/12/76	1.52	0.62	0.36	560	389	40.0
*03/16/76	5.34	2.44	2.21	1260	1289	80.0

* - EVENTS USED IN CALIBRATION
NOTE: STORM RAINFALL IS WEIGHTED (AND OR ADJUSTED).

TOTAL NUMBER OF CALIB. POINTS = 26

MEANS BASED ON CALIB. PTS. =	0.47	0.45	515.96	520.88	21.6

CALIBRATION FOR STATION 02203820 SUGAR CK AT CLIFTON CH RD NR ATLANTA, GA. (Q)

THE FOLLOWING STATISTICS ARE BASED ON LOGS (BASE 10) OF 26 CALIB. POINTS:

	OBS. PEAKS	SIM. PEAKS
MEAN =	2.6664	2.6489
VARIANCE =	0.0407	0.0611
STANDARD DEV. =	0.2017	0.2472

CORRELATION COEFF. OF SIM. AND OBS. PEAKS = 0.888
SLOPE OF REGRESSION LINE = 0.724 (1 HORIZ. : 0.724 VERT.)
INTERCEPT OF REGRESSION LINE = 0.748 LOG UNITS (OBS. Q SCALE)

ANALYSIS OF CALIBRATION (ASSUME BIVARIATE NORMAL DISTRIBUTION OF LOGS. OF OBS. AND SIM. PEAKS):

1. TEST OF CORRELATION COEFFICIENT (IS CORRELATION COEFF = 0 ?) ----

CORRELATION COEFF. = 0.888 ;

A. THE CORRELATION COEFF. IS SIGNIFICANTLY DIFFERENT THAN ZERO AT 5% LEVEL OF SIGNIFICANCE,
AND IS SIGNIFICANTLY DIFFERENT THAN ZERO AT 10% LEVEL OF SIGNIFICANCE.

B. THE CORRELATION COEFF. COULD RANGE FROM 0.867 TO 0.905 AT 5% LEVEL OF SIGNIFICANCE,
AND FROM 0.871 TO 0.902 AT 10% LEVEL OF SIGNIFICANCE.

C.

IF CORRELATION COEFF. IS	REGRESSION IS
GREATER THAN OR EQUAL TO 0.388	ASSUMED SUCCESSFUL (5% LEVEL)
BETWEEN 0.331 AND 0.387	TENTATIVELY SUCCESSFUL (5-10% LEVEL)
LESS THAN OR EQUAL TO 0.330	ASSUMED UNSUCCESSFUL (10% LEVEL)

2. TEST OF SLOPE (IS SLOPE = 1 ?) ----

A. THE SLOPE IS SIGNIFICANTLY DIFFERENT THAN ONE AT 5% LEVEL OF SIGNIFICANCE,
AND IS SIGNIFICANTLY DIFFERENT THAN ONE AT 10% LEVEL OF SIGNIFICANCE.

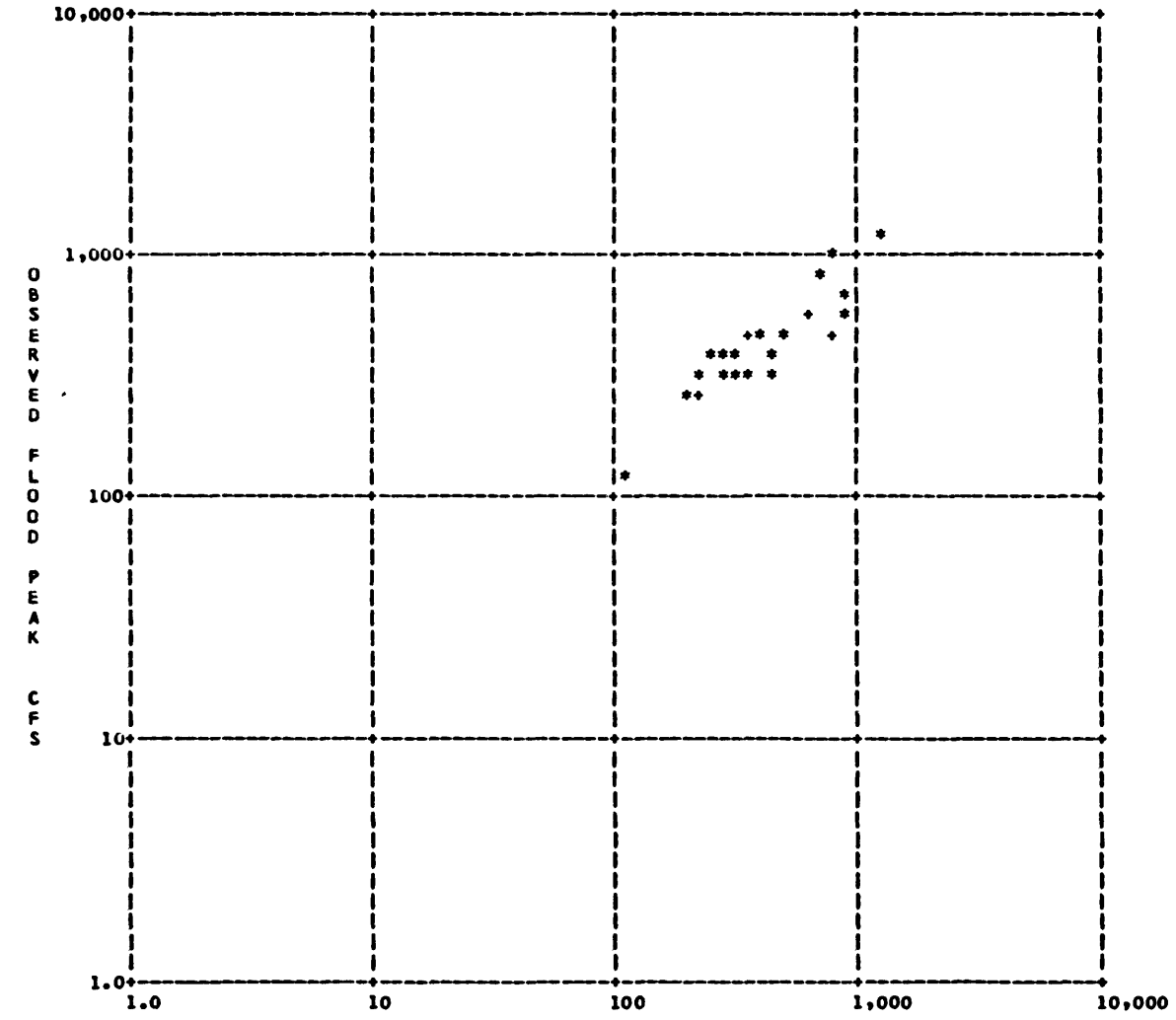
B. THE SLOPE SHOULD RANGE FROM 0.842 TO 1.158 AT 5% LEVEL OF SIGNIFICANCE,
AND FROM 0.869 TO 1.131 AT 10% LEVEL OF SIGNIFICANCE.

C. THE SLOPE TEST INDICATES THAT CALIBRATION IS BIASED.

3. TEST OF MEANS (ARE MEANS SIGNIFICANTLY DIFFERENT ?) ----

A. THE MEANS ARE NOT SIGNIFICANTLY DIFFERENT AT 5% LEVEL OF SIGNIFICANCE.

B. THE DIFFERENCE IN MEANS (ABSOLUTE) SHOULD NOT BE GREATER THAN 0.1292 AT 5% LEVEL OF SIGNIFICANCE.



NUMBER OF POINTS PLOTTED = 26
NUMBER OF MULTIPLE POINTS = 4
NUMBER OF POINTS OFF GRID = 0
NUMBER OF POINTS OMITTED = 4

*** NOTE ***
PLOT ROUTINE EXCLUDES
POINTS NOT INCLUDED
IN CALIBRATION

USGS URBAN RR MODEL(G824)

PLOT(S) OF OBSERVED AND COMPUTED DISCHARGES AND RAINFALL - SHOWING INFILTRATION
AND EXCESS - HAVE BEEN REQUESTED (COL. 78 = 1 ON CARD 8).
RAINFALL, INFILTRATION, AND EXCESS ARE WEIGHTED.
TIME RESOLUTION IS THAT OF OBSERVED DISCHARGE.

NOTE:

(1) COLUMN 1,
  (A) IF=B BEGINNING OF HYDROGRAPH AS DEFINED BY SEPARATION POINT.
  (B) IF=C CONTINUATION OF HYDROGRAPH.
  (C) IF=E ENDING OF HYDROGRAPH AS DEFINED BY SEPARATION POINT.

(2) COLUMN 2-5,
  NUMERICAL VALUE OF HYDROGRAPH ELEMENT -- NEW SEPARATION POINTS
  MAY BE DEFINED DIRECTLY FROM PLOT.

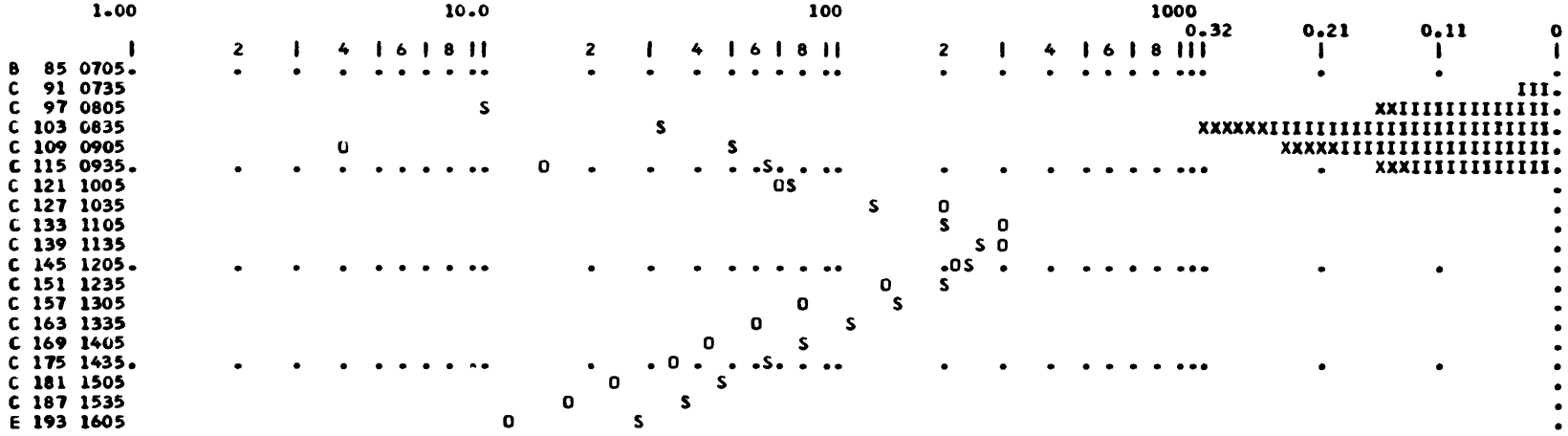
(3) COLUMN 7-10,
  TIME RELATIVE TO 24 HOUR CLOCK.

USGS URBAN RR MODEL(G824)

STATION NUMBER 02203820 SUGAR CK AT CLIFTON CH RD NR ATLANTA, GA. (Q) 12/15/73 - 12/15/73

COMPUTED (S), OBSERVED (O), BOTH (*), DISCHARGE IN CFS
NOTE -- BASE FLOW(S) SUBTRACTED FROM OBSERVED DISCHARGES IN PLOT DURING THIS RUN

WEIGHTED INFIL. (I) AND EXCESS (X) IN INCHES

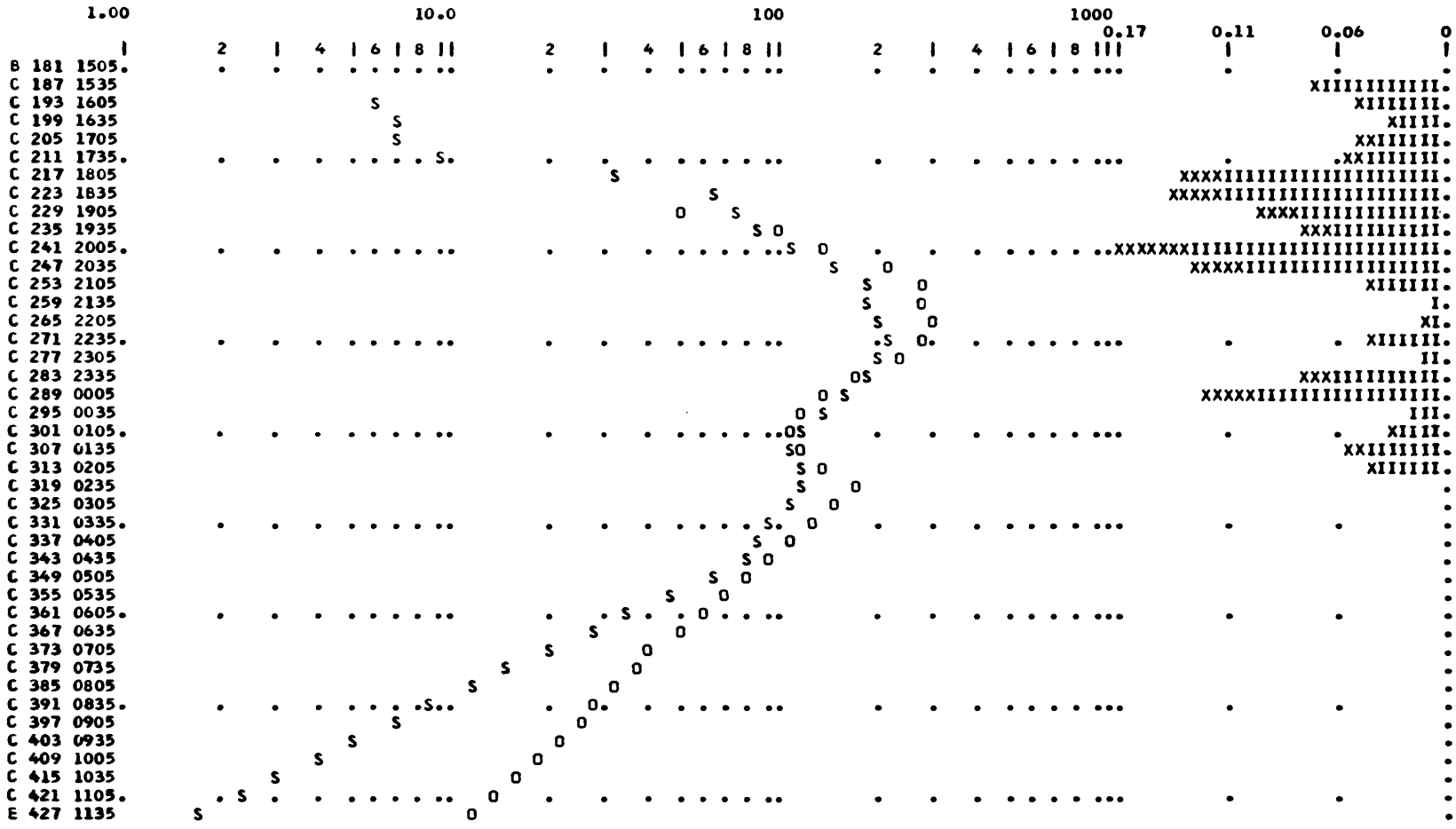


USGS URBAN RR MODEL(G824)

