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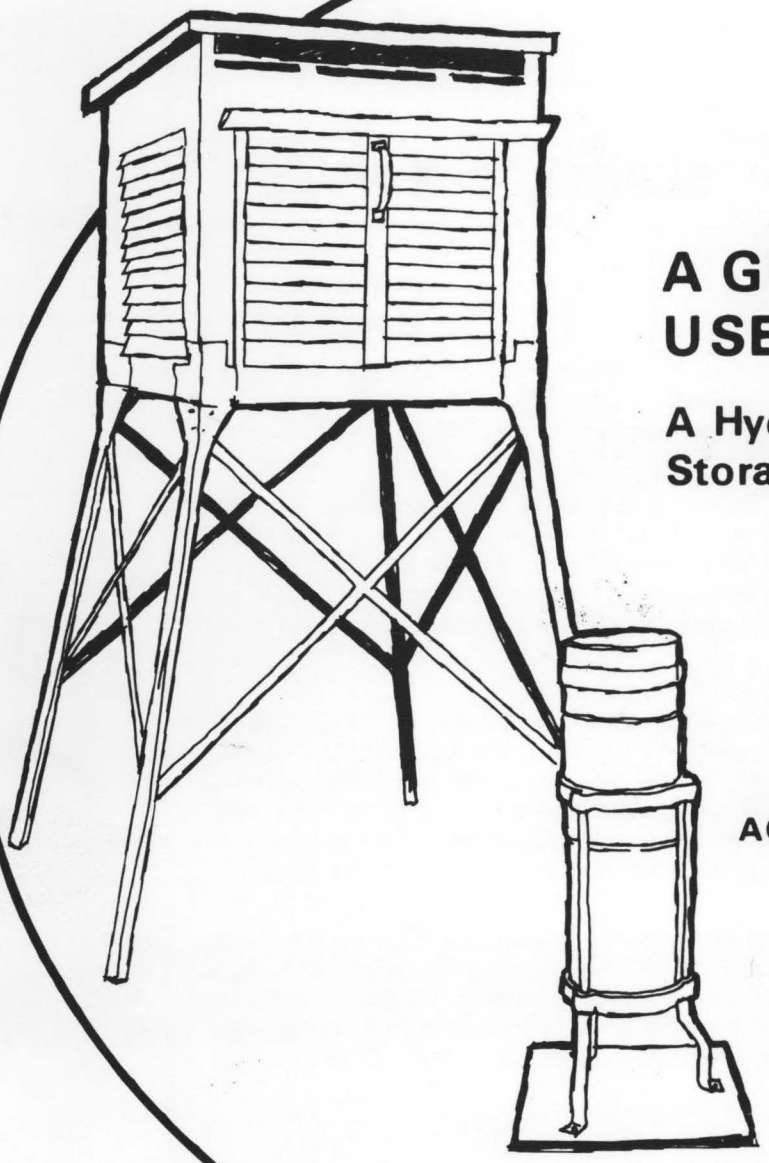

A GUIDE TO THE USE OF HISARS

A Hydrologic Information Storage and Retrieval System

Myron Molnau

DEPARTMENT OF
AGRICULTURAL ENGINEERING

Agricultural Experiment Station

UNIVERSITY OF IDAHO

College of Agriculture

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This work was supported by the Idaho Agricultural Experiment Station and by the Idaho Water Resources Research Institute under project A-045-IDA.

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PREFACE

The HISARS system was implemented out of a need to have a large body of hydrologic data available for ease of access. Many people have collected information for a project. Often the finding and collection of the necessary data, even when published, takes an inordinate amount of time when compared to the necessary analysis. Since much of the hydrologic data is in published form, the real need was for an efficient storage and retrieval system.

A search of available systems led to the adoption of HISARS, developed at North Carolina State University by E.H. Wiser. In this system the data are stored on a magnetic disk pack and the data retrieved by the Indexed Sequential Access Method (ISAM). The data elements currently supported are listed in Section I.B.2.

It should be emphasized that almost all of these data have been obtained from governmental agencies such as the National Weather Service and the Geological Survey. Because of the very large amount of data in this system, no attempt has been made to check the records which are assumed good until proven otherwise. For any critical use, the user is advised to check against the original published records. It would still be advantageous to use HISARS, even in that case, since no keypunching and additional checking would be required. In case any errors or omissions are found, please notify the author so changes can be made.

This manual is organized into three section; the ACCESS facilities, the PROCESS facilities and the COPY facilities. The ACCESS facilities merely allow a user to obtain listings of data in a standard format. These are described in detail in Section I.D.

The PROCESS facilities (see Part II) allow routine types of analyses on the data. These are relatively standard types of programs. The COPY facility allows the user to copy data from the disk pack and store it on a private tape or data set where it will be used as input to a user written program (see Part III).

This user's guide to HISARS has been patterned after the Guide published by North Carolina State University. The help of Ed Wiser in implementing this system at Idaho is gratefully acknowledged. Comments about HISARS are solicited from users, whether they be about these Guides or the files. Any comments should be directed to the author.

Since this is a new system and additions are contemplated for the data files and processing program, an updating list will be maintained for those who request this service. Also any user who has data that may be useful to others is urged to consider adding it to HISARS. Please contact the author for the proper procedures.

I. HISARS USERS' GUIDE: THE ACCESS FACILITIES

A. INTRODUCTION

The access facilities of HISARS are designed to provide copies of data in a convenient form. These are merely listings of available records or listings of data.

The following shows some examples of use of the access facilities to obtain listings of indexes and data.

Example 1. To obtain a list of all stations in Idaho and Lewis counties that have rainfall data available.

```
ACCESS
ELEMENT        RAINFALL
COUNTY         IDAHO LEWIS
LIST           INDEX
```

Example 2. To obtain a printout of the daily rainfall records for Potlatch, Idaho, and streamflow records for the Palouse River at Potlatch, Idaho.

```
ACCESS
ELEMENT   RAINFALL   STREAMFLOW
STATION   107301     13345000
LIST   DAILY   10
```

B. COMMAND LANGUAGE SPECIFICATIONS FOR THE ACCESS FACILITIES

The following commands constitute the access facility of HISARS:

ACCESS	
ELEMENT	op1
STATION	op1
LOCATION	op1
BASIN	op1
REGION	op1
COUNTY	op1
ELEVATION	op1
AREA	op1
ALTERNATE	op1
PERIOD	op1
LIST	op1
COPY	op1
AND	
OR	

The command word is punched starting in Column 1, followed by at least one blank before the operand op1 (if any). It is preferable for checking to start the operand in Column 11, but this is not required.

If more than one operand is required for a given command, there are three optional forms:

a) Several operands may be punched on a single card, separated by 2 or more blanks. Each operand must be complete, i.e. continuation of an operand from one card to the next is not possible.

b) Operands may be punched on consecutive cards, leaving at least one blank column preceding the operand. Thus, any cards with Column 1 blank are assumed to contain operands that are associated with the last control word.

c) The command itself can be repeated, with a different operand on each card. In this case, they do not even have to be consecutive.

A group of command cards constitutes a single access request. A group is always begun by an ACCESS card, followed by additional command cards in any order, provided only that at least one ELEMENT card is included. A group is terminated by an end of file card, an ACCESS card beginning another group or a PROCESS card signalling processing of the data just accessed.

There is no limit to the number of command cards included in a single group. Thus, a large number of stations, counties, etc. could be accessed as a single group. Any number of groups may be

stacked for a single run, and this is encouraged for efficiency. However, excessive stacking of groups will increase total job time and lead to possible job cutoffs.

1._ ACCESS

The ACCESS command signals the beginning of a group of command cards constituting a single access request. The ACCESS command must always be the first card in a group. Anything else punched in the card following the word ACCESS will be ignored. This is a convenient location for comments.

2._ ELEMENT

The ELEMENT command identifies the element or elements for which access is requested. The operand must give the element in one of the standard forms. The following elements are included in the current implementation:

a) STREAMFLOW
b) RAINFALL
c) TEMPERATURE
d) EVAPORATION
e) SNOWFALL
f) EVENT
g) PEAKFLOW
h) HOURRAIN

Any number of elements can be given for a single access request. The temperature command is also used to obtain evaporation pan water temperature as explained later in the section on control cards, Section I.E.

3. STATION

The STATION command is used to request access to specific stations. Standard agency codes are used, except that only the numbers (without punctuation) are permitted.

The 8-digit code of the U.S. Geological Survey is used for the Streamflow and Peak Flow files. To access data for Station 12.1695.00 the operand must be formatted as 21169500.

The 6-digit codes of the National Weather Service is used for the Rainfall, Temperature, Evaporation, Snowfall and Event files. To access data for station 10-6152 the operand must be formated as 106152.

4. LOCATION

The LOCATION command is used to request access for stations in a geographic region called a geographic location block.

A 4-digit number defines each 1-degree quadrangle, specified by the latitude and longitude, respectively, of the southeast corner. (If the longitude exceeds 100, only the last two digits are used.) This quadrangle may then be divided into four 30-minute quadrangles number 1, 2, 3 and 4 taking in order the SE, SW, NW and NE quadrants. Each quadrangle thus obtained may in turn be subdivided repeatedly until the desired accuracy is obtained. HISARS uses a 10-digit code to define locations in storage. This is sufficient to define an area 60/64 minutes square or approximately one square mile (see Fig. A 1).

The operand for the LOCATION command may contain from 1 to 10 digits, referring to all stations which start with the same group of digits. If for example a 6-digit location code 451634 were used, all stations would be accessed in the 15-minute quadrangle bounded on the south by 45^{o} 45' and on the east by 116^{o} 30'. Similarly, a 1-digit code 4 would result in access to all stations between 40^{o} and 50^{o} latitude, regardless of longitude.

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Figure A 1. Location codes as used in HISARS

5._ BASIN

The BASIN command identifies requests by river basin. The codes being used are those used by the National Weather Service. Figure A 2 shows the river basin codes for Idaho.

Future plans call for a more detailed breakdown by sub-basins but this has not been implemented yet.

6._ REGION

The REGION command identifies requests by climatological region. The code used is a two character code devised by the National Weather Service (See Figure A 3).

7._ COUNTY

The COUNTY command is used to access stations by county. The operand consists of a string of one or more characters. All stations are retrieved which have the same character string in the name of the county. Unlike other comparisons, however, the string does not have to occur at the beginning of the county name, but can occur anywhere in the name. Thus, for example, for the operand BO all stations in BOnner, BOise, BOundary and CariBOu counties would be accessed.

8._ ELEVATION

The ELEVATION command is used to access stations within a given range of elevations. The operand is given in the form MIN TO MAX. For example, the command card ELEVATION 2000 TO 2500 will access all stations between 2000 and 2500 feet elevation. Stations with elevations equal to either the upper or lower limit will be included.

The format of the operand is quite free, the only requirement being at least one blank between the two limits. The limits can also be punched with a decimal point, and several decimal places if required. Thus the operand 2000.00 2500.0 will produce the same results as the example above.

If only a lower limit is desired, only a single limit need be given. A default upper limit of 100,000 feet will be supplied automatically.

For certain stations, the elevation may be unknown or irrelevant, and the elevation in the index will be left blank. These blank values are not interpreted as zeros, and such stations cannot be accessed using the ELEVATION command.

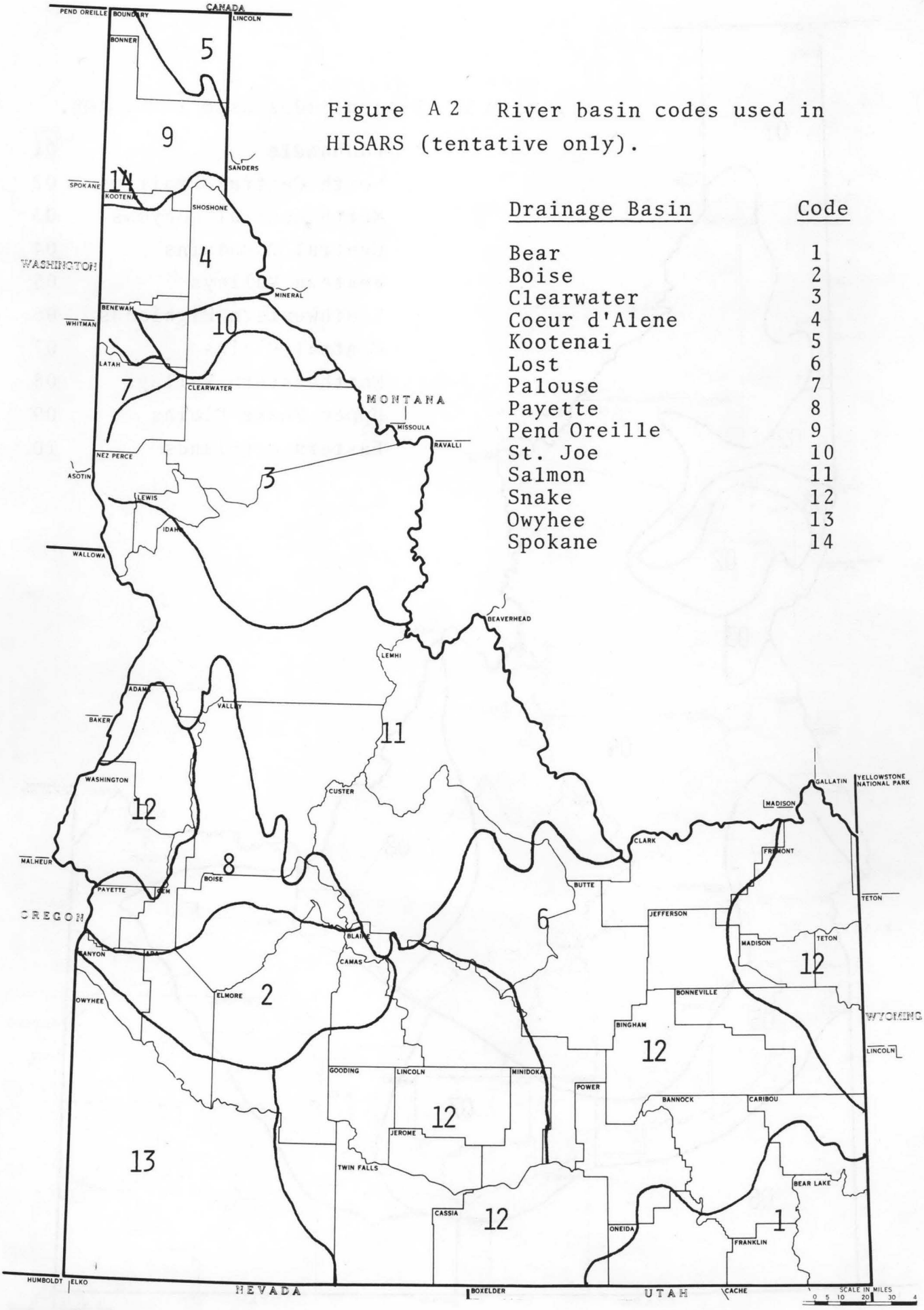

Figure A 2 River basin codes used in HISARS (tentative only).