STATION NUMBER 02203820 SUGAR CK AT CLIFTON CH RD NR ATLANTA, GA. (Q) 2/14/74 - 2/15/74

COMPUTED (S), OBSERVED (O), BOTH (*), DISCHARGE IN CFS
NOTE -- BASE FLOW(S) SUBTRACTED FROM OBSERVED DISCHARGES IN PLOT DURING THIS RUN

WEIGHTED INFIL. (I) AND EXCESS (X) IN INCHES



FLOOD PEAK SYNTHESIS IN NATURAL OR URBAN BASINS

Program E784

Cataloged Procedure RRSIMLOG

Description

The purpose of program E784 is to synthesize a long-term record of annual floods using as input data one long-term unit rainfall record and one long-term daily rainfall and evaporation record. The 10 optimized parameters from the natural (rural) basin calibration program A634 (section 13) or the 9 optimized parameters from the urban basin calibration program G824 (section 14) are also part of the input. The log Pearson Type III frequency analysis (program E675, Isherwood and others, 1976, section C) is also part of this cataloged procedure, as well as the retrieval programs H268 and DSK268.

The output from this program contains listings, on the line printer, of identifications, such as station names and numbers, sizes of pervious, impervious, and total drainage areas, unit time interval, parameter magnitudes, listing of the magnitude and rank of the synthetic peaks and of the input data to and results of the log Pearson frequency analysis. If desired, punch cards for later input to the log Pearson Type III frequency analysis may also be obtained. (card formats given by Isherwood and others, 1976, section C).

Bias in the synthetic frequency curve caused by the calibration regression effect (loss of variance) may be corrected, at user's option, by entering the magnitude of the correlation coefficient determined in a calibration program on card type '5'.

Often the daily evaporation record begins at a later date then the long-term rainfall records. The missing record may be synthesized by using program H266 - RRGENEVP (section 7).

Precautions

1. Line printer output from this cataloged procedure is referenced by an 8-digit identifier and by the name for the discharge record station. No difficulties will arise in the user interpreting the 8-digit identifier so long as an 8-digit downstream order number is used to identify the discharge record. If a 15-digit station identifier is used, however, the output will indicate only the 8 rightmost digits of this longer identifier.

2. The input is limited to one unit rainfall record, one daily rainfall record, and one daily evaporation record. A daily rainfall and evaporation record must be furnished for the entire period of record.

3. Use of the rural or urban model is indicated on an option card; multiple syntheses using either model are possible, however, mixed rural and urban model syntheses are not permitted.

4. As a general rule, the unit time intervals used in calibration and for routing in this program should be the same.

Cataloged Procedure

```
/*RELAY  PUNCH RE2

//xxxxxxxx JOB (-------)

//PROCLIB  WRD.PROCLIB

// EXEC RRSIMLOC

//H268.SYSIN DD *

    .
    .

  Complete set of program H268 input cards generally for one long-term
  data site (additional site data can be retrieved if required).

    .
    .

//E784.SYSIN DD *
    .

  Program E784 input cards for first synthesis site (one option card only,
  see below).
    .

  Program E784 input cards for second synthesis site, etc. (do not repeat
  the option card).

    .
    .

//

$$$
```

Multiple syntheses (using either the rural or urban model) are possible for a multiple number of calibration sites using one (same) long-term data set. The rural and urban models cannot be mixed; a separate execution of the cataloged procedure must be invoked. If a Password-Agency Identification card (Z card) is required in the retrieval step, refer to Section 8 (program H268) for placement in job stream.

The default time for program H268 and DSK268 is 3 minutes and should be sufficient for most job runs. If it is necessary to change this value, it may be done by coding the following on the "EXEC" card:

```
,T1=time
```

The default time for program E784, which includes program E675, is 8 minutes. If it is necessary to change this value, it may be done by coding the following on the "EXEC" card:

,T2=time

The region for steps H268 and DSK268 is fixed at 226K and 200K respectively and should not require changing. The region for step E784 is defaulted to 400K which should be adequate for most synthesis using the urban or rural model; if it is necessary to change this value, it may be done by coding the following on the "EXEC" card:

,R=regionK

The region for program E675 is 160K and should not require changing.

If the user does not have a card punch and would like a line printer listing of the card output, he may get it by inserting the following on the "EXEC" card, in addition to making the appropriate card input changes:

,SYSOUT=A

If the user desires card images to be written on a magnetic device, then the output data set must be fully described by overriding the cataloged procedure job control language cards for the file; consult Automatic Data Section in Reston, VA, for details.

Input cards

Program H268 input cards.--These cards identify the unit rainfall, daily rainfall and evaporation records to be used in synthesizing the floods. See section 8 for format.

Program E784 Input Cards.--

A) Option card type - 'X' (mandatory).

Column	Identification
1	Card type 'X' (required).
2-6	Program option (required); 'E784R' = Rural model synthesis. 'E784U' = Urban model synthesis.
7-80	Blank.

B) Card type - '1' (mandatory).

Column	Identification
1	Card type - '1'
2-16	Unit discharge station number (right justified).
17-57	Unit discharge station name.
58-60	Log-Pearson flood base discharge (optional).
61-64	First optional skew for log-Pearson analysis (punch decimal).
65-68	Second optional skew for log-Pearson analysis (punch decimal).
69-74	Drainage area at discharge site in square miles (right justified; punch decimal if required).
75-80	If model option is: RURAL ('E784U' on option card) - punch proportion of impervious area in basin, in percent, right justified (generally blank for rural sites). URBAN ('E784U' on option card) - punch basin area in planimetric units; right justified.

NOTE: Refer to documentation for program E675 (Isherwood and others, 1976) for explanation of optional discharge base and skew values.

C) Card type '2' (mandatory)

Column	Identification
1	Card type - '2'.
2-16	Unit rainfall station identifier; this number must conform to the number used in the Station Header File (right justified).
17-65	Unit rainfall station name.
66-68	Unit precipitation recording time interval (generally 5-minute increment); right justified.

Card type 2.--continued

Column	Identification
69-74	Pervious area in planimetric units - If model option selected is: RURAL - leave blank. URBAN - punch total basin pervious area in planimetric units; right justified.
75-80	Impervious area in planimetric units - If model option selected is: RURAL - leave blank. URBAN - punch total basin impervious area in planimetric units, right justified.

D) Card type '3' (mandatory)

Column	Identification
1	Card type - '3'.
2-16	Daily rainfall station identifier (right justified).
17-65	Daily rainfall station name.
66-77	Record period, beginning after 1881, for which flood peak synthesis is desired.
	Beginning date:
66-67	Calendar year (last two digits)
68-69	Month
70-71	Day
	Ending date:
72-73	Calendar year (last two digits)
74-75	Month
76-77	Day
75-80	Blank.

E) Card type - '4' (mandatory)

Column	Identification
1	Card type - '4'.
2-16	Daily evaporation station identifier (right justified).

Card type 4.--continued

Column	Identification
17-65	Daily evaporation station name.
66-80	Blank.

F) Card type - '5' (mandatory)

Column	Identification
1	Card type - '5'.
2-9	User 8-digit identifier (optional).
10-59	Nine (urban) or 10 (rural) model parameter values - 5 columns per value. These values are the 9 or 10 optimized values for the sites calibrated using programs G824 or A634, respectively. Note on cols. 55-59 (TP/TC): If urban model is being used, leave blank; otherwise code if rural model is being used.
60-63	Time interval in minutes that was used in calibration, right justified.
64-67	Routing interval in minutes to be used in synthesis (mandatory); this time should be equal to or a multiple of the calibration interval.
68	Number of pairs of time-area cards to be read - if model option selected is: RURAL - leave blank. URBAN - punch number of pairs of time-area cards to be read (these cards describe the pervious and/or impervious area(s)) - code '1' (pervious or impervious area only), or '2' (both pervious and impervious area).
69-73	Correlation coefficient determined in the calibration programs - right justified, punch decimal.
74-77	Constant base flow to be added to all synthetic peak discharges for use in log-Pearson analysis; leave blank or punch right justified with decimal if needed.

Card type 5.--continued

Column	Identification
78*	Punch option - Leave blank, or punch '1' if punched card output in log-Pearson formats (except correlation cards(s)) are desired.
79-80	Print option - If blank, then all peak discharges in each year are printed; any non-blank character in the field indicates to print only each annual peak.

*Code this col. with a '9' to punch out a correlation coefficient card.

G) Card type - 'T' (USED ONLY IF URBAN MODEL IS SELECTED - i.e. cols. 2-6 on option card = 'E784U')

Twenty points are necessary to define the pervious and/or impervious area distributions. The 'T' cards contain 10 six-column fields for definition of time-area histograms of the pervious and/or impervious area(s) of the basin. In the urban-model calibration (program G824), multiple input (1 to 5 subbasins) was possible; however, in the urban synthesis, the basin is treated as one basin, i.e., the time-area histograms are "collapsed" into one histogram for the pervious area and/or one histogram for the impervious area. Two cards are required for the defining of the time-area histogram for the pervious and for the impervious area. The program requires that the cards for the pervious area be first. If just pervious or impervious area is present, then col. 68 on card 5 is equal to '1'; if both types of area are used, then col. 68 is equal to '2' (4 type-T cards).

Column	Identification
1	Card type - 'T'.
2-9	User specified identifier.
10-15, 16-21 22-27, 28-33 34-39, 40-45 46-51, 52-57 58-63, 64-69	Subareas in planimetric units (right justified).
70-78	Blank.
79-80	Blank or optional card sequence number.

Card reading procedure:

1. Record period date error (card 3).

   ERROR IN DATE PERIOD SPECIFIED ON CARD STA.NO. = 'station identifier'

   NOT PROCESSED

2. Card Type error

   CD. TYPE ERROR STA.NO. 'station identifier' CD. TYPE='card type' STA. NOT PROCESSED

   Program checks for valid card types 1 to 5.

3. Insufficient card data

   INSUFFICIENT CARD DATA SUPPLIED FOR SYNTHESIS TO BE COMPLETED
   ALL CARDS 1-5 REG. STA. NO. 'station identifier' NOT PROCESSED

   Program requires complete sets of cards for site to be analyzed.

4. Conversion error

   CONVERSION ERROR ENCOUNTERED. CHECK ALL INPUT CARDS FOR PROPER CODING. STATION NOT PROCESSED. STATION = 'station identifier'

   A non-numeric character was noted in a numeric data field.

5. Insufficient file data

   NUMBER OF UNIT PRECIP. DAYS AND NUMBER OF -100 INDICATORS NOT EQUAL AS INDICATED BY THE PREVIOUS SYNTHESIS ATTEMPT. STATION NOT PROCESSED.
   DISCHARGE STATION 'station identifier'
   RAINFALL STATION 'station identifier'

   To reduce computer costs, users are encouraged to synthesize peaks at several sites in one computer job if the same model is applicable. If bad file data is read, resulting in termination of synthesis for a station and the next synthesis is to use the same file data, the program passes over the synthesis request before again retrieving that data.

6. Routing, calibration, or unit rainfall time intervals in error.

   (a) ROUTING TIME LESS THAN GIVEN CALIBRATION TIME.
   (b) UNIT PRECIP. DATA GREATER THAN SPECIFIED ROUTING TIME.
   (c) UNIT PRECIP. DATA GREATER THAN SPECIFIED CALIBRATION TIME.

The program will route rainfall excess using time intervals greater than the unit data if so specified. The routing and calibration time intervals, however, must not be less than the historical unit data time interval. Also, the routing interval must be a multiple of the calibration interval.

7. Invalid option card

*** OPTION CARD WAS NOT READ OR INVALID OPTION FOUND ON CARD: PROCESSING TERMINATED.

An 'X' was not found in col. 1, or 'E784R' or 'E784U' was not found in cols. 2-6 of the first card read by the synthesis program; supply proper option card.

8. Number of time-area cards missing

URBAN MODEL IS SPECIFIED, HOWEVER NO. OF PAIRS OF T-CARDS TO BE READ (col. 68, card-5) IS MISSING: JOB ABORTED.

Supply proper data.

9. Invalid time-area cards

INVALID TYPE ROUTING CARD (TYPE-T) FOUND FOR URBAN MODEL SYNTHESIS FOR STATION 'station identifier'; JOB ABORTED.

Check for a 'T' in col. 1 on all time-area cards.

Disk-record retrieval:

1. Daily record not found

a. For rainfall data

WATER YR + 'year' NOT FOUND STA.NO. 'station identifier' PREC. DATA

b. For evaporation data

GIVEN YR NOT FOUND = 'year' STA.NO. 'station identifier' FOR EVAP. DATA

The program reads consecutive water years of data from the disk file. If a desired water year, within a record period specified, is not found, the above message is printed.

2. No storm data found for given year

NO STORMS ON FILE FOR WATER YR 'year' STA 'station identifier' 1 CFS WILL BE STORED IN DISCHARGE PEAK ARRAY

The program, after reading a given water year of daily data, tests each record for -100 indicators and if none are found the above

message will result. The "1 cfs" value is stored to permit a "log-Pearson Type III" analysis to be made later.

3. Unit precipitation and -100 indicators do not match

UNIT PREC. DAYS = 'number of days' NOT EQ DAILY - 100 INDICS = 'number of days'
UNIT STA.NO. 'station identifier'

Unit precipitation days and -100 indicators must match before synthesis is attempted for given year.

4. Flood events for given year do not match

NO. EVENTS NOT THE SAME FOR UNIT AND DAILY RAINFALL STA. NO. 'station identifier'

Events computed must match for both types of data.

5. Missing value indicators

SEE LIST AT END OF PEAK DISCHARGE SUMMARY FOR DATES OF MISSING VALUE INDICATORS (9999) IN DAILY FILE

The National Climatic Center has sometimes used values of 8888 or 9999 to indicate missing daily rainfall data. If the program encounters a daily rainfall value greater than 5555, it sets that value to zero, and prints the date of that value in a list after printing the peak discharge summary.

Disk on-key conditions:

1. Station record not found

STA. REC. NOT FOUND DATA USED FOR KEY: 'station identifier' '999999' '999999' 'parameter code' 'statistic code' 'readings per day' 'record count'

The program sets up a key for each record to be retrieved from file. If the record is not found the above message is printed and program branches to read the next card set. Record count is the number of days of unit-value records or number of years of daily-value records retrieved from the files.

2. Others on-key conditions

ON KEY CONDITION RAISED KEY CONDITION = 'condition code number'
   a) DURING DAILY RAINFALL RETRIEVAL
   b) DURING DAILY EVAPORATION RETRIEVAL
or c) DURING UNIT RAINFALL RETRIEVAL

This is an unrecoverable error by the program. The ADP section should be notified if this error is encountered.

Examples of Setting Up Jobs

Two examples using this program will be presented to illustrate use of the "rural" model, and of the "urban" model. In these examples, the "rural" station is located in northern Florida and the "urban" station is located near Atlanta, Georgia. The examples are separately shown for clarity; the examples could be executed in one job, i.e., two executions of the cataloged procedure.

For simplicity, the same long-term data will be used in both examples. The long-term daily rainfall and unit rainfall data are at the Atlanta, Georgia, airport and the lone-term daily evaporation data (partly generated) is at Athens, Georgia. The Atlanta airport station identifier is 33390008426001 and the Athens station identifier is 33570008319001. All necessary station information is stored in the WRD Station Header file, and all data are available in the Current Unit and Daily Values Files. The long-term unit data is stored as 288 readings per day (5-minute data). The synthesis period will encompass water years 1898-1973.

Example 1.--Caney Creek near Monticello, Florida, (station identifier 02326598) is a rural station approximately 230 miles south of Atlanta. The basin drainage area is 2.54 sq miles. THe calibration interval was 15 minutes and was completed using 0.01 percent impervious area. The ten parameter values, determined from the calibration and used to synthesize annual floods, follows:

PSP =	3.418	EVC =	0.897
KSAT =	0.144	RR =	0.870
DRN =	1.000	KSN =	1.320
RGF =	11.73	TC =	220.0
BMSM =	7.222	TP/TC =	0.500

The average base flow from the calibration is 9 cfs. The correlation coefficient, based on the logarithms of observed and computed peak discharges used in the calibration, is 0.946. Data to be used in the log-Pearson Type III flood-frequency analysis of synthetic peaks (executed automatically by use of cataloged procedure) includes a flood base of 1 cfs and a generalized skew coefficient of 0.0; an alternate skew coefficient of -0.1 will also be used. A listing of the magnitudes and the annual synthetic peaks will be obtained.

The job deck and printout follow description of the second example.

Example 2.--Sugar Creek at Clifton Church Road near Atlanta, Georgia, (station identifier 02203820) is an urban basin just south of Atlanta. The site was calibrated using the distributive urban model (user defined translation histograms). The basin drainage area is 8.67 sq. miles (52,947 planimetric units). The basin consists of 43,461 planimetric units of pervious area and 9,486 planimetric units of effective impervious area. The calibration interval was 5 minutes. The nine parameter values determined from the calibration and used to synthesize annual floods, follow:

PSP =	2.820	EVC =	0.787
KSAT =	0.225	RR =	0.880
DRN =	1.000	KSW =	2.200
RGF =	13.50	TC =	190.0
BMSM =	7.837		

The average base flow from the calibration is 21 cfs. The correlation coefficient, based on the logarithms of observed and computed peak discharges used in the calibration, is 0.888. Data to be used in the log-Pearson Type III flood-frequency analysis of synthetic peaks includes a flood base of 1 cfs and a generalized skew coefficient of 0.0; an alternate skew coefficient of -0.1 will also be used. A listing of magnitudes of all synthetic peaks in each year will be obtained; a listing of each annual synthetic peak is obtained automatically.

The distribution of pervious area and impervious areas in planimetric units are as follows:

Time zone	Accumulative area, in planimetric units	
	Pervious	Impervious
1	651	52
2	2415	203
3	4586	379
4	6879	485
5	8935	635
6	10738	774
7	12794	907
8	14893	1094
9	16892	1295
10	18957	1459
11	21130	1612
12	23392	1870
13	25686	2424
14	27949	3161
15	30461	4002
16	33401	5320
17	36786	6505
18	40033	7748
19	42301	8902
20	43461	9486

The separate time-area histograms for each rain-gage subbasin used in calibrating the urban model are combined into one time-area histogram for the pervious and for the impervious areas.

The job deck and printout follow those for first example.

PROGRAMMER _____ DIVISION _____
LOCATION _____ PHONE _____

U. S. DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
COMPUTER CODING FORM

PROGRAM NO. _____
PROJECT _____
SHEET ___ OF ___

PROGRAM IDENTIFICATION: _____
PROGRAM INFORMATION: Example 1

STATEMENT IDENTIFICATION

```
//*RELAY  PUNCH REZ
//XXXXXXXX JOB (-------)
//*PROCLIB  WRD.PROCLIB
//  EXEC RRSIMLOG
//H268.SYSIN DD *
D333900008426000 1                    000450000061897100119730930PASS
U333900008426000 1                    000450000061897100119730930PASS
D335700008319000 1                    000450000061897100119730930PASS
//E784.SYSIN DD *
XE784R
1          02326598CANEY CREEK NR MONTICELLO, FL                  1.0 0.0-0.1  2.54  0.01
233390008426000 1ATLANTA, GA - AP                                      5
333390008426000 1ATLANTA, GA - AP                                  971001730930
433570008319000 1ATHENS, GA
502326598 3.1480. 1441 .00011.737.2220.8970.8701.320220.00.500   15  15 0.946 9.0 XX
//
$$$
```

15-13

FORM 9—1634 A
JULY 1967

0 = ZERO Ø = ALPHA O 1 = ONE I = ALPHA I 2 = TWO Z = ALPHA Z / = SLASH | = VERT. BAR - = MINUS _ = HORZ. BAR

PROGRAM CODING FORM

PROGRAM H268 , REVISED DEC 1975

RETRIEVE, PRINT, PUNCH AND/OR PASS UNIT AND DAILY VALUES FOR RAINFALL-RUNOFF MODELING PROGRAMS

MESSAGES - RETRIEVALS MADE AND ATTEMPTED, AND ERRORS FOLLOW:

DAILY VALUES DATA RETRIEVAL: STATION=333900084260001 PARAMETER= 45 STATISTIC= 6
THE WATER YEARS LISTED BELOW WERE RETRIEVED, PASSED:

1898	1899	1900	1901	1902	1903	1904	1905	1906	1907	1908
1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919
1920	1921	1922	1923	1924	1925	1926	1927	1928	1929	1930
1931	1932	1933	1934	1935	1936	1937	1938	1939	1940	1941
1942	1943	1944	1945	1946	1947	1948	1949	1950	1951	1952
1953	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963
1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	

UNIT VALUES DATA RETRIEVAL: STATION=333900084260001 PARAMETER= 45 STATISTIC= 6
THE DATES LISTED BELOW WERE RETRIEVED, PASSED:

JULY 22, 1898(288)	JULY 23, 1898(288)	AUG. 26, 1898(288)	AUG. 27, 1898(288)	SEP. 1, 1898(288)	SEP. 2, 1898(288)
SEP. 3, 1898(288)	OCT. 2, 1898(288)	OCT. 3, 1898(288)	OCT. 4, 1898(288)	FEB. 26, 1899(288)	JULY 21, 1899(288)
AUG. 29, 1899(288)	AUG. 30, 1899(288)	SEP. 10, 1899(288)	DEC. 23, 1899(288)	FEB. 10, 1900(288)	FEB. 11, 1900(288)
FEB. 12, 1900(288)	MAR. 7, 1900(288)	MAR. 8, 1900(288)	JUNE 21, 1900(288)	JUNE 22, 1900(288)	JUNE 23, 1900(288)
JUNE 24, 1900(288)	JULY 29, 1900(288)	SEP. 14, 1900(288)	SEP. 15, 1900(288)	NOV. 24, 1900(288)	NOV. 25, 1900(288)
JAN. 10, 1901(288)	JAN. 11, 1901(288)	FEB. 3, 1901(288)	MAR. 25, 1901(288)	MAR. 26, 1901(288)	APR. 13, 1901(288)
MAY 20, 1901(288)	MAY 21, 1901(288)	AUG. 21, 1901(288)	AUG. 22, 1901(288)	DEC. 28, 1901(288)	DEC. 29, 1901(288)
JAN. 31, 1902(288)	FEB. 1, 1902(288)	FEB. 27, 1902(288)	MAR. 16, 1902(288)	DEC. 15, 1902(288)	DEC. 16, 1902(288)
FEB. 7, 1903(288)	FEB. 16, 1903(288)	MAR. 20, 1903(288)	MAR. 21, 1903(288)	MAR. 22, 1903(288)	MAR. 23, 1903(288)
MAR. 28, 1903(288)	MAR. 29, 1903(288)	MAR. 30, 1903(288)	MAY 31, 1903(288)	JUNE 4, 1903(288)	JUNE 5, 1903(288)
NOV. 3, 1903(288)	MAY 29, 1904(288)	MAY 30, 1904(288)	MAY 31, 1904(288)	AUG. 7, 1904(288)	AUG. 8, 1904(288)
AUG. 26, 1904(288)	JAN. 11, 1905(288)	JAN. 12, 1905(288)	JULY 10, 1905(288)	SEP. 30, 1905(288)	DEC. 2, 1905(288)
DEC. 3, 1905(288)	JAN. 3, 1906(288)	MAR. 14, 1906(288)	MAR. 15, 1906(288)	MAR. 18, 1906(288)	MAR. 19, 1906(288)
MAY 25, 1906(288)	JUNE 12, 1906(288)	JUNE 13, 1906(288)	JULY 17, 1906(288)	OCT. 1, 1906(288)	OCT. 2, 1906(288)
OCT. 3, 1906(288)	FEB. 4, 1907(288)	APR. 22, 1907(288)	JULY 9, 1907(288)	JULY 10, 1907(288)	DEC. 22, 1907(288)
JAN. 31, 1908(288)	FEB. 14, 1908(288)	MAR. 22, 1908(288)	MAR. 23, 1908(288)	APR. 24, 1908(288)	APR. 25, 1908(288)
JULY 5, 1908(288)	AUG. 23, 1908(288)	DEC. 21, 1908(288)	DEC. 22, 1908(288)	FEB. 9, 1909(288)	FEB. 15, 1909(288)
MAR. 9, 1909(288)	MAR. 11, 1909(288)	MAR. 12, 1909(288)	MAR. 13, 1909(288)	AUG. 1, 1909(288)	AUG. 2, 1909(288)
AUG. 3, 1909(288)	AUG. 4, 1909(288)	APR. 16, 1910(288)	APR. 17, 1910(288)	MAY 19, 1910(288)	MAY 20, 1910(288)
MAY 24, 1910(288)	OCT. 6, 1910(288)	OCT. 7, 1910(288)	JAN. 2, 1911(288)	JAN. 3, 1911(288)	APR. 4, 1911(288)
APR. 5, 1911(288)	JULY 13, 1911(288)	JULY 16, 1911(288)	OCT. 16, 1911(288)	NOV. 8, 1911(288)	DEC. 22, 1911(288)
JAN. 28, 1912(288)	JAN. 29, 1912(288)	FEB. 14, 1912(288)	MAR. 14, 1912(288)	MAR. 15, 1912(288)	APR. 15, 1912(288)
APR. 16, 1912(288)	JUNE 13, 1912(288)	JUNE 24, 1912(288)	OCT. 3, 1912(288)	OCT. 4, 1912(288)	JAN. 26, 1913(288)
JAN. 27, 1913(288)	MAR. 12, 1913(288)	MAR. 13, 1913(288)	MAR. 14, 1913(288)	MAR. 15, 1913(288)	MAR. 21, 1913(288)
FEB. 6, 1914(288)	APR. 13, 1914(288)	APR. 14, 1914(288)	AUG. 20, 1914(288)	OCT. 14, 1914(288)	OCT. 15, 1914(288)
NOV. 15, 1914(288)	DEC. 3, 1914(288)	DEC. 4, 1914(288)	MAY 7, 1915(288)	DEC. 17, 1915(288)	DEC. 18, 1915(288)
DEC. 28, 1915(288)	DEC. 29, 1915(288)	MAY 21, 1916(288)	MAY 22, 1916(288)	MAY 23, 1916(288)	JULY 6, 1916(288)
JULY 7, 1916(288)	JULY 8, 1916(288)	JULY 9, 1916(288)	JULY 10, 1916(288)	FEB. 19, 1917(288)	FEB. 20, 1917(288)
MAR. 3, 1917(288)	MAR. 4, 1917(288)	MAR. 24, 1917(288)	MAR. 27, 1917(288)	APR. 4, 1917(288)	APR. 5, 1917(288)
SEP. 27, 1917(288)	SEP. 28, 1917(288)	JAN. 11, 1918(288)	APR. 7, 1918(288)	APR. 8, 1918(288)	NOV. 27, 1918(288)
NOV. 28, 1918(288)	DEC. 20, 1918(288)	DEC. 21, 1918(288)	DEC. 22, 1918(288)	MAY 6, 1919(288)	MAY 7, 1919(288)
JULY 8, 1919(288)	JULY 9, 1919(288)	JULY 10, 1919(288)	DEC. 7, 1919(288)	DEC. 8, 1919(288)	DEC. 9, 1919(288)
FEB. 3, 1920(288)	FEB. 4, 1920(288)	MAR. 12, 1920(288)	AUG. 15, 1920(288)	NOV. 15, 1920(288)	NOV. 16, 1920(288)
FEB. 7, 1921(288)	FEB. 8, 1921(288)	FEB. 9, 1921(288)	FEB. 10, 1921(288)	AUG. 24, 1921(288)	NOV. 16, 1921(288)
FEB. 13, 1922(288)	FEB. 14, 1922(288)	FEB. 15, 1922(288)	MAR. 9, 1922(288)	MAR. 10, 1922(288)	MAY 2, 1922(288)
MAY 3, 1922(288)	MAY 4, 1922(288)	JUNE 1, 1922(288)	JULY 19, 1922(288)	OCT. 6, 1922(288)	FEB. 13, 1923(288)
MAR. 12, 1923(288)	MAR. 13, 1923(288)	MAY 15, 1923(288)	MAY 16, 1923(288)	DEC. 4, 1923(288)	APR. 4, 1924(288)
APR. 17, 1924(288)	APR. 18, 1924(288)	MAY 27, 1924(288)	JULY 3, 1924(288)	DEC. 7, 1924(288)	DEC. 8, 1924(288)