Drainage Basin	Code
Bear	1
Boise	2
Clearwater	3
Coeur d'Alene	4
Kootenai	5
Lost	6
Palouse	7
Payette	8
Pend Oreille	9
St. Joe	10
Salmon	11
Snake	12
Owyhee	13
Spokane	14

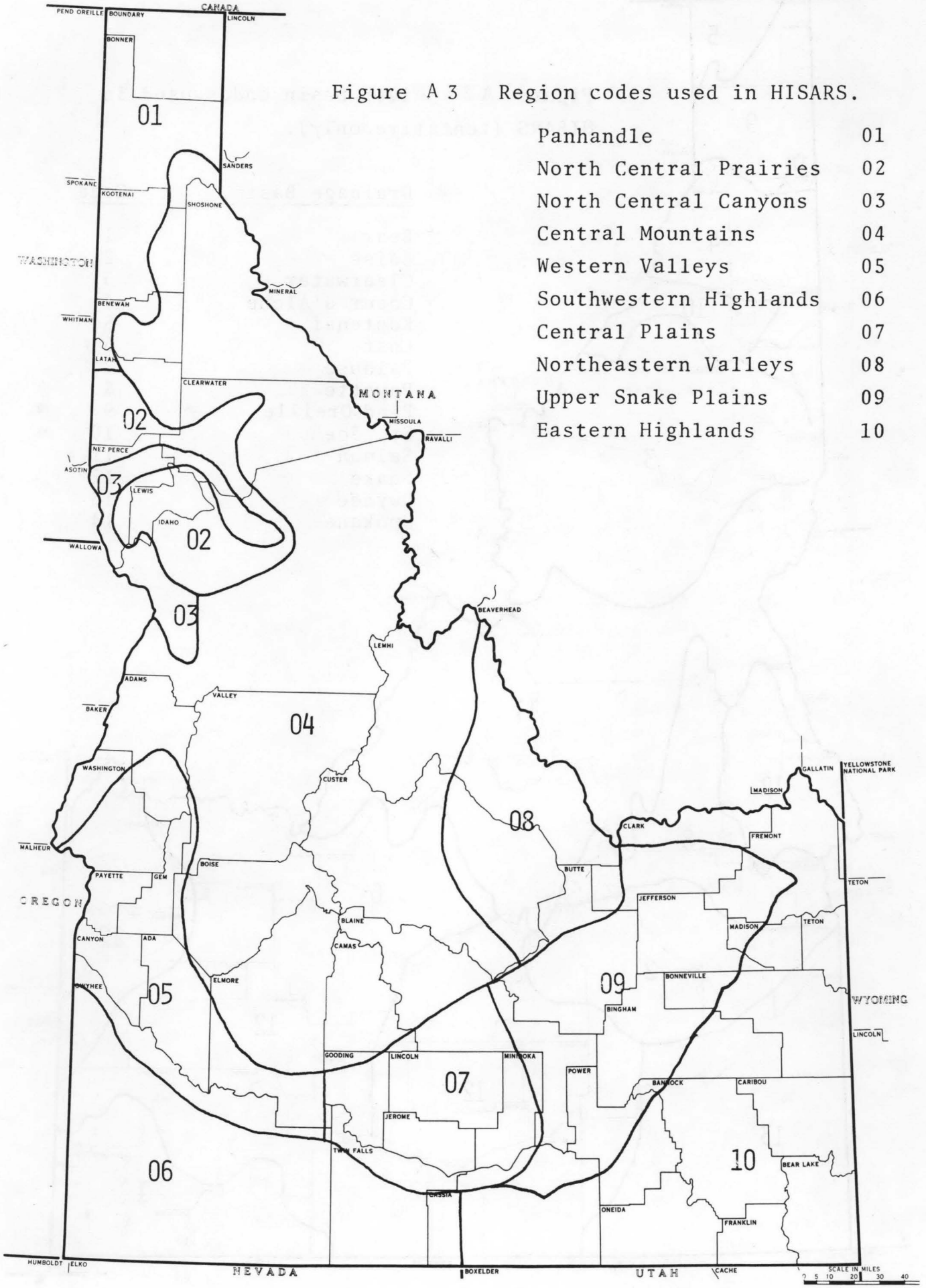

Figure A 3 Region codes used in HISARS.

Panhandle	01
North Central Prairies	02
North Central Canyons	03
Central Mountains	04
Western Valleys	05
Southwestern Highlands	06
Central Plains	07
Northeastern Valleys	08
Upper Snake Plains	09
Eastern Highlands	10

9. AREA

The AREA command is used to access streamflow stations by drainage area. The format and usage of the operand is identical to that of the ELEVATION command given above, except that the limits are of drainage areas in square miles. Again, if only a lower limit is required, a single limit is sufficient.

Blank values are more common for drainage areas. These occur for springs, and for stations with varying drainage areas such as swamps. Such stations cannot be accessed using the area command.

10. PERIOD

The period for which records are included in the data files is recorded in the associated index file. Since records for most files are stored by month, the beginning and ending of a period of record is stored by year and month. Each period which is complete, but which is preceded and followed by a missing month, is defined as a period of record, and is indexed by beginning and ending dates and length in months. Up to 100 such periods can be accessed for a single station; if there are more, only the last 100 are indexed and accessible by the system.

For the files which contain data obtained at irregular intervals, such as snowfall, the index assumes a single period of record, with the first and last months being the months in which the first and last days of record occurred. The number of months is replaced by the number of records in the file. There is no way to tell from the index whether the record is complete during the period.

If an access group is given without a PERIOD command, the entire period of record is accessed for every station included by the group. The PERIOD command may be used to restrict the length of period for which records are to be accessed.

The format of the operand is BEGIN TO END, where BEGIN and END are months in the form Month/Year. For example, the command

PERIOD 6/1939 TO 12/1940

would limit access to records in the period June 1939 to December 1940 inclusive. The format requires the slash ('/') immediately preceded by month and followed by year without intervening blanks. The same format is required for BEGIN and END but spacing and words in between are irrelevant.

For some purposes, a complete period of record may be required. If the word COMPLETE is added at the end of the preceding operand, with at least one intervening blank, only stations having complete records for the entire period specified will be accessed. This feature could be used, for example, to obtain averages for all stations which have complete records for a specific period.

11. LIST

The LIST command directs the system to produce certain listings of the accessed data. The following operand are permitted:

a) INDEX
b) MONTHLY
c) DAILY
d) HOURLY
e) CONTENTS

The INDEX operand indicates that a listing of the index is to be produced. The MONTHLY and DAILY operands indicate that data are to be listed for the specified time periods.

Listings of monthly values for several of the elements normally include such summary information as annual totals, monthly and annual averages for the period, and the ratio of the annual total to the annual average for each year with complete records. In order to print the ratios in a convenient format, the data are actually read twice. If the ratios are not required, the word PARTIAL may be added following the operand MONTHLY. Thus, the command LIST MONTHLY PARTIAL will produce listings, complete except for ratios, at noticeably less cost and should be used whenever possible.

Detailed formats of output listings are given in Section I.D. The LIST command has one option. This is the month for which the listing is to begin. For example, LIST MONTHLY 6 will list the year with June as the first month. LIST DAILY 10 will list one year's data beginning on October 1. This is most useful for streamflow files where a wateryear listing rather than a calendar year list is desired. Default is 1 except for snowfall files where default is 7.

12. COPY

The COPY command is provided to permit users to copy records from the HISARS data files to other formats, for use with other languages. Since HISARS files are not accessible to FORTRAN and COBOL,operands provide for conversions appropriate to these languages. This feature is discussed in detail in Part III, the Users' Guide to the Copying Facilities.

13. AND or OR

The AND and OR commands are not strictly commands, but are control words for the And/Or option. This option is described in Section I.C.2 below.

C. ACCESS COMMAND OPTIONS

Several options are permitted beyond the standard specifications described in the previous section. The options are designed to permit either extension to the access facilities or simplification of the command format.

1. The complete file option

For certain uses of the system it may be desirable to access the entire file. For example, the user may wish to obtain an index of all records in the files.

This option is obtained by using only an ACCESS card, an ELEMENT card with the requested element or elements as operands, and appropriate LIST cards as required. No other command cards are permitted.

When this option is used, the entire file is scanned, and entries for each station in order are processed as requested. Since such processing may be unacceptably extensive, only limited operations are permitted. For example, operands for the LIST command of INDEX and MONTHLY are permitted, but DAILY is not.

2. The AND/OR option

The regular access facilities permit retrieval of records that satisfy one or more criteria. For example, if the command cards

```
BASIN  06
       07
COUNTY BONNER
```

are used, then all stations that are either in Basin 06 or in Basin 07 or in Bonner County will be accessed. Note that the word OR is used in the logical sense.

OR command cards could be inserted between the command cards above, without changing the results. These cards are therefore without function to the system, but may help the user to recognize the logic of the retrieval request.

The AND command introduces the requirement that in addition to preceding criteria, the following criterion must be met. For example, if the command cards

```
BASIN 06  07
COUNTY BONNER
AND
ELEVATION 2000
AND
AREA 0 to 500
```

are used, all stations that are either in Basin 06 or in Basin 07 or in Bonner County and having elevations over 2000 feet and having drainage areas of less than 500 square miles will be accessed. Note that the word AND is used in the logical sense also. This option permits some additional flexibility in making access requests.

3. Optional abbreviation

Abbreviation of the command words and certain operands is possible. The user who is just becoming acquainted with the system should probably use the whole words as given, but a user with more experience may prefer the abbreviated forms.

Abbreviation is possible because the system when reading the command cards reads only enough of each word to identify it uniquely. Thus, to distinguish between the commands ELEMENT and ELEVATION, only the first four letters need be read. Four letters are sufficient to uniquely identify all other commands. The allowable abbreviations are:

a) Command words - the first four letters of the names given in Section I.B;

b) Element names - the first three letters of the names given in Section I.B.2;

c) List operand - the first two letters of the names given in Section I.B.11.

D. OUTPUT FORMATS

This section contains examples of the output that may be produced by the access facilities of HISARS. Examples show the command cards used, and the corresponding output. The examples include all listings that are now available. Other listings will be implemented as the need arises.

1._ The output heading page

A heading is printed at the beginning of the output associated with each access group. This contains the system name and version, the date and time of execution, a list of access requests as recognized by the system, and a map showing station locations and location blocks searched. No map is produced if only an Index listing is requested. An example is shown in Figure A 4 , which resulted from the following command cards:

```
ACCESS
ELEMENT      STREAMFLOW
STATION      13196500
LIST         MONTHLY
```

2._ Indexes of the files

The command sequence

```
ACCESS
ELEMENT      STREAMFLOW
COUNTY       SHOSHONE  KOOTENAI
LIST         INDEX
```

produced the output shown in Figure A 5 .

Not all of the indexes printed will include information under all headings. An example is drainage area which would not be used for temperature files. For any other spaces left blank, the information was not known at file generation time.

All users are encouraged to obtain indexes of the files of interest to them. This is the only way to determine the file contents, period of record or number of records and so forth.