JAN. 10, 1925(288)	JAN. 11, 1925(288)	JAN. 15, 1925(288)	JAN. 16, 1925(288)	JAN. 17, 1925(288)	JAN. 18, 1925(288)
NOV. 1, 1925(288)	NOV. 2, 1925(288)	JAN. 3, 1926(288)	JAN. 4, 1926(288)	JAN. 5, 1926(288)	JAN. 17, 1926(288)
JAN. 18, 1926(288)	FEB. 17, 1926(288)	FEB. 18, 1926(288)	FEB. 19, 1926(288)	MAR. 30, 1926(288)	AUG. 11, 1926(288)
NOV. 15, 1926(288)	FEB. 13, 1927(288)	FEB. 23, 1927(288)	DEC. 1, 1927(288)	DEC. 2, 1927(288)	DEC. 3, 1927(288)
MAY 19, 1928(288)	MAY 20, 1928(288)	MAY 23, 1928(288)	JUNE 12, 1928(288)	JUNE 13, 1928(288)	JULY 9, 1928(288)
JULY 10, 1928(288)	AUG. 14, 1928(288)	AUG. 15, 1928(288)	FEB. 26, 1929(288)	FEB. 27, 1929(288)	FEB. 28, 1929(288)
MAR. 4, 1929(288)	MAR. 13, 1929(288)	MAR. 14, 1929(288)	MAR. 15, 1929(288)	MAR. 21, 1929(288)	MAR. 22, 1929(288)
MAR. 23, 1929(288)	SEP. 24, 1929(288)	SEP. 25, 1929(288)	SEP. 30, 1929(288)	OCT. 1, 1929(288)	JAN. 28, 1930(288)
JAN. 29, 1930(288)	MAR. 6, 1930(288)	MAR. 7, 1930(288)	MAY 16, 1930(288)	MAY 17, 1930(288)	NOV. 14, 1930(288)
NOV. 15, 1930(288)	NOV. 16, 1930(288)	JULY 28, 1931(288)	AUG. 10, 1931(288)	DEC. 3, 1931(288)	DEC. 4, 1931(288)
DEC. 16, 1931(288)	DEC. 17, 1931(288)	FEB. 21, 1932(288)	JUNE 18, 1932(288)	JUNE 19, 1932(288)	OCT. 15, 1932(288)
OCT. 16, 1932(288)	DEC. 15, 1932(288)	DEC. 16, 1932(288)	DEC. 17, 1932(288)	DEC. 26, 1932(288)	DEC. 27, 1932(288)
DEC. 28, 1932(288)	MAR. 19, 1933(288)	MAR. 20, 1933(288)	JUNE 9, 1933(288)	JUNE 10, 1933(288)	FEB. 25, 1934(288)
MAR. 3, 1934(288)	MAR. 4, 1934(288)	JULY 19, 1934(288)	OCT. 5, 1934(288)	OCT. 6, 1934(288)	MAR. 5, 1935(288)
MAR. 6, 1935(288)	SEP. 10, 1935(288)	NOV. 12, 1935(288)	JAN. 2, 1936(288)	FEB. 3, 1936(288)	APR. 5, 1936(288)
APR. 6, 1936(288)	APR. 7, 1936(288)	SEP. 29, 1936(288)	APR. 29, 1937(288)	JUNE 15, 1937(288)	JUNE 16, 1937(288)
JUNE 17, 1937(288)	OCT. 18, 1937(288)	OCT. 19, 1937(288)	MAR. 31, 1938(288)	APR. 1, 1938(288)	APR. 6, 1938(288)
APR. 8, 1938(288)	JUNE 25, 1938(288)	JUNE 26, 1938(288)	SEP. 27, 1938(288)	NOV. 16, 1938(288)	FEB. 27, 1939(288)
FEB. 28, 1939(288)	MAR. 29, 1939(288)	MAR. 30, 1939(288)	JUNE 22, 1939(288)	AUG. 17, 1939(288)	JULY 8, 1940(288)
JULY 9, 1940(288)	AUG. 12, 1940(288)	AUG. 13, 1940(288)	SEP. 10, 1940(288)	JUNE 23, 1941(288)	JUNE 24, 1941(288)
AUG. 13, 1941(288)	DEC. 22, 1941(288)	DEC. 23, 1941(288)	FEB. 16, 1942(288)	FEB. 17, 1942(288)	MAR. 2, 1942(288)
MAR. 20, 1942(288)	MAR. 21, 1942(288)	SEP. 26, 1942(288)	SEP. 27, 1942(288)	JAN. 17, 1943(288)	JAN. 18, 1943(288)
MAR. 20, 1943(288)	MAR. 21, 1943(288)	APR. 18, 1943(288)	APR. 19, 1943(288)	JUNE 29, 1943(288)	JUNE 30, 1943(288)
NOV. 7, 1943(288)	APR. 26, 1944(288)	SEP. 10, 1944(288)	SEP. 11, 1944(288)	DEC. 7, 1944(288)	APR. 24, 1945(288)
JUNE 18, 1945(288)	JULY 25, 1945(288)	OCT. 22, 1945(288)	JAN. 5, 1946(288)	JAN. 6, 1946(288)	MAR. 28, 1946(288)
JUNE 16, 1946(288)	JAN. 18, 1947(288)	JAN. 19, 1947(288)	JAN. 20, 1947(288)	MAR. 5, 1947(288)	MAR. 6, 1947(288)
MAR. 7, 1947(288)	MAY 20, 1947(288)	JUNE 20, 1947(288)	JUNE 21, 1947(288)	AUG. 8, 1947(288)	NOV. 7, 1947(288)
NOV. 11, 1947(288)	MAR. 22, 1948(288)	MAR. 23, 1948(288)	MAY 28, 1948(288)	MAY 29, 1948(288)	JULY 10, 1948(288)
JULY 11, 1948(288)	JULY 14, 1948(288)	NOV. 26, 1948(288)	NOV. 28, 1948(288)	JAN. 4, 1949(288)	JAN. 5, 1949(288)
APR. 28, 1949(288)	APR. 29, 1949(288)	AUG. 21, 1949(288)	AUG. 22, 1949(288)	JULY 28, 1950(288)	AUG. 25, 1950(288)
AUG. 26, 1950(288)	SEP. 6, 1950(288)	SEP. 7, 1950(288)	OCT. 19, 1950(288)	FEB. 20, 1951(288)	JULY 26, 1951(288)
JULY 29, 1951(288)	SEP. 22, 1951(288)	DEC. 20, 1951(288)	DEC. 21, 1951(288)	MAR. 3, 1952(288)	MAR. 10, 1952(288)
AUG. 29, 1952(288)	APR. 12, 1953(288)	APR. 30, 1953(288)	SEP. 25, 1953(288)	SEP. 26, 1953(288)	DEC. 3, 1953(288)
DEC. 4, 1953(288)	JAN. 21, 1954(288)	MAY 13, 1954(288)	JULY 14, 1954(288)	JAN. 10, 1955(288)	FEB. 5, 1955(288)
FEB. 6, 1955(288)	MAR. 15, 1956(288)	MAR. 16, 1956(288)	APR. 11, 1956(288)	APR. 15, 1956(288)	SEP. 24, 1956(288)
SEP. 25, 1956(288)	DEC. 22, 1956(288)	DEC. 23, 1956(288)	APR. 4, 1957(288)	APR. 5, 1957(288)	JULY 2, 1957(288)
JULY 3, 1957(288)	NOV. 17, 1957(288)	NOV. 18, 1957(288)	FEB. 5, 1958(288)	FEB. 6, 1958(288)	MAY 11, 1958(288)
JULY 20, 1958(288)	SEP. 21, 1958(288)	MAR. 5, 1959(288)	MAY 30, 1959(288)	MAY 31, 1959(288)	OCT. 13, 1959(288)
OCT. 14, 1959(288)	JAN. 17, 1960(288)	JAN. 29, 1960(288)	JAN. 30, 1960(288)	APR. 3, 1960(288)	APR. 4, 1960(288)
AUG. 9, 1960(288)	SEP. 26, 1960(288)	SEP. 27, 1960(288)	SEP. 28, 1960(288)	FEB. 18, 1961(288)	FEB. 19, 1961(288)
FEB. 20, 1961(288)	FEB. 24, 1961(288)	FEB. 25, 1961(288)	MAR. 30, 1961(288)	MAR. 31, 1961(288)	JUNE 20, 1961(288)
JUNE 21, 1961(288)	DEC. 10, 1961(288)	DEC. 11, 1961(288)	DEC. 12, 1961(288)	FEB. 21, 1962(288)	FEB. 22, 1962(288)
MAR. 10, 1962(288)	MAR. 11, 1962(288)	APR. 11, 1962(288)	APR. 12, 1962(288)	SEP. 26, 1962(288)	NOV. 21, 1962(288)
APR. 28, 1963(288)	APR. 29, 1963(288)	APR. 30, 1963(288)	JULY 24, 1963(288)	SEP. 27, 1963(288)	SEP. 28, 1963(288)
SEP. 29, 1963(288)	MAR. 14, 1964(288)	MAR. 15, 1964(288)	MAR. 25, 1964(288)	MAR. 26, 1964(288)	APR. 6, 1964(288)
APR. 27, 1964(288)	MAY 2, 1964(288)	MAY 3, 1964(288)	OCT. 15, 1964(288)	OCT. 16, 1964(288)	JAN. 23, 1965(288)
JUNE 7, 1965(288)	JUNE 10, 1965(288)	JUNE 11, 1965(288)	SEP. 30, 1965(288)	OCT. 1, 1965(288)	FEB. 12, 1966(288)
FEB. 13, 1966(288)	OCT. 18, 1966(288)	OCT. 23, 1966(288)	OCT. 24, 1966(288)	NOV. 9, 1966(288)	NOV. 10, 1966(288)
MAR. 10, 1967(288)	MAY 21, 1967(288)	MAY 22, 1967(288)	AUG. 23, 1967(288)	AUG. 24, 1967(288)	OCT. 31, 1967(288)
NOV. 1, 1967(288)	MAR. 11, 1968(288)	MAR. 12, 1968(288)	APR. 4, 1968(288)	APR. 5, 1968(288)	DEC. 21, 1968(288)
DEC. 22, 1968(288)	APR. 17, 1969(288)	APR. 18, 1969(288)	MAY 8, 1969(288)	SEP. 22, 1969(288)	SEP. 23, 1969(288)
MAR. 19, 1970(288)	OCT. 29, 1970(288)	MAR. 1, 1971(288)	MAR. 2, 1971(288)	MAR. 3, 1971(288)	MAR. 25, 1971(288)
JULY 31, 1971(288)	SEP. 17, 1971(288)	JAN. 9, 1972(288)	JAN. 10, 1972(288)	JAN. 11, 1972(288)	JAN. 29, 1972(288)
JAN. 30, 1972(288)	MAY 13, 1972(288)	JUNE 19, 1972(288)	JUNE 20, 1972(288)	OCT. 27, 1972(288)	DEC. 14, 1972(288)
DEC. 15, 1972(288)	DEC. 20, 1972(288)	DEC. 21, 1972(288)	JAN. 7, 1973(288)	JAN. 8, 1973(288)	FEB. 1, 1973(288)
MAR. 16, 1973(288)	MAR. 30, 1973(288)	MAR. 31, 1973(288)	APR. 7, 1973(288)	MAY 19, 1973(288)	MAY 20, 1973(288)
MAY 28, 1973(288)					

DAILY VALUES DATA RETRIEVAL: STATION=335700083190001 PARAMETER= 50 STATISTIC= 6
THE WATER YEARS LISTED BELOW WERE RETRIEVED. PASSED:

1898	1899	1900	1901	1902	1903	1904	1905	1906	1907	1908
1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919
1920	1921	1922	1923	1924	1925	1926	1927	1928	1929	1930
1931	1932	1933	1934	1935	1936	1937	1938	1939	1940	1941
1942	1943	1944	1945	1946	1947	1948	1949	1950	1951	1952
1953	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963
1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	

PROGRAM DSK268 REVISED 04-01-75

CREATES A TEMPERARY ISAM FILE FOR RAINFALL-RUNOFF PROGRAMS

SUMMARY OF RECORDS ENTERED INTO ISAM FILE:

STA= 333900084260001	PARM=	45	STAT=	6	RPD=	1	RECORDS WRITTEN=	76
STA= 333900084260001	PARM=	45	STAT=	6	RPD=	288	RECORDS WRITTEN=	565
STA= 335700083190001	PARM=	50	STAT=	6	RPD=	1	RECORDS WRITTEN=	76

END PROGRAM DSK268

BEGIN PROGRAM E784
ANNUAL PEAK DISCHARGE SYNTHESIS
REVISION OF 8-1-76

OPTION TO USE RURAL BASIN FLOOD HYDROGRAPH MODEL WAS SELECTED.