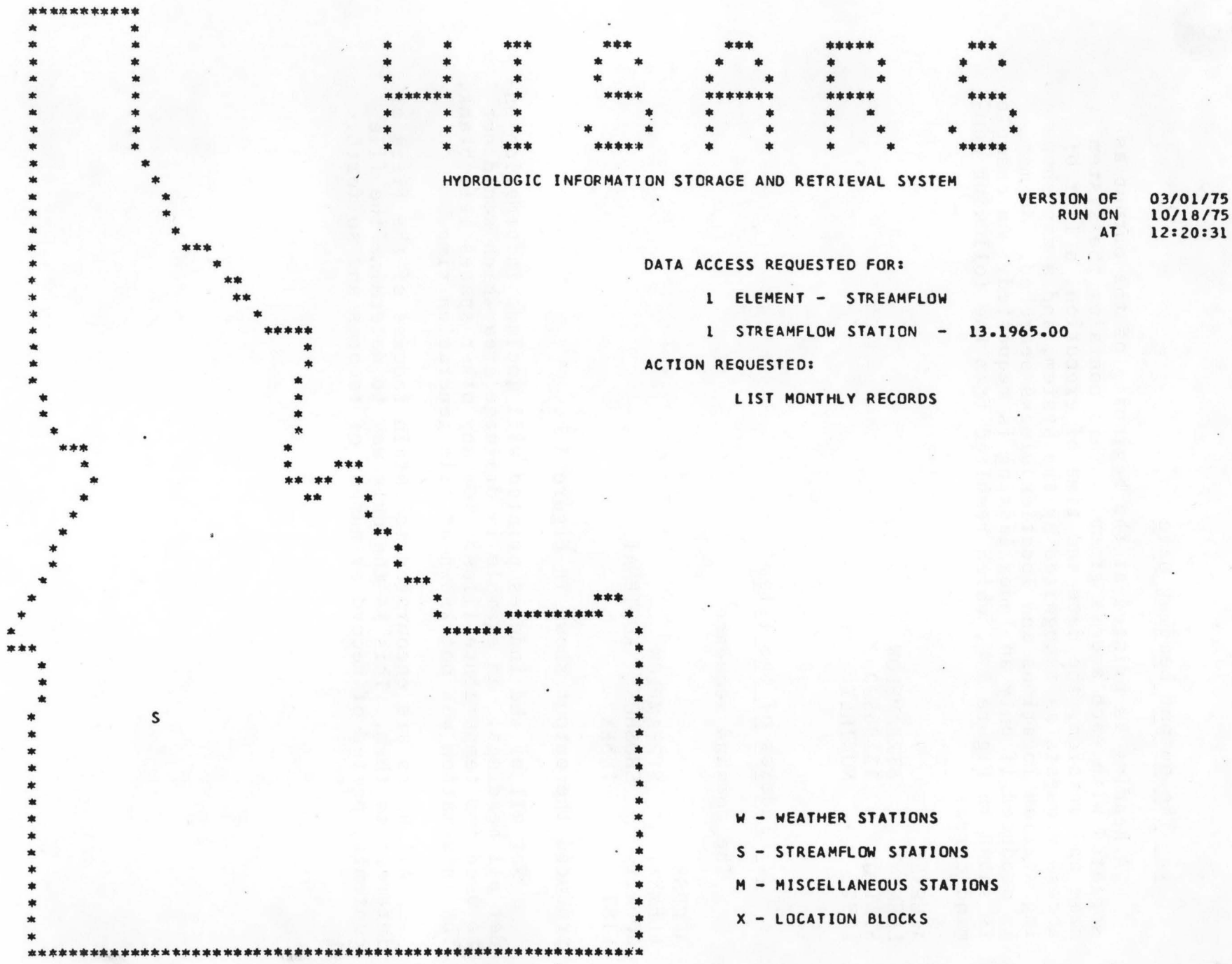

Figure A 4. Output heading page

ST. JOE RIVER AT CALDER, IDA
LATITUDE 47-16-30 LONGITUDE 116-11-15
ELEVATION FT MSL REGION 04
SHOSHONE STATION NO. 12.4145.00
GEOGRAPHIC LOCATION BLOCK 4716-142-214
BASIN 14-/4 AREA 1030 SQ MI

PERIOD OF RECORDS	LENGTH, MONTHS
05/1911 - 09/1912	17
08/1920 - 09/1973	638

COEUR D'ALENE LAKE AT COEUR D'ALENE, IDA
LATITUDE 47-39-55 LONGITUDE 116-46-05
ELEVATION FT MSL REGION 01
KOOTENAI STATION NO. 12.4155.00
GEOGRAPHIC LOCATION BLOCK 4716-324-142
BASIN 14-/4 AREA 3700 SQ MI

PERIOD OF RECORDS	LENGTH, MONTHS
08/1904 - 10/1905	15
01/1906 - 02/1906	2
04/1906 - 04/1906	1
06/1906 - 04/1911	59
06/1911 - 09/1917	76
11/1917 - 09/1922	59
11/1922 - 09/1962	479

HAYDEN CREEK BELOW NORTH FORK NEAR HAYDEN LAKE, IDA
LATITUDE 46-49-22 LONGITUDE 116-39-10
ELEVATION 2370 FT MSL REGION 01
KOOTENAI STATION NO. 12.4160.00
GEOGRAPHIC LOCATION BLOCK 4616-342-412
BASIN 14 AREA 22 SQ MI

PERIOD OF RECORDS	LENGTH, MONTHS
10/1965 - 09/1973	96

RATHDRUM PRAIRIE CANAL AT HUETTER, IDA
LATITUDE 47-42-35 LONGITUDE 116-52-05
ELEVATION FT MSL REGION 01
KOOTENAI STATION NO. 12.4180.00
GEOGRAPHIC LOCATION BLOCK 4716-324-323
BASIN 14 AREA SQ MI

PERIOD OF RECORDS	LENGTH, MONTHS
10/1960 - 09/1973	156

SPOKANE RIVER NEAR POST FALLS, IDA
LATITUDE 47-42-10 LONGITUDE 116-58-40
ELEVATION FT MSL REGION 01
KOOTENAI STATION NO. 12.4190.00
GEOGRAPHIC LOCATION BLOCK 4716-323-321
BASIN 14 AREA 3840 SQ MI

PERIOD OF RECORDS	LENGTH, MONTHS
01/1913 - 09/1973	729

Figure A 5. Streamflow index listing

3. Monthly streamflow

The command sequence

```
ACCESS
ELEMENT     STREAMFLOW
STATION     13196500
LIST        MONTHLY
```

produced the output shown in Figure A 6

Values listed are monthly streamflow totals. Sufficient decimal places are provided to print the correct total of the daily values. Means are computed for each month, and the numbers of months used in these computations are also listed.

The annual mean discharge is obtained as the sum of the monthly mean values and is not necessarily equal to the mean of the annual totals. For those annual totals which are complete (i.e. contain 12 months of data), the ratio of the total to the annual mean is computed.

If the word PARTIAL follows the operand MONTHLY, the mean annual discharge is not computed until the rest of the table has been printed, so that the ratios of the annual totals to the mean cannot be computed. This processing is more efficient and is recommended unless the ratios are required.

Mean daily discharge values in cubic feet per second and in cubic feet per second per square mile are also given. These values are obtained as the mean for all days used in the computations.

A minus sign to the right of a monthly value indicates that there are missing daily values during the month. Neither the monthly total nor the recorded daily values for such months are used in the computations.

4. Daily streamflow

The command sequence

```
ACCESS
ELEMENT     STREAMFLOW
STATION     12414500
PERIOD      10/1952 to 9/1953
LIST        DAILY 10
```

produced the output shown in Figure A 7 .

Values listed are daily totals in cubic feet per second. Since values are stored in hundredths, they are printed this way, although for larger basins these decimal places are usually not used. Monthly totals are also listed. Note that this is a water year listing so the operand DAILY 10 will begin the listing with October and the entire water year is then on one page. Had the 10 been left off, two pages of output would have resulted.

A dash indicates that the daily value is missing.

BANNOCK CREEK NEAR IDAHO CITY, IDA BOISE STATION NO. 13.1965.00

TOTAL MONTHLY STREAMFLOW IN CFS-DAYS

	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER	ANNUAL	% AVE
1939		19.55	41.95	96.4	56.38	22.65	9.22	4.94	7.36	11.18	11.5	18.41	299.54	
1940	18.81	24.24	90.5	156.8	87.2	24.88	10.48	4.97	11.09	16.37	20.13	18.84	484.31	61
1941	18.4	20.43	48.2	99	91	45.1	18.36	12.68	11.7	15			379.87	
1950										24.8	33	34.9	92.7	
1951	25.3	52.5	50.9	285.3	293.6	114.4	47.3	31.8	18.5	36.2	30.8	36.1	1022.7	129
1952	27.2	30.5	39.6	429.4	350.6	89.6	34	17.9	15.1	15.5	17.6	23.6	1090.6	138
1953	45.5	46.4	57.7	179	210.3	219.4	49.6	22.8	17.6	18	26.9	25.7	918.9	116
1954	31	38.2	76	233.2	158.4	90.6	51.2	25.7	17.3	16.2	20.4	20.3	778.5	98
1955	22	19.2	25.7	62.9	196.9	58.4	20	9.8	7.9	14.7	21.4	130.1	589	75
1956	111.8	39.6	90.4	347.6	238.6	108.8	40.5	20.8	18.3	29.4	30.2	31.5	1107.5	140
1957	25.6	42	104.1	281.9	500.2	122	35.4	17.6	14.5	25.7	25.9	33.5	1228.4	155
1958	27.4	53.7	73.9	311.7	517	108.3	44.7	18.6	17.6	19.9	25.5	28.1	1246.4	158
1959	31.6	30	43.7	126.2	128.1	64.3	21.9	13.4	22.7	28.7	23.2	24.3	558.1	71
1960	23.4	19.7	53.2	206.6	146.8	58.4	16.8	11.2	12.3	14.8	20.6	18.7	602.5	76
1961	15.5	24.3	40.5	70.9	65.7	28.6	10.7	7.2	11.2	14.5	18.6	21.4	329.1	42
1962	17	19.5	21.7	169.9	169.5	81.6	25.5	12	12.2	21	22.6	26.2	598.7	76
1963	16.9	52.8	50.1	124.8	174.9	92.8	25.8	10.5	10.2	14.5	20.8	17.3	611.4	77
1964	18.8	17.1	19.3	81	173.2	72	21.9	8.9	9.8	11.3	16.6	96.6	546.5	69
1965	70.3	89.9	103.3	531.6	377	123.6	40.8	20.6	22.5	24.9	25.5	24.1	1454.1	184
1966	31.5	28.6	52.7	107.7	66.8	26.2	11.1	6.2	8.1	11.3	15.5	19.24	384.94	49
1967	25.41	21.8	39.3	75.6	156.7	58.1	18.55	6.32	8.35	14	15.72	17.15	457	58
1968	19.3	42.95	58.3	72.8	62.2	41.69	12.19	19.52	15.73	17.45	29.04	21.07	412.24	52
1969	50.76	37.5	68.5	488	279	70.5	32.7	14.84	16.19	20.67	23.96	25.66	1128.28	143
1970	61.55	60.6	114.1	132.2	349.9	113.9	46.13	14.74	17.84	24.49	43.11	44.68	1023.24	129
1971	80.3	92.7	136.8	497	511.1	120.3	50.06	18.46	17.69	27.72	1.84-		1553.97	
MEAN	35.44	38.49	62.51	215.31	223.37	81.50	28.95	14.64	14.23	19.53	23.41	32.93		
NO. OF MONTHS	23	24	24	24	24	24	24	24	24	25	23	23		
PERCENT ANNUAL	4.5	4.9	7.9	27.2	28.3	10.3	3.7	1.9	1.8	2.5	3.0	4.2		

MEAN ANNUAL DISCHARGE 790.37 CFS-DAYS
MEAN DAILY DISCHARGE 2.17 CFS
0.38 CFS/SQ MI (5.75 SQ MI)

Figure A 6. Streamflow file monthly data listing

ST. JOE RIVER AT CALDER, IDA SHOSHONE 12.4145.00

MEAN DAILY STREAMFLOW IN CFS

1952-53

	OCTOBER	NOVEMBER	DECEMBER	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER
1	342.00	333.00	230.00	290.00	5270.00	890.00	2040.00	6500.00	8660.00	2830.00	728.00	494.00
2	338.00	309.00	302.00	265.00	3940.00	798.00	1900.00	5460.00	10200.00	2720.00	702.00	515.00
3	333.00	290.00	346.00	294.00	3370.00	798.00	1870.00	4850.00	8960.00	2660.00	709.00	531.00
4	333.00	279.00	342.00	358.00	4210.00	798.00	1790.00	4890.00	7880.00	2590.00	819.00	499.00
5	329.00	290.00	317.00	290.00	3300.00	770.00	1920.00	5940.00	7750.00	2470.00	722.00	484.00
6	325.00	294.00	298.00	260.00	2670.00	735.00	2050.00	8200.00	7590.00	2360.00	670.00	474.00
7	325.00	283.00	294.00	280.00	2470.00	716.00	1960.00	11000.00	7680.00	2250.00	634.00	459.00
8	321.00	257.00	302.00	294.00	2550.00	763.00	1780.00	9440.00	7500.00	2160.00	670.00	449.00
9	313.00	221.00	279.00	728.00	2250.00	928.00	1580.00	7570.00	6900.00	2100.00	702.00	435.00
10	313.00	224.00	279.00	1190.00	1960.00	1210.00	1490.00	6160.00	6460.00	1970.00	658.00	435.00
11	313.00	325.00	275.00	1090.00	1790.00	1390.00	1480.00	5310.00	6860.00	1850.00	599.00	430.00
12	309.00	367.00	321.00	2770.00	1590.00	1430.00	1480.00	5030.00	7880.00	1770.00	559.00	426.00
13	309.00	371.00	440.00	3290.00	1490.00	1340.00	1420.00	5180.00	8680.00	1680.00	537.00	411.00
14	306.00	346.00	384.00	2010.00	1380.00	1240.00	1320.00	5730.00	7500.00	1600.00	499.00	393.00
15	306.00	350.00	321.00	1340.00	1340.00	1210.00	1220.00	6630.00	6560.00	1530.00	499.00	389.00
16	309.00	338.00	283.00	1130.00	1240.00	1240.00	1310.00	7570.00	5940.00	1440.00	499.00	376.00
17	306.00	309.00	268.00	1230.00	1200.00	1310.00	1500.00	8800.00	5800.00	1340.00	499.00	367.00
18	302.00	290.00	272.00	1800.00	1130.00	1200.00	1840.00	9410.00	5560.00	1270.00	504.00	371.00
19	302.00	283.00	275.00	2610.00	990.00	1250.00	2100.00	10900.00	5090.00	1210.00	515.00	362.00
20	302.00	283.00	272.00	2320.00	860.00	1270.00	2920.00	10900.00	4600.00	1160.00	521.00	371.00
21	302.00	268.00	261.00	2340.00	930.00	1230.00	4570.00	8710.00	4160.00	1120.00	531.00	367.00
22	298.00	208.00	261.00	1810.00	912.00	1170.00	6200.00	7130.00	3880.00	1060.00	526.00	362.00
23	298.00	150.00	257.00	1890.00	868.00	1130.00	9650.00	6140.00	3740.00	1010.00	521.00	371.00
24	298.00	208.00	217.00	2250.00	784.00	1170.00	10600.00	6260.00	3530.00	982.00	622.00	402.00
25	294.00	230.00	160.00	1930.00	819.00	1720.00	9180.00	6220.00	3350.00	958.00	749.00	411.00
26	294.00	140.00	210.00	1670.00	812.00	1910.00	8860.00	6580.00	3180.00	950.00	599.00	430.00
27	294.00	100.00	260.00	1400.00	833.00	1840.00	10500.00	7500.00	3080.00	898.00	576.00	531.00
28	290.00	120.00	280.00	1250.00	935.00	1920.00	12900.00	7680.00	2990.00	861.00	570.00	531.00
29	287.00	130.00	298.00	1180.00		2020.00	10500.00	7900.00	2960.00	826.00	570.00	521.00
30	313.00	180.00	317.00	1500.00		2170.00	8070.00	8390.00	2880.00	798.00	542.00	407.00
31	354.00		317.00	2110.00		2210.00		8110.00		763.00	510.00	
TOTAL	9658.00	7776.00	8938.00	43169.00	51893.00	39776.00	126000.00	226090.00	177800.00	49186.00	18561.00	13004.00

Figure A 7. Streamflow file daily data listing

5. Monthly listings from rainfall file

The command sequence

```
ACCESS
ELEMENT     RAINFALL
STATION     101956
PERIOD      1/1950 To 12/1972
LIST        MONTHLY
```

produced the output shown in Figure A 8 . The addition of the work PARTIAL would delete the last column.

Values in the table are totaly monthly precipitation amounts in inches. The following special symbols are used to qualify the monthly amounts:

- \- missing values during month;
- * accumulations during month;
- E estimated values during month.

Only one symbol is printed for one month, and the symbol is selected in the above order. Thus, if a minus sign appears, there may also be accumulations or estimated values during the month, but if an E is printed, there are neither missing values nor accumulations.

Monthly means are computed excluding those months marked with a minus sign, and the mean annual precipitation is obtained as the sum of the monthly means. Annual totals are obtained for all years, but the ratio of the annual total to the annual mean is obtained only for years with no missing values.