PROCESS DATE 08/20/76

****
***** ANNUAL PEAK DISCHARGE SYNTHESIS *****
***** VIA RURAL BASIN FLOOD HYDROGRAPH MODEL *****
****

SYNTHESIS USES HISTORICAL RAINFALL FROM 1898 TO 1973

DISCHARGE STATION: 02326598 CANEY CREEK NR MONTICELLO, FLA.
TOTAL DRAINAGE AREA= 2.540 SQUARE MILES
PERVIOUS DRAINAGE AREA= 2.540 SQUARE MILES (99.99 %)
IMPERVIOUS DRAINAGE AREA= 0.000 SQUARE MILES (0.01 %)
ROUTING INTERVAL= 15 MINUTES

UNIT RAINFALL STATION: 333900084260001 ATLANTA, GEORGIA-AP
UNIT RAINFALL IS DEFINED AT 5 MINUTE INTERVALS
AND WILL BE SMOOTHED TO 15 MINUTE INTERVALS
AS WAS USED IN THE CALIBRATION OF THE MODEL.

DAILY RAINFALL STATION: 333900084260001 ATLANTA, GEORGIA-AP

PAN EVAPORATION STATION: 335700083190001 ATHENS, GEORGIA

FOLLOWING ARE PARAMETER VALUES:

PSP=	3.148
KSAT=	0.144
DRN=	1.000
RGF=	11.730
BMSM=	7.222
EVC=	0.897
RR=	0.870
KSW=	1.320
TC=	220.000
TP/TC=	0.500

FOLLOWING ARE INITIAL CONDITIONS:

BMS=0.5*BMSM
SMS=0
CONSTANT BASE FLOW (USER SUPPLIED) TO BE ADDED TO ALL PEAK DISCHARGES = 9.0 CFS
CORRELATION COEFF. TO BE USED IN LOG-PEARSON ANALYSIS = 0.946

PROCESS DATE 08/20/76

****
***** ANNUAL PEAK DISCHARGE SYNTHESIS *****
***** VIA RURAL BASIN FLOOD HYDROGRAPH MODEL *****
****

DISCHARGE STATION: 02326598 CANEY CREEK NR MONTICELLO, FLA.
RAINFALL STATION: 333900084260001 ATLANTA, GEORGIA-AP

(OPTION TO NOT PRINT ALL PEAK DISCHARGES IN EACH YEAR WAS SELECTED)

****
***** ANNUAL PEAK DISCHARGE SYNTHESIS *****
***** VIA RURAL BASIN FLOOD HYDROGRAPH MODEL *****
****

DISCHARGE STATION: 02326598 CANEY CREEK NR MONTICELLO, FLA.
RAINFALL STATION: 333900084260001 ATLANTA, GEORGIA-AP

ANNUAL PEAK DISCHARGE SUMMARY (1898-1973)

WATER YEAR	DISCHARGE (CFS)	RANK
1898	827	3
1899	280	33
1900	262	40
1901	554	12
1902	206	51
1903	189	53
1904	151	59
1905	89	69
1906	295	32
1907	54	75
1908	727	4
1909	266	36
1910	61	73
1911	84	70
1912	1492	1
1913	316	29
1914	615	9
1915	211	50
1916	181	54
1917	216	48
1918	56	74
1919	249	41
1920	655	6
1921	556	11
1922	458	18
1923	296	31
1924	165	57
1925	328	27
1926	633	8
1927	71	71
1928	511	16
1929	263	39
1930	108	66
1931	112	65
1932	235	43
1933	328	28
1934	155	58
1935	70	72
1936	518	14
1937	301	30
1938	439	19
1939	246	42
1940	418	22
1941	268	35
1942	497	17

****
***** ANNUAL PEAK DISCHARGE SYNTHESIS *****
***** VIA RURAL BASIN FLOOD HYDROGRAPH MODEL *****
****

(ANNUAL PEAK LIST CONTINUED)

1943	383	23
1944	331	26
1945	514	15
1946	429	21
1947	337	25
1948	716	5
1949	264	37
1950	141	61
1951	232	45
1952	219	47
1953	173	55
1954	230	46
1955	166	56
1956	143	60
1957	100	68
1958	641	7
1959	37	76
1960	277	34
1961	561	10
1962	216	49
1963	339	24
1964	233	44
1965	100	67
1966	202	52
1967	523	13
1968	116	64
1969	439	20
1970	123	63
1971	264	38
1972	130	62
1973	828	2

NOTE: DISCHARGES INCLUDE USER SUPPLIED BASE FLOW (9.0 CFS).

***** ANNUAL PEAK DISCHARGE SYNTHESIS *****
***** VIA RURAL &ASIN FLOOD HYDROGRAPH MODEL *****

CARD IMAGES SENT TO LOG PEARSON PROGRAM LISTED BELOW-(STATION ID TRUNCATED TO RIGHT MOST 8-DIGITS)

```
1                                                                                    (PLOT OPTION CARD)
S CANEY CREEK NR MONTICELLO, FLA.                          1  0.0 -0.1 7602326598XX  (HEADER CARD)
    827    280    262    554    206    189    151     89    295     5402326598XX  (DATA CARD)
    727    266     61     84   1492    316    615    211    181    21602326598XX  (DATA CARD)
     56    249    655    556    458    296    165    328    633     7102326598XX  (DATA CARD)
    511    263    108    112    235    328    155     70    518    30102326598XX  (DATA CARD)
    439    246    418    268    497    383    331    514    429    33702326598XX  (DATA CARD)
    716    264    141    232    219    173    230    166    143    10002326598XX  (DATA CARD)
    641     37    277    561    216    339    233    100    202    52302326598XX  (DATA CARD)
    116    439    123    264    130    828      0      0      0      002326598XX  (DATA CARD)
0.946                                                                                (CORRELATION COEFF. CARD)
```

END PROGRAM E784.

LOG-PEARSON PGM. E675X

S CANEY CREEK NR MONTICELLO, FLA. NO. OF ITEMS = 76 STATION 2326598 CODE XX

****

DATA USED IN CALCULATIONS

827.000	280.000	262.000	554.000	206.000	189.000	151.000	89.000	295.000	54.000
727.000	266.000	61.000	84.000	1492.000	316.000	615.000	211.000	181.000	216.000
56.000	249.000	655.000	556.000	458.000	296.000	165.000	328.000	633.000	71.000
511.000	263.000	108.000	112.000	235.000	328.000	155.000	70.000	518.000	301.000
439.000	246.000	418.000	268.000	497.000	383.000	331.000	514.000	429.000	337.000
716.000	264.000	141.000	232.000	219.000	173.000	230.000	166.000	143.000	100.000
641.000	37.000	277.000	561.000	216.000	339.000	233.000	100.000	202.000	523.000
116.000	439.000	123.000	264.000	130.000	828.000				

****

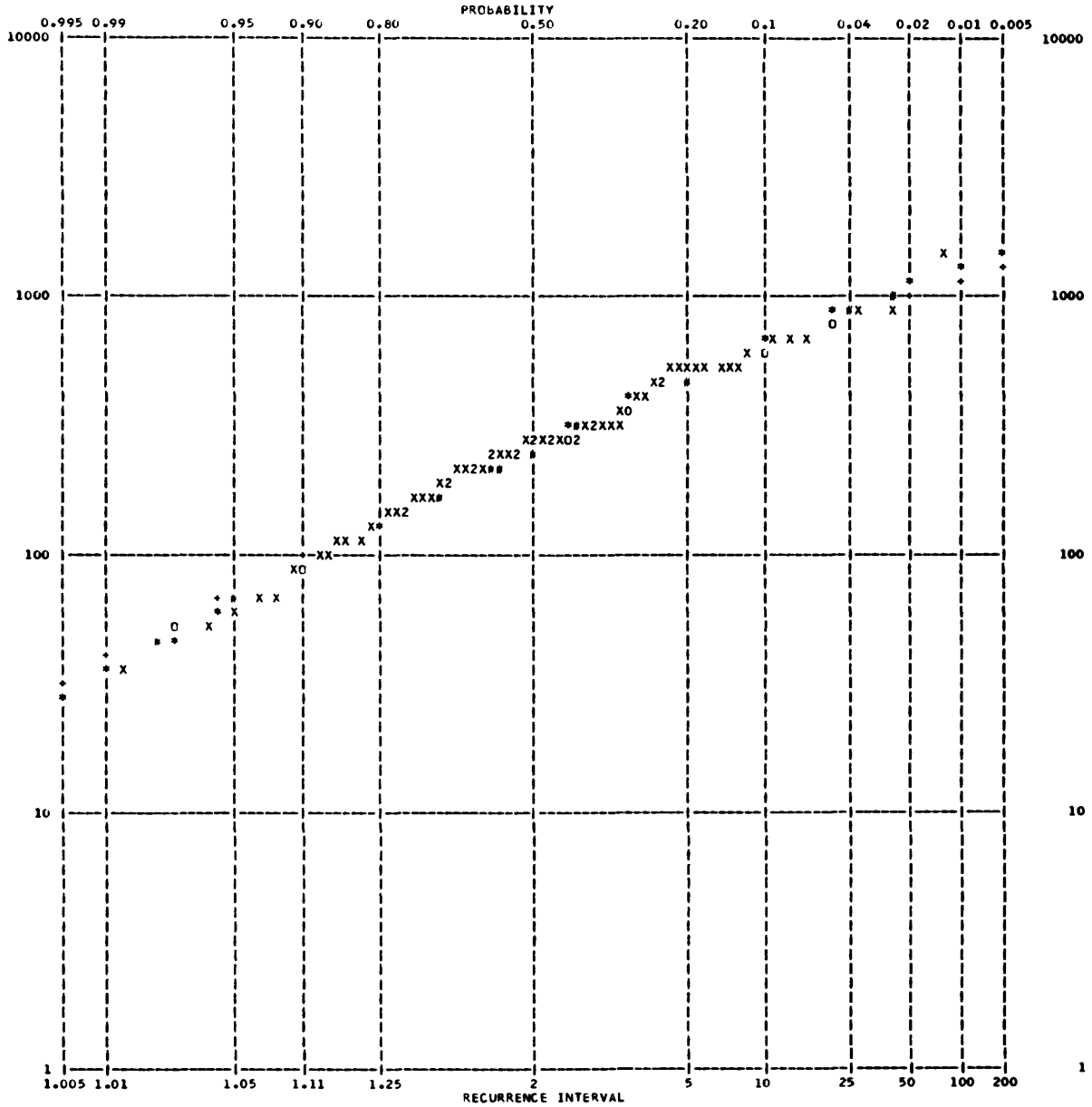
ANNUAL FLOOD STATISTICS

	LOGS	CFS
MEAN=	2.399	321.3
STANDARD DEVIATION=	0.320	237.3
SKEWNESS=	-0.299	2.000
STANDARD ERROR OF SKEWNESS=	0.276	
CORR COEFF =	0.946	
ADJUSTED STANDARD DEVIATION =	0.339	

LOG-PEARSON TYPE III CALCULATIONS

EXECEEDANCE PROB	RECURRENCE INTERVAL	MAGNITUDES UNADJUSTED	MAGNITUDES ADJUSTED FOR REGRESSION EFFECT	
0.9900	1.01	38.346	34.451	
0.9500	1.05	70.121	65.206	
0.9000	1.11	95.316	90.202	
0.8000	1.25	136.369	131.718	
0.5000	2.00	259.818	260.363	
0.2000	5.00	469.948	487.137	
0.1000	10.00	627.843	661.656	
0.0400	25.00	842.465	902.865	
0.0200	50.00	1010.583	1094.345	
0.0100	100.00	1184.009	1293.788	
0.0050	200.00	1362.788	1501.144	*** R.I.> 2N
0.0020	500.00	1607.205	1787.126	*** R.I.> 2N

S CANEY CREEK NR MONTICELLO, FLA. NO. OF ITEMS = 76 STATION 2326598 CODE XX



THE FOLLOWING SYMBOLS MAY APPEAR IN THE PLOT
X - AN INPUT DATA VALUE
2 - TWO INPUT DATA VALUES
3 - THREE INPUT DATA VALUES
+ - AN UNADJUSTED, CALCULATED VALUE
* - A CALCULATED VALUE ADJUSTED FOR REGRESSION EFFECT
# - ADJUSTED AND UNADJUSTED CALCULATED VALUES
O - A CALCULATED VALUE AND ONE DATA VALUE
A - A CALCULATED VALUE AND TWO DATA VALUES
B - A CALCULATED VALUE AND THREE DATA VALUES
C - TWO CALCULATED VALUES (ADJ&UNADJ) AND ONE DATA VALUE
D - TWO CALCULATED VALUES (ADJ&UNADJ) AND TWO DATA VALUES
E - TWO CALCULATED VALUES (ADJ&UNADJ) AND THREE DATA VALUES

PROGRAMMER ______ DIVISION ______ LOCATION ______ PHONE ______

U. S. DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

COMPUTER CODING FORM

PROGRAM NO. ______ PROJECT ______ SHEET ___ OF ___

PROGRAM IDENTIFICATION: ______

PROGRAM INFORMATION: *Example 2*

STATEMENT IDENTIFICATION

```
//*RELAY  PUNCH RE2
//XXXXXXXX JØB (-------)
//*PRØCLIB  WRD.PRØCLIB
//  EXEC RRSIMLØG
//H268.SYSIN DD *
D33390008426000I                             0004500006I897I00I I9730930PASS
U33390008426000I                             0004500006I897I00I I9730930PASS
D33570008319000I                             0004500006I897I00I I9730930PASS
//E784.SYSIN DD *
XE784U
I        02203820SUGAR CR @ CLIFTØN CH RD NR ATLANTA, GA  I.0 0.0-0.I  8.67 52947
233390008426000IATLANTA, GA - AP                                     5 4346I   9486
333390008426000IATLANTA, GA - AP                                   97I00I730930
43357000831900OIATHENS, GA
5022038202.8200.2251.00013.507.8370.7870.8802.200190.0       5    520.88821.0
T02203820     651   2415   4586  6879   8935  10738  12794  14893  16892  18957      I
T02203820  2II30  23392  25686  27949  3046I  3340I  36786  40033  4230I  4346I      2
T02203820      52    203    379   485    635    774    907   I094   I295   I459      3
T02203820    I6I2   I870   2424  3I6I   4002   5320   6505   7748   8902   9486      4
//
$$$
```


FORM 9—1634 A
JULY 1967

0 = ZERO   Ø = ALPHA O   1 = ONE   I = ALPHA I   2 = TWO   Z = ALPHA Z   / = SLASH | = VERT. BAR   - = MINUS   _ = HORZ. BAR

PROGRAM CODING FORM

```
**************************************************************
*****          ANNUAL PEAK DISCHARGE SYNTHESIS           *****
*****       VIA URBAN BASIN FLOOD HYDROGRAPH MODEL       *****
**************************************************************
```


SYNTHESIS USES HISTORICAL RAINFALL FROM 1898 TO 1973

DISCHARGE STATION: 02203620 SUGAR CK AT CLIFTON CH RD NR ATLANTA, GA.
TOTAL DRAINAGE AREA= 8.670 SQUARE MILES
PERVIOUS DRAINAGE AREA= 7.117 SQUARE MILES (82.08 %)
IMPERVIOUS DRAINAGE AREA= 1.553 SQUARE MILES (17.92 %)
ROUTING INTERVAL= 5 MINUTES

UNIT RAINFALL STATION: 33590008426o0001 ATLANTA, GEORGIA-AP
UNIT RAINFALL IS DEFINED AT 5 MINUTE INTERVALS
AND WILL BE SMOOTHED TO 5 MINUTE INTERVALS
AS WAS USED IN THE CALIBRATION OF THE MODEL.

DAILY RAINFALL STATION: 33590008426o0001 ATLANTA, GEORGIA-AP

PAN EVAPORATION STATION: 33570008319o001 ATHENS, GEORGIA

FOLLOWING ARE PARAMETER VALUES:

PSP=	2.620
KSAT=	0.225
DRN=	1.000
RGF=	13.500
BMSM=	7.637
EVC=	0.787
RR=	0.880
KSW=	2.200
TC=	190.000

FOLLOWING ARE INITIAL CONDITIONS:
BMS=0.5*BMSM
SMS=0
CONSTANT BASE FLOW (USER SUPPLIED) TO BE ADDED TO ALL PEAK DISCHARGES = 21.0 CFS
CORRELATION COEFF. TO BE USED IN LOG-PEARSON ANALYSIS = 0.888

DISTANCE-AREA CURVE DATA FOR URBAN PERVIOUS DRAINAGE AREA:

651	2415	4586	6879	8935	10736	12794	14893	16892	18957
21130	23392	25686	27949	30461	33401	36786	40033	42301	43461

DISTANCE-AREA CURVE DATA FOR URBAN IMPERVIOUS DRAINAGE AREA:

52	203	379	485	635	774	907	1094	1295	1459
1612	1870	2424	3161	4002	5320	6505	7748	8902	9486

****
***** ANNUAL PEAK DISCHARGE SYNTHESIS *****
***** VIA URBAN BASIN FLOOD HYDROGRAPH MODEL *****
****

DISCHARGE STATION: 02203820 SUGAR CK AT CLIFTON CH RD NR ATLANTA, GA.
RAINFALL STATION: 333900084260001 ATLANTA, GEORGIA-AP

1898 WATER YEAR	NO.	DATE	PRECIP (IN)	DURATION (DAYS)	RUNOFF (IN)	DISCHARGE AND RANK (CFS)	
	1	1898 723	5.74	2	2.12	2496	1
	2	1898 827	2.39	2	0.51	364	3
	3	1898 9 3	4.11	3	1.04	477	2

NOTE: USER SUPPLIED CONSTANT BASE FLOW (21.0 CFS) ADDED TO ALL SIMULATED PEAK DISCHARGES; RUNOFF VOL. NOT ADJUSTED.

1899 WATER YEAR	NO.	DATE	PRECIP (IN)	DURATION (DAYS)	RUNOFF (IN)	DISCHARGE AND RANK (CFS)	
	1	1899310 4	2.97	3	0.59	185	5
	2	1899 826	2.76	1	0.95	663	2
	3	1899 721	3.99	1	1.15	1219	1
	4	1899 830	2.24	2	0.43	312	4
	5	1899 910	1.88	1	0.42	600	3

NOTE: USER SUPPLIED CONSTANT BASE FLOW (21.0 CFS) ADDED TO ALL SIMULATED PEAK DISCHARGES; RUNOFF VOL. NOT ADJUSTED.

1900 WATER YEAR	NO.	DATE	PRECIP (IN)	DURATION (DAYS)	RUNOFF (IN)	DISCHARGE AND RANK (CFS)	
	1	19991223	1.77	1	0.35	366	6
	2	1900 212	5.95	3	1.55	844	1
	3	1900 3 8	2.66	2	0.54	384	5
	4	1900 624	4.51	4	1.02	563	2
	5	1900 729	2.09	1	0.46	463	3
	6	1900 915	3.58	2	0.75	385	4

NOTE: USER SUPPLIED CONSTANT BASE FLOW (21.0 CFS) ADDED TO ALL SIMULATED PEAK DISCHARGES; RUNOFF VOL. NOT ADJUSTED.

****
***** ANNUAL PEAK DISCHARGE SYNTHESIS *****
***** VIA URBAN BASIN FLOOD HYDROGRAPH MODEL *****
****

DISCHARGE STATION: 02203820 SUGAR CK AT CLIFTON CH RD NR ATLANTA, GA.
RAINFALL STATION: 333900084260001 ATLANTA, GEORGIA-AP

1901 WATER YEAR	NO.	DATE	PRECIP (IN)	DURATION (DAYS)	RUNOFF (IN)	DISCHARGE AND RANK (CFS)	
	1	19001125	2.34	2	0.52	566	6
	2	1901 111	3.11	2	0.84	552	7
	3	1901 2 3	2.58	1	0.82	634	4
	4	1901 326	2.70	2	1.30	1792	1
	5	1901 413	2.18	1	0.60	605	5
	6	1901 521	5.00	2	1.46	1087	3
	7	1901 622	3.65	2	1.23	1307	2

NOTE: USER SUPPLIED CONSTANT BASE FLOW (21.0 CFS) ADDED TO ALL SIMULATED PEAK DISCHARGES; RUNOFF VOL. NOT ADJUSTED.

1902 WATER YEAR	NO.	DATE	PRECIP (IN)	DURATION (DAYS)	RUNOFF (IN)	DISCHARGE AND RANK (CFS)	
	1	19011229	4.81	2	1.16	701	3
	2	1902 2 1	3.35	2	0.93	577	4
	3	1902 227	3.63	1	1.26	789	1
	4	1902 316	1.73	1	0.68	772	2

NOTE: USER SUPPLIED CONSTANT BASE FLOW (21.0 CFS) ADDED TO ALL SIMULATED PEAK DISCHARGES; RUNOFF VOL. NOT ADJUSTED.

1903 WATER YEAR	NO.	DATE	PRECIP (IN)	DURATION (DAYS)	RUNOFF (IN)	DISCHARGE AND RANK (CFS)	
	1	19021216	2.32	2	0.48	426	5
	2	1903 2 7	2.69	1	0.57	294	6
	3	1903 216	2.20	1	0.71	661	2
	4	1903 323	4.70	4	1.66	583	4
	5	1903 330	2.28	3	0.54	268	7

****
***** ANNUAL PEAK DISCHARGE SYNTHESIS *****
***** VIA URBAN BASIN FLOOD HYDROGRAPH MODEL *****
****

DISCHARGE STATION: 02203820 SUGAR CK AT CLIFTON CH RD NR ATLANTA, GA.
RAINFALL STATION: 333900084260001 ATLANTA, GEORGIA-AP

1969 WATER YEAR

NO.	DATE	PRECIP (IN)	DURATION (DAYS)	RUNOFF (IN)	DISCHARGE AND RANK (CFS)	
1	19681222	2.12	2	0.40	200	4
2	1969 418	2.69	2	0.64	614	2
3	1969 5 8	4.34	1	1.53	1632	1
4	1969 923	2.62	2	0.53	417	3

NOTE: USER SUPPLIED CONSTANT BASE FLOW (21.0 CFS) ADDED TO ALL SIMULATED PEAK DISCHARGES; RUNOFF VOL. NOT ADJUSTED.

1970 WATER YEAR

NO.	DATE	PRECIP (IN)	DURATION (DAYS)	RUNOFF (IN)	DISCHARGE AND RANK (CFS)	
1	1970 329	4.64	1	1.26	684	1

NOTE: USER SUPPLIED CONSTANT BASE FLOW (21.0 CFS) ADDED TO ALL SIMULATED PEAK DISCHARGES; RUNOFF VOL. NOT ADJUSTED.

1971 WATER YEAR

NO.	DATE	PRECIP (IN)	DURATION (DAYS)	RUNOFF (IN)	DISCHARGE AND RANK (CFS)	
1	19701029	2.52	1	0.55	475	2
2	1971 5 5	4.50	3	1.81	1010	1
3	1971 525	2.10	1	0.51	330	5
4	1971 731	1.92	1	0.42	456	4
5	1971 917	2.70	1	0.66	474	3

NOTE: USER SUPPLIED CONSTANT BASE FLOW (21.0 CFS) ADDED TO ALL SIMULATED PEAK DISCHARGES; RUNOFF VOL. NOT ADJUSTED.

1972 WATER YEAR

NO.	DATE	PRECIP (IN)	DURATION (DAYS)	RUNOFF (IN)	DISCHARGE AND RANK (CFS)	
1	1972 111	4.49	3	1.11	488	1
2	1972 130	2.00	2	0.41	256	2

ANNUAL PEAK DISCHARGE SYNTHESIS
VIA URBAN BASIN FLOOD HYDROGRAPH MODEL

(PEAK LIST CONTINUED)

3	1972 513	2.01	1	0.38	190	4
4	1972 620	3.17	2	0.61	199	3

NOTE: USER SUPPLIED CONSTANT BASE FLOW (21.0 CFS) ADDED TO ALL SIMULATED PEAK DISCHARGES; RUNOFF VOL. NOT ADJUSTED.

1973 WATER YEAR

NO.	DATE	PRECIP (IN)	DURATION (DAYS)	RUNOFF (IN)	DISCHARGE AND RANK (CFS)	
1	19721027	1.97	1	0.39	340	9
2	19721215	3.25	2	0.74	350	8
3	19721221	2.23	2	0.47	249	10
4	1973 1 8	3.87	2	2.01	2195	1
5	1973 2 1	2.78	1	1.06	1047	3
6	1973 316	2.46	1	0.89	1109	2
7	1973 331	2.32	2	0.80	655	4
8	1973 4 7	2.37	1	0.66	581	5
9	1973 520	2.57	2	0.63	454	7
10	1973 528	2.07	1	0.60	557	6

NOTE: USER SUPPLIED CONSTANT BASE FLOW (21.0 CFS) ADDED TO ALL SIMULATED PEAK DISCHARGES; RUNOFF VOL. NOT ADJUSTED.

****
***** ANNUAL PEAK DISCHARGE SYNTHESIS *****
***** VIA URBAN BASIN FLOOD HYDROGRAPH MODEL *****
****

DISCHARGE STATION: 02203820 SUGAR CK AT CLIFTON CH RD NR ATLANTA, GA.
RAINFALL STATION: 33390008426000I ATLANTA, GEORGIA-AP

ANNUAL PEAK DISCHARGE SUMMARY (1898-1973)

WATER YEAR	DISCHARGE (CFS)	RANK
1898	2496	2
1899	1219	27
1900	844	47
1901	1792	15
1902	789	54
1903	810	49
1904	803	51
1905	524	66
1906	1134	31
1907	594	74
1908	2472	3
1909	1131	32
1910	475	72
1911	561	65
1912	4023	1
1913	1191	28
1914	1991	8
1915	1066	36
1916	881	44
1917	731	56
1918	590	75
1919	827	48
1920	1998	7
1921	1644	12
1922	1429	22
1923	1097	33
1924	907	43
1925	999	41
1926	1941	10
1927	523	69
1928	2110	5
1929	804	50
1930	556	66
1931	531	67
1932	1066	37
1933	1354	23
1934	690	58
1935	413	73
1936	1600	14
1937	1325	24
1938	1466	21
1939	1020	38
1940	1618	17
1941	1093	34
1942	1515	20

****
***** ANNUAL PEAK DISCHARGE SYNTHESIS *****
***** VIA URBAN BASIN FLOOD HYDROGRAPH MODEL *****
****

(ANNUAL PEAK LIST CONTINUED)

1943	1274	25
1944	1137	30
1945	2106	0
1946	1691	16
1947	1612	39
1948	1967	9
1949	850	46
1950	810	63
1951	1080	35
1952	737	55
1953	865	45
1954	981	42
1955	890	57
1956	833	62
1957	481	71
1958	1917	11
1959	369	78
1960	1175	29
1961	1579	18
1962	868	61
1963	1257	26
1964	797	52
1965	578	64
1966	789	53
1967	1530	19
1968	885	59
1969	1832	13
1970	884	60
1971	1010	40
1972	488	70
1973	2195	4

NOTE: DISCHARGES INCLUDE USER SUPPLIED BASE FLOW (21.0 CFS).