** CAUTION **

Much rainfall data previous to 1970 is not flagged for missing, accumulated or estimated data . Therefore, the above symbols may not appear in the listings for dates before 1970.

6. Daily listings from rainfall file

The command sequence

```
ACCESS
ELEMENT     RAINFALL
STATION     107301
PERIOD      1/1970 to 12/1970
LIST        DAILY
```

produced the output shown in Figure A 9 .

Values in the table are daily precipitation amounts in inches. Amounts are qualified by the following special symbols:

- \-- amount missing;
- * amount accumulated;
- E amount estimated;
- T trace reported;
- X invalid code combination.

Combinations of the symbols may be printed as appropriate.

Monthly totals are also printed.

COEUR D'ALENE 1 E KOOTENAI STATION NO. 10-1956

TOTAL MONTHLY PRECIPITATION IN INCHES

	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER	ANNUAL	% AVE
1950	4.69-	2.82	4.40	1.06	1.04	2.98	1.14	0.95	0.38	4.48	2.25	2.63	28.82	
1951	4.38	2.07	2.86	0.44	1.28	1.88	0.86	0.68	0.71	6.96	2.49	6.39	31.00	126
1952	3.67	1.54	1.28	0.88	0.88	2.25	0.32	0.10	0.52	0.35	0.68	4.00	16.47	67
1953	5.32	1.91	1.91	2.12	2.29	1.66	0.00	1.22	0.38	0.52	3.73	3.13	24.19	99
1954	6.82	1.61	0.86	1.20	1.36	1.58	1.30	2.83	1.30	1.43	2.45	2.80	25.54	104
1955	1.50	2.16	0.94	2.54	1.33	1.82	1.86	0.00	1.54	4.12	5.03	5.25	28.09	115
1956	4.51	2.11	2.44	0.47	2.83	2.60	1.16	1.81	0.69-	2.34-	0.95	2.72	24.63	
1957	2.09	2.83	2.61	1.48	6.43	2.63	0.09	0.49	0.86	3.22	1.64	3.08	27.45	112
1958	4.15	3.63	1.33	3.94	0.63	2.13	1.13	0.25	0.71	2.11	4.19-	4.02-	28.22	
1959	5.45	1.84-	2.03	1.65	2.06	0.79	0.11	0.65	2.81	2.53	2.19-	1.65	23.76	
1960	1.57-	2.22	1.01-	1.40-	3.50-	0.82	0.00	2.17	1.13	1.48-	3.42-	0.38-	19.10	
1961	1.18-	3.38-	2.38-	1.39-	2.22	1.05	0.36	0.62	0.35	1.53	2.07E	2.73-	19.26	
1962	0.53-	1.13-	1.87-	0.13-	1.74-	0.73	0.28	1.03	1.04	1.42-	2.88-	1.10-	13.88	
1963	0.55	2.03-	1.39	1.02-	1.67	1.66	1.03	0.63	1.36	1.45	3.94-	2.16-	18.89	
1964	4.25E	0.51-	2.00-	1.19	0.58	4.01	1.49	2.63	1.65	1.05	2.91	7.85E	30.12	
1965	3.59-	1.78-	0.15	3.02	1.27	2.36	0.22	3.54	1.04	0.26	2.13-	1.79	21.15	
1966	4.07	0.92	2.51-	0.35	0.63	1.47	0.55	0.59	0.21	0.82	4.60-	2.76-	19.48	
1967	4.36-	1.05	1.82-	2.34	2.18	2.03	0.04	0.00	0.70	3.26	1.89	2.74	22.41	
1968	2.81	4.16	0.95	0.48	2.41	2.01	0.35	2.32	2.29	3.49	3.26-	3.64-	28.17	
1969	0.00-	1.15-	0.74	2.56-	0.00-	2.30	0.32	0.00	1.35	1.37	0.54	2.21-	12.54	
1970	3.68-	3.27	0.65-	1.94-	0.47	1.87	1.10	0.32	0.89	2.28-	3.18-	2.91-	22.56	
1971	4.01*	1.77	2.98*	1.99*	2.11	4.62	0.88	1.90	2.05	1.82	2.64*	4.95*	31.72	129
1972	4.37*	2.12-	2.79*	2.32*	2.33	1.61	0.67	1.64	1.21	0.83	1.72	3.35-	24.96	
MEAN	3.86	2.27	1.85	1.62	1.80	2.04	0.66	1.15	1.11	2.19	2.21	3.77		
NO. OF MONTHS	15	15	16	17	20	23	23	23	22	19	14	13		
PERCENT ANNUAL	15.8	9.3	7.6	6.7	7.4	8.4	2.7	4.7	4.6	9.0	9.1	15.4		

MEAN ANNUAL PRECIPITATION 24.53 INCHES

Figure A 8. Precipitation file monthly data listing.

POTLATCH 3 NNE LATAH 10-7301

DAILY PRECIPITATION IN INCHES

1970

	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER
1			0.40	0.11					0.03			0.05
2			0.18	0.25				0.02				
3	0.03								0.15			0.15
4									0.56			
5									0.01	0.20	0.22	0.06
6		0.21	0.19		0.35					0.02	0.01	
7			0.27	0.11	0.02							
8					0.08	0.25					0.10	
9	0.47			0.20	0.41	0.29				0.92	0.07	0.11
10	0.28			0.01		0.01						
11			0.15								0.42	
12	0.28		0.10		0.14					0.04	0.31	
13	0.97	0.71			0.02	0.10	0.73					
14	0.28		0.25			0.28						0.04
15		0.60	0.03			0.56						0.15
16	0.27	0.41	0.40								0.59	0.10
17	0.08	0.28										
18	0.93								0.27	0.01	0.27	
19	0.61			0.42								
20	0.33			0.17					0.07	0.22	0.09	
21	0.43						0.05			0.09		0.04
22	0.30			0.03					0.26			
23	0.74									0.38	0.17	0.20
24	0.73			0.46						0.07	0.47	
25	0.41			0.02			0.11				0.13	
26	0.22										0.11	
27	0.32			0.02		0.46	1.15				0.05	
28	0.02		0.53				0.25					0.06
29			0.11	0.03	0.13	0.01						0.26
30				0.04	0.16						0.32	0.16
31	0.19							0.01				
TOTAL	7.89	2.21	2.61	1.87	1.31	1.96	2.29	0.03	1.35	1.95	3.33	1.38

Figure A 9. Precipitation file daily data listing

7._ Monthly average, maximum and minimum temperatures

The command sequence

```
ACCESS
ELEMENT     TEMPERATURE
STATION     101551
LIST        MONTHLY
```

produced the output shown in Figure A 10. The addition of the word PARTIAL would delete the last column.

Values in the table are the average maximum and minimum temperatures in degrees Fahrenheit for each month. If there are missing daily maximum temperatures during a month, a minus sign is printed to the right of the average maximum. Similarly, missing daily minimum temperatures are identified by a minus sign to the right of the average minimum. If there are any estimated values of either maximum or minimum daily temperatures, an E is printed to the right of the average maximum, provided that there are not also missing maximum temperatures.

Monthly means are calculated using only values for complete months. The number of months printed is the number of months with complete minimum temperatures.

The mean annual temperatures are computed as the average of all complete months. These values may be biased if certain months are missing.

The annual average temperatures are computed using all the monthly averages, and are therefore subject to the same source of unreliability cited above. However, the ratio of the annual average to the mean annual temperature is calculated only for years with complete data.