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**********************************************************
*****          ANNUAL PEAK DISCHARGE SYNTHESIS          *****
*****       VIA URBAN BASIN FLOOD HYDROGRAPH MODEL      *****
**********************************************************
```


CARD IMAGES SENT TO LOG PEARSON PROGRAM LISTED BELOW-(STATION ID TRUNCATED TO RIGHT MOST 8-DIGITS)

```
1                                                                                    (PLOT OPTION CARD)
S SUGAR CK AT CLIFTON CH RD NR ATLANTA, GA.              1  0.0 -0.1 760220382OXX    (HEADER CARD)
   2496   1219    844   1792    789    610    803    524   1134     39402203820XX   (DATA CARD)
   2472   1131    475    561   4023   1191   1991   1068    881     73102203820XX   (DATA CARD)
    390    827   1998   1844   1429   1097    907    999   1941     52302203820XX   (DATA CARD)
   2110    804    556    531   1066   1354    696    413   1800    132502203820XX   (DATA CARD)
   1466   1020   1018   1093   1515   1274   1137   2106   1091    101202203820XX   (DATA CARD)
   1967    656    616   1080    737    865    981    690    633     48102203820XX   (DATA CARD)
   1917    389   1175   1579    668   1257    797    578    789    153002203820XX   (DATA CARD)
    685   1832    684   1010    488   2195      0      0      0       002203820XX   (DATA CARD)
0.888                                                                                (CORRELATION COEFF. CARD)
```


END PROGRAM E784.

S SUGAR CK AT CLIFTON CH RD NR ATLANTA, GA. NO. OF ITEMS = 76 STATION 2203820 CODE XX

****

D A T A U S E D I N C A L C U L A T I O N S

2496.000	1219.000	644.000	1792.000	769.000	810.000	803.000	524.000	1134.000	394.000
2472.000	1131.000	475.000	561.000	4023.000	1191.000	1991.000	1068.000	881.000	731.000
390.000	827.000	1998.000	1844.000	1429.000	1097.000	907.000	999.000	1941.000	523.000
2110.000	804.000	556.000	531.000	1066.000	1354.000	690.000	413.000	1800.000	1325.000
1466.000	1020.000	1618.000	1093.000	1515.000	1274.000	1137.000	2106.000	1691.000	1012.000
1967.000	656.000	616.000	1080.000	737.000	865.000	981.000	690.000	633.000	481.000
1917.000	389.000	1175.000	1579.000	668.000	1257.000	797.000	578.000	789.000	1530.000
685.000	1832.000	684.000	1010.000	488.000	2195.000				

****

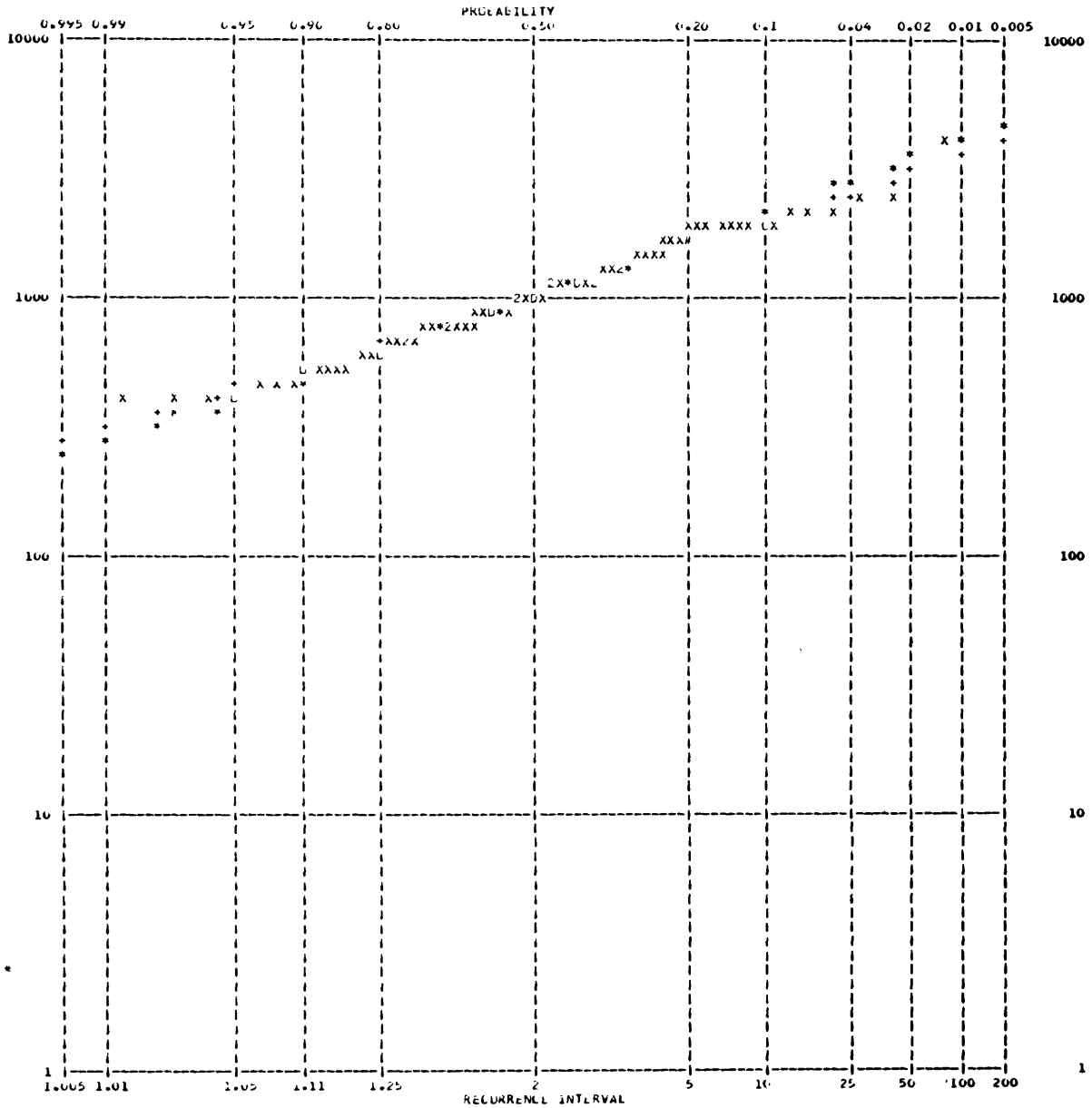
A N N U A L F L O O D S T A T I S T I C S

	LOGS	CFS
MEAN=	3.008	1162.4
STANDARD DEVIATION=	0.223	635.0
SKEWNESS=	0.115	1.569
STANDARD ERROR OF SKEWNESS=	0.276	
CORR COEFF =	0.888	
ADJUSTED STANDARD DEVIATION =	0.252	

L O G - P E A R S O N T Y P E I I I C A L C U L A T I O N S

EXCEEDANCE PROB	RECURRENCE INTERVAL	MAGNITUDES UNADJUSTED	MAGNITUDES ADJUSTED FOR REGRESSION EFFECT	
0.9900	1.01	321.700	278.160	
0.9500	1.05	444.818	400.660	
0.9000	1.11	530.622	488.698	
0.8000	1.25	659.223	623.985	
0.5000	2.00	1009.057	1007.804	
0.2000	5.00	1566.225	1653.474	
0.1000	10.00	1982.036	2155.521	
0.0400	25.00	2558.727	2873.778	
0.0200	50.00	3024.842	3469.745	
0.0100	100.00	3521.852	4118.121	
0.0050	200.00	4053.329	4824.352	*** R.I.> 2N
0.0020	500.00	4814.277	5855.758	*** R.I.> 2N

S SUGAR CK AT CLIFTON CH RD NR ATLANTA, GA. NO. OF ITEMS = 76 STATION 2203820 CODE XX



THE FOLLOWING SYMBOLS MAY APPEAR IN THE PLOT
X - AN INPUT DATA VALUE
2 - TWO INPUT DATA VALUES
3 - THREE INPUT DATA VALUES
+ - AN UNADJUSTED, CALCULATED VALUE
* - A CALCULATED VALUE ADJUSTED FOR REGRESSION EFFECT
# - ADJUSTED AND UNADJUSTED CALCULATED VALUES
O - A CALCULATED VALUE AND ONE DATA VALUE
A - A CALCULATED VALUE AND TWO DATA VALUES
B - A CALCULATED VALUE AND THREE DATA VALUES
C - TWO CALCULATED VALUES (ADJ&UNADJ) AND ONE DATA VALUE
D - TWO CALCULATED VALUES (ADJ&UNADJ) AND TWO DATA VALUES
E - TWO CALCULATED VALUES (ADJ&UNADJ) AND THREE DATA VALUES

SECTION S

SUPPLEMENTARY DATA

The user may be interested in creating a data set from the Current and/or Historical Unit and/or Daily Values Files to serve as input to a program not described in this user's guide. Referring to figure 2-1, these private data sets can be created by programs G490, H572, H268, and A604.

Standard ADP Formats

Programs H572 and G490 will respectively retrieve data from the Unit and Daily Values Files. The magnetic record formats created as output from these programs are described in the WATSTORE User's Guide, Volumes 1 and 5 (Hutchison, 1975, 1976).

Output Data Set Formats for Program A604

Program A604 (Section 9) creates a data set which can be used as input to program A634, (Section 13). The magnetic record formats are as follows:

Daily Values (one record for each water year)

Variable	Length (in bytes)	Type 1/	Byte position
Station identifier	16	C	1
Cross-section location (always 999999.)	4	R	17
Depth location (always 999999.)	4	R	21
Parameter code - rainfall or evaporation	2	I	25
Statistic code	2	I	27
Readings per day	2	I	29
Sequential number of record for station in file	2	I	31
Indicator switch	2	I	33
Water year for record (2 digits)	2	I	35
Date record entered file	4	I	37
No value indicator (not used)	4	R	41

Variable	Length (in bytes)	Type	Byte position
Daily values for water year (12 x 31 array)	4 per day	R	45
Delete indicator	4	I	1533
State code	2	I	1537
District code	2	I	1539
State name	48	C	1541
Drainage area (sq. mi)	4	R	1589
Total			1592

1/ Variable types C, R, and I respectively indicate character, real (floating point), and integer variables

Unit values (one record for each day)

The duration of a storm for use in a rainfall-runoff model may be several days. In order to define the start of rainfall and of discharge within the event, the number of unit values counted from the beginning of the event and from the beginning of the day of occurrence must be declared. The duration of the rainfall and of discharge, defined by the number of unit values (including zero magnitudes occurring from the beginning of rainfall to end) must also be declared.

Variable	Length (in bytes)	Type	Byte position
Station identifier	16	C	1
Cross-section location (always 999999.)	4	R	17
Depth location (always 999999.)	4	R	21
Parameter code - rainfall or discharge	2	I	25
Statistic code	2	I	27
Readings per day	2	I	29

Variable	Length (in bytes)	Type	Byte position
Calendar year of record (2 digits)	2	I	31
Month	2	I	33
Day	2	I	35
Date record entered file	4	I	37
Starting interval in day	4	I	41
Dummy variable (always 1)	2	I	45
Number of unit values stored for given event	2	I	47
State code	2	I	49
District code	2	I	51
Station name	48	C	53
Drainage area (sq. mi)	4	R	101
Delete Indicator	4	I	105
No value indicator	4	R	109
Unit values (variable length array storing from 1 to 349 values)	4	R	113
Maximum			1508

Output Data Set Formats for Program H268

Program H268 (Section 8) and an interface program (transparent to user) creates a data set which can be used as input to programs A604, G159, A634, and E784 (Sections 9, 10, 13, and 15). The magnetic record formats are as follows:

Daily Values (one record for each water year)

Variable	Length (in bytes)	Type	Byte position
Station identifier	16	C	1
Cross-section location (always 999999.)	4	R	17
Depth location (always 999999.)	4	R	21

Variable	Length (in bytes)	Type	Byte position
Parameter code - rainfall or evaporation	2	I	25
Statistic code -	2	I	27
Readings per day	2	I	29
Sequential number of record for station in file	2	I	31
Switch to indicate last record for station (1, on; 0, off)	2	I	33
Water year (4 digits)	2	I	35
Date record entered file	4	I	37
No value indicator	4	R	41
Daily values for water year (12 x 31 array)	4 per day	R	45
Delete indicator	4	I	1533
State code	2	I	1537
District code	2	I	1539
Station name	48	C	1541
Drainage area (sq. mi).	4	R	1589
Total			1592

Unit values (one record for each day)

Variable	Length (in bytes)	Type	Byte position
Station identifier	16	C	1
Cross-section location (always 999999.)	4	R	17
Depth location (always 999999.)	4	R	21
Parameter code - rainfall or discharge	2	I	25

Variable	Length (in bytes)	Type	Byte position
Statistic code	2	I	27
Readings per day	2	I	29
Sequential number of record for station in file	2	I	31
Date record entered file	4	I	33
Switch to indicate last record for station (1, on; 0, off)	2	I	37
Switch to indicate record filled (1, on; 0, off)	2	I	39
The following grouping is repeated six times:			
Calendar year (4 digits)	2	I	41
Month	2	I	43
Day	2	I	45
Delete indicator	2	I	47
Readings per day	2	I	49
Starting interval in day	2	I	51
Number of unit values stored for day	2	I	53
Number of element in array in which first unit value for day stored	2	I	55
No value indicator	4	R	137
Unit values (349 element array)	4 per value	R	141
State code	2	I	1537
District code	2	I	1539
Station name	48	C	1541
Drainage area (sq. mi.)	4	R	1589
Total			1592

COMPUTER HARDWARE AND SOFTWARE REQUIREMENTS

All programs in this user's guide, programs for maintenance of the file, and the files have been designed for operation with the IBM 360 and 370 series of computers. The computer core necessary to operate the programs must be at least 800,000 bytes. In addition to the main frame of the computer, the programs require the following peripheral devices: card reader, line printer (132 character), two tape drives, two disk drives (type 3330), and a Calcomp plotter.

All programs in this user's guide are written in the PL/I or Fortran language which is supported by IBM.

Programs which perform file maintenance, such as creating backup copies of files and program libraries and sort-merge operations, are written in the PL/I language or are utility programs furnished by IBM.

DETERMINATION OF DATA IN WRD STATION HEADER, UNIT AND DAILY VALUE FILES

The user may wish to find which stations (rainfall, evaporation, discharge) are in the files for a particular State, district, range in station identifiers, what type of data are stored in the files for each station, the tape numbers for the historical files, and the individual records stored for each station.

Queries can be made to determine if the station identifier for rainfall, discharge, or evaporation has been established in the WRD Station Header File. Using the catalog procedure HDRLIST (WATSTORE User's Guide, Chap. 3, Sec. III.B), many types of retrievals of data in the WRD Station Header File can be made. In particular, the user might be interested in a listing of stations in a State or district, in a region (polygonal retrieval), or within a range of station identifiers to determine station identifiers and site codes for each station.

If the data are in the unit and/or daily values historical files, the following job step may be executed to determine the historical file tape number:

```
/*RELAY  PUNCH RE2

//xxxxxxxx JOB (-------)

//PROCLIB  WRD.PROCLIB

//EXEC MESSAGE,PRINT=NE

//

$$$
```

A listing will be printed which gives the historical file tape numbers assigned to each district for both the unit and daily values historical files.

An inventory of the daily value records for an individual station (rainfall or evaporation) can be made using program H483 (WATSTORE User's Guide, Chap. IV, Section D).

An inventory of the unit value records for a station (rainfall or discharge) can be made using catalog procedure UNRETR (section 13, program H572) in this user's guide.

Long Term Rainfall and Evaporation Records

In table S1, records of rainfall and evaporation with 20 or more years of data are listed. Information about these records can be obtained from the District Chief, Water Resources Division, U.S. Geological Survey, for the State of interest.

Table S1.--List of long-term meteorologic stations

Type of data: R=rainfall, E=evaporation; file type: U=unit values, D=daily values

State	Location	Identifier	Period 1/	Type of Data	File Type 2/
Alabama	Birmingham	333400086450001	1902-1973	R	U, D
	Montgomery	322300086180001	1896-1951	R	U, D
Arkansas	Fort Smith	352000094220001	1900-1971	R	D
	Little Rock	344400092140001	1896-1971	R	U, D
California	Fresno	364300119490001	1911-1962	R	D
	Los Angeles	340300118140001	1911-1962	R	D
	McCloud	411600122080001	1911-1962	R	D
	San Francisco	374700122250001	1911-1962	R	D
	Santa Barbara	342500119410001	1911-1962	R	D
	Yosemite	374500119350001	1911-1962	R	D
Colorado	Denver	394600104530001	1871-1973	R	U, D
	Ft. Collins	403500105050001	1897-1974*	E	D
	Grand Junction	390600108320001	1892-1973	R	D
	Pueblo	381400104380001	1888-1973	R	U, D
Florida	Apalachicola	294400084590001	1908-1972	R	D
	Jacksonville	303000081420001	1897-1972	R	U, D
	Miami	254800080160001	1911-1962	R	D
	Pensacola	302800087120001	1896-1972	R	U, D
	Tampa	275800082320001	1897-1972	R	U, D
Georgia	Atlanta	333900084260050	1897-1973	R	U, D
	Augusta	332200081580050	1897-1973	R	U, D
	Macon	324200083390050	1898-1973	R	U, D
	Rome	342100085100050	1897-1974	E	D
	Savannah	320800081120050	1897-1973	R	U, D
	Thomasville	304800083540050	1904-1973	R	U, D
Illinois	Cairo	370000089000001	1907-1974	R	U, D
	Chicago	414700087450001	1870-1974	R	U, D
	Hennepin	411800089190001	1954-1974	E	D
	Peoria	404000089410001	1904-1974	R	U, D
	Springfield	395000089400001	1900-1974	R	U, D
	Urbana	400600088140001	1954-1974	E	D
Iowa	Dubuque	422400090420001	1899-1972*	R	U, D
Kansas	Concordia	393300097390001	1906-1973	R	U, D
	Dodge City	374600099580000	1911-1962	R	D
	Wichita	373900097250001	1888-1973	R	U, D

Table S1 (cont.) - List of long-term meteorologic station

State	Location	Identifier	Period 1/	Type of Data	File Type
Kentucky	Lexington	380218084355800	1912-1974	R	U, D
	Louisville	381105085443001	1911-1974*	R	U, D
Louisiana	New Orleans	295900090150001	1911-1973	R	U, D
	Shreveport	322800093490001	1911-1973	R	U, D
	Woodworth Exp Sta	310700092280000	1953-1974	E	D
Maryland	Baltimore	391700076370001	1899-1971	R	U, D
Massachusetts	Boston	422100071040001	1911-1962	R	D
		422200071010000	1911-1974*	R	U, D
Minnesota	Duluth	465000092110001	1911-1962	R	D
	Minneapolis	445300093130001	1891-1972	R	U, D
Mississippi	Meridian	322000088450001	1899-1971	R	U, D
	Vicksburg	322400090470001	1890-1967	R	U, D
Missouri	Columbia	385700092200001	1896-1971	R	U, D
	Kansas City	390700094350001	1892-1971	R	U, D
	Lakeside	381200092370001	1947-1971*	E	D
	St. Louis	383800090120001	1892-1975	R	U, D
	Springfield	371400093230001	1901-1971	R	U, D
New Jersey	Atlantic City	392200074250001	1900-1958	R	U, D
New Mexico	Roswell	332400104320001	1899-1971	R	U, D
	Santa Fe	353700106050001	1879-1971	R	D
North Carolina	Asheville	353600082320001	1911-1962	R	D
	Chapel Hill	355500079060001	1966-1972	E	D
	Charlotte	351400080560001	1901-1969	R	U, D
	Hatteras	351500075400001	1911-1962	R	D
Oklahoma	Oklahoma City	352400097360001	1890-1970	R	U, D
Oregon	Portland	453130122403600	1903-1973	R	U, D
South Carolina	Charleston	325400080020001	1910-1971	R	D
	Columbia	340000081030001	1901-1953*	R	U
		335700081070001	1899-1974	R	D
	Greenville	345100082240001	1916-1973	R	U, D

Table S1 (cont.) - List of long term meteorologic stations

State	Location	Identifier	Period 1/	Type of Data	File Type 1/
South Dakota	Huron	442300098130001	1892-1974	R	U, D
	Rapid City	440400103120001	1888-1974	R	U, D
Tennessee	Chattanooga	350200085120001	1899-1974	R	U, D
	Knoxville	354900083590001	1890-1971	R	U, D
	Memplis	350300089590001	1896-1974	R	U, D
	Nashville	360700086410001	1890-1974	R	U, D
Texas	Abilene	322700099410001	1884-1974	R	U, D
	Amarillo	351400101420001	1891-1974	R	U, D
	Austin	301800097420001	1897-1974	R	U, D
	Beeville 3/	283000097300005	1910-1974	E	D
	Beaumont 3/	303000094300005	1910-1974	E	D
	Big Spring 3/	323000100300005	1910-1974	E	D
	Brownwood 3/	313000099300005	1910-1974	E	D
	Corpus Cristi	274600097260001	1911-1974	R	U, D
	Dallas	325100096510001	1913-1974	R	U, D
		292000100530001	1912-1957	R	U
	Del Rio				
		292200100490001	1911-1962	R	D
	El Paso	314800106240001	1911-1962	R	D
	Ft. Worth	324900097210001	1911-1962	R	D
	Galveston	291600094510001	1911-1962*	R	D
	Grapevire Dam	325800097030001	1913-1970	E	D
	Houston 3/	293000095300005	1910-1974	E	D
	Llano 3/	303000098300005	1910-1974	E	D
	Palestine 3/	313000095300005	1910-1974	E	D
		314500095400001	1881-1974	R	U, D
	San Antonio 3/	292700098280001	1912-1974	R	U, D
	Sequin 3/	293000097300005	1910-1974	E	D
	Sherman 3/	333000097300005	1910-1974	E	D
	Tyler E. 3/	323000094300005	1910-1974	E	D
	Tyler W. 3/	323000095300005	1910-1974	E	D
	Wichita Falls 3/	333000098300005	1910-1974	E	D
Utah	Milford	382600113010001	1911-1962	R	D
	Salt Lake City	404600111580001	1911-1962	R	D
Virginia	Blacksburg	371100080250001	1929-1972	R	D
	Buchanan	373200079410001	1929-1960	R	D
	Catawba Hospital	372300080050001	1929-1960	R	D
	Charlottesville	380200078310001	1951-1974	E	D
	Farmville	372000078230001	1929-1974*	R	D
	Holland	364100076470001	1950-1974	E	D
	Hot Springs	380000079500001	1929-1970	R	D
	Lynchburg	372000007912001	1890-1974	R	U, D
	Norfolk	365400076120001	1947-1970	R	D

Table S1 (cont.) - List of long-term meteorologic stations

State	Location	Identifier	Period 1/	Type of Data	File Type 2/
Virginia (cont.)	Randolph	365900078420001	1929-1960	R	D
	Richmond	373000077200001	1897-1974	R	U, D
	Roanoke	371900079580001	1949-1974	R	U*,D
	Stuart	363800080160001	1929-1960	R	D
	Timberville	383900078430001	1930-1960	R	D
	Williamsburg	371800076420001	1949-1968	R	U*,D
	Woodstock	385300078310001	1929-1960	R	D
	Wytheville	365600081050001	1902-1972	R	U, D
Washington	Snoqualmie Pass	472500121250001	1915-1962*	R	D
West Virginia	Davis	390800079280001	1911-1962*	R	D
	Elkins	385300079510001	1898-1971	R	D
Wisconsin	Green Bay	442900088080001	1891-1972	R	D
	La Crosse	435600091170001	1901-1972	R	U, D
	Madison	430800089200001	1903-1972	R	U, D
	Marshfield Exp Farm	443900090080001	1940-1974	E	D
	Milwaukee	425700087540001	1871-1972	R	D
	Rainbow Reservoir	455000089330001	1946-1974	E	D
	Trempealeau Dam	440000091260001	1939-1974	E	D

1/ An asterisk (*) indicates some missing record in the period

2/ Data unit values files are defined at 5-minute intervals except those identified by an asterisk (*) which are defined at 10-minute intervals

3/ Grid Evaporation

ADDRESSES OF DISTRICT OFFICES

Alabama
P.O. Box V
University, Alabama 35486

Alaska
218 E Street
Anchorage, Alaska 99501

Arizona
Federal Building
301 West Congress Street
Tucson, Arizona 85701

Arkansas
Room 2301, Federal Office Building
700 West Capitol Avenue
Little Rock, Arkansas 72201

California
855 Oak Grove Avenue
Menlo Park, California 94025

Colorado
Building 53, Denver Federal Center
Mail Stop 415, Box 25046
Lakewood, Colorado 80225

Connecticut
135 High Street
Hartford, Connecticut 06103

Delaware (See Maryland)

District of Columbia (See Maryland)

Florida
Suite F-240, 325 John Knox Road
Tallahasse, Florida 32303

Georgia
Suite B, 6481 Peachtree
Industrial Blvd.
Doraville, Georgia 30360

Hawaii
5th Floor, 1833 Kalakaua Avenue
Honolulu, Hawaii 96815

Idaho
Room 365, Federal Building,
Box 036
550 West Fort Street
Boise, Idaho 83724

Illinois
P.O. Box 1026
Champaign, Illinois 61820

Indiana
1819 North Meridian Street
Indianapolis, Indiana 46202

Iowa
P.O. Box 1230
Iowa City, Iowa 52240

Kansas
1950 Avenue "A" - Campus West
University of Kansas
Lawrence, Kansas 66045

Kentucky
Room 572, Federal Building
600 Federal Place
Louisville, Kentucky 40202

Louisiana
P.O. Box 66492
Baton Rouge, Louisiana 70896

Maine (See Massachusetts)

Maryland
208 Carroll Building
8600 La Salle Road
Towson, Maryland 21204

Massachusetts
Suite 1001, 150 Causeway Street
Boston, Massachusetts 02114

Michigan
2400 Science Parkway
Red Cedar Research Park
Okemos, Michigan 48864

ADDRESSES OF DISTRICT OFFICES (Continued)

Minnesota
1033 Post Office Building
St. Paul, Minnesota 55101

Mississippi
430 Bounds Street
Jackson, Mississippi 39206

Missouri
1400 Independence Road
Rolla, Missouri 65401

Montana
P.O. Box 1696
Helena, Montana 59601

Nebraska
Room 406, Federal Building and
U.S. Court House
Lincoln, Nebraska 68508

Nevada
Room 227, Federal Building
705 North Plaza Street
Carson City, Nevada 89701

New Hampshire (See Massachusetts)

New Jersey
P.O. Box 1238
Trenton, New Jersey 08607

New Mexico
P.O. Box 26659
Albuquerque, New Mexico 87125

New York
P.O. Box 1350
Albany, New York 12201

North Carolina
P.O. Box 2857
Raleigh, North Carolina 27602

North Dakota
P.O. Box 778
Bismarck, North Dakota 58501

Ohio
975 West Third Avenue
Columbus, Ohio 43212

Oklahoma
Room 621, 201 N.W. 3rd
Oklahoma City, Oklahoma 73102

Oregon
P.O. Box 3202
Portland, Oregon 97208

Pennsylvania
P.O. Box 1107
Harrisburg, Pennsylvania 17108

Puerto Rico
P.O. Box 34168
Fort Buchanan, Puerto Rico 00934

Rhode Island (See Massachusetts)

South Carolina
Suite 200, 2001 Assembly Street
Columbia, South Carolina 29201

South Dakota
P.O. Box 1412
Huron, South Dakota 57350

Tennessee
A-413 Federal Building and
U.S. Court House
Nashville, Tennessee 37203

Texas
649 Federal Building
300 East 8th Street
Austin, Texas 78701

Utah
Room 8002, Federal Building
Salt Lake City, Utah 84138

Vermont (See Massachusetts)

Virginia
Room 304, 200 West Grace Street
Richmond, Virginia 23220

Washington
Suite 600, 1201 Pacific Avenue
Tacoma, Washington 98402

West Virginia
Room 3017, Federal Building and
U.S. Court House
500 Quarrier Street, East
Charleston, West Virginia 25301

Wisconsin
Room 200, 1815 University Avenue
Madison, Wisconsin 53706

Wyoming
P.O. Box 2087
Cheyenne, Wyoming 82001