8._ Daily maximum and minimum temperatures_

The command sequence

```
ACCESS
ELEMENT     TEMPERATURE
STATION     100010
PERIOD      1/1951 To 12/1951
LIST        DAILY
```

produced the output shown in Figure A 11.

Values in the table are daily maximum and minimum temperatures in degrees Fahrenheit. Missing values are left blank.

Monthly averages are also printed. For months with missing days, the averages are calculated using the available data.

** NOTE ** These same command sequences are used to obtain the water temperatures of the evaporation pans BUT the DD cards must be modified as shown in Section 1.5.

CASTLEFORD 2 N TWIN FALLS STATION NO. 10-1551

AVERAGE MONTHLY MAXIMUM AND MINIMUM TEMPERATURES IN DEGREES F.

	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER	ANNUAL	% AVE
1963						74.2	88.6	88.6	81.0	71.3	48.8	36.3	69.9	
						44.0	49.9	51.5	48.9	38.7	28.6	17.9	39.9	
1964	35.8	37.4	45.1	58.6	71.4	75.3	90.0	85.3	75.2M	68.7	47.8	41.1	61.1	
	15.9	17.5	22.7	30.2	38.3	44.6	52.0	48.5	38.0M	33.5	25.0	23.1	32.5	
1965	40.2	48.5	53.5	62.9	70.0M	78.5	86.1				54.6	40.5M	59.5	
	23.9	23.8	19.3M	37.0	37.2M	46.8	49.8				29.9	18.4M	31.8	
1966	41.2M	42.6M	55.2M	64.6M	79.3M	79.6	89.9	87.4M	81.8	67.1M	53.2M	37.1M	65.0	
	21.8M	20.0M	24.8M	30.3M	41.2M	47.0M	50.1	50.4M	42.6M	30.5M	29.9M	20.4M	34.2	
1967	42.9M	50.3M	55.4M	55.6	71.9	77.7	91.8M	92.1	82.6	65.5	52.6	36.6	64.7	
	26.2M	24.6M	27.2M	29.6	38.2M	46.2	55.4M	53.3	46.7	34.1M	29.5	17.0	35.7	
1968	39.0M	48.5M	59.0	59.5	73.6M	82.2	91.6	80.0	76.4	64.8	47.1	39.2	63.5	
	16.1M	26.6M	28.1M	29.0	38.8M	48.2	51.9	49.1	41.6	31.9	29.2	20.7	34.3	
1969	40.3	40.0	51.3	67.0	76.0	77.2	88.9	90.8	81.5	58.3	51.5	40.6	63.7	99
	21.5	22.7	24.5	32.8	42.3	47.4	53.1	51.0	43.9	30.0	23.4	23.9	34.8	99
1970	40.8	51.9	52.5	56.1	71.5	81.7	88.5	90.7	74.1	61.6	49.0	38.1	63.1	98
	25.9	26.6	26.8	28.3	38.7	47.1	53.4	53.2	38.8	30.3	30.4	18.9	34.9	99
1971	40.8	47.4	50.5	61.4M	72.7	80.0M	89.0	91.1	74.8	60.5	M	33.7	63.9	
	22.5	24.5	26.1	32.9M	41.2	47.8M	52.5	55.1	38.7	32.9	40.7	17.2	36.1	
1972	35.0	43.0	58.5	60.8	73.8	81.7	87.6	87.4	70.7	61.3	46.8	32.1	61.6	96
	18.2	23.9	30.6	31.5	38.8	48.6	50.8	51.9M	41.0	35.3	27.1	13.1	34.3	
1973	35.2	43.8	52.3	60.7	74.7	82.0	88.5	87.6	74.7	65.0	47.6	42.8M	63.0	
	16.7	23.2	26.3M	31.8	38.5	44.6	52.5	53.5M	43.6	33.8	29.2	27.8M	35.2	
MEANS	38.3	44.5	52.8	60.2	73.1	79.0	88.9	88.2	77.5	64.1	49.5	37.2		
	20.7	23.1	26.1	31.3	39.6	46.4	51.6	51.7	42.9	33.3	29.3	19.0		
NO. OF MONTHS	7	7	5	8	6	9	10	7	8	8	9	8		

MEAN ANNUAL MAXIMUM TEMPERATURE 64.3 DEGREES F.
MEAN ANNUAL MINIMUM TEMPERATURE 35.3 DEGREES F.

Figure A 10. Air temperature file monthly data listing

ABERDEEN EXP STATION BINGHAM 10-0010

DAILY MAXIMUM AND MINIMUM TEMPERATURES IN DEGREES F.

1951

	JANUARY		FEBRUARY		MARCH		APRIL		MAY		JUNE		JULY		AUGUST		SEPTEMBER		OCTOBER		NOVEMBER		DECEMBER	
1	31	10	13	-12	32	8	51	28	49	31	58	36	88	47	91	61	78	38	73	40	38	15	46	26
2	30	24	23	6	34	18	60	25	57	30	57	33	84	49	88	61	78	39	64	44	42	7	43	27
3	37	26	37	21	32	15	64	25	68	28	63	32	94	44	82	61	78	40	59	40	48	16	30	26
4	33	17	39	22	39	22	63	29	77	42	74	33	88	55	78	61	80	40	53	39	55	22	34	20
5	30	16	40	34	38	20	65	26	80	34	63	46	91	44	81	53	83	44	59	38	50	17	36	24
6	23	7	40	32	40	13	65	27	78	47	63	34	89	42	85	52	84	48	64	29	51	13	27	16
7	20	-3	51	34	38	31	68	29	69	46	60	32	82	39	83	47	88	41	67	30	54	18	23	10
8	24	-1	47	34	38	22	64	31	57	40	67	31	83	40	80	45	82	54	73	32	55	33	13	-6
9	25	14	55	31	45	27	67	42	68	36	72	35	82	44	83	44	76	36	78	30	60	18	12	-13
10	29	10	55	31	31	11	60	31	73	35	76	37	79	50	87	45	85	37	79	33	57	24	19	0
11	33	14	57	33	32	9	58	18	72	38	80	39	72	43	93	49	77	44	69	42	54	32	23	16
12	29	2	46	30	37	16	68	22	55	31	69	54	82	41	85	49	65	29	58	38	43	32	25	19
13	31	19	38	20	37	26	74	28	55	38	75	46	97	46	83	49	75	32	58	36	40	25	24	20
14	42	25	39	18	47	29	72	32	63	27	81	44	97	50	80	44	81	34	66	31	40	30	23	-4
15	32	22	48	22	50	31	58	23	75	31	89	50	99	45	90	39	79	43	58	40	36	20	30	4
16	33	20	46	25	49	23	69	23	73	37	86	48	98	58	92	48	86	37	52	19	31	9	35	26
17	41	24	43	17	34	19	72	38	77	38	84	47	98	59	93	49	83	39	55	24	34	8	35	24
18	43	26	41	28	40	16	68	40	75	48	80	46	99	55	90	48	78	47	55	20	39	9	32	20
19	27	18	35	20	48	23	65	48	74	43	80	41	94	63	90	61	82	38	61	35	43	17	35	14
20	23	1	38	21	56	24	62	23	73	44	77	43	86	62	85	58	80	54	57	36	48	23	22	3
21	33	12	39	26	63	28	58	30	75	44	76	40	83	54	84	50	61	29	47	29	44	30	29	16
22	39	30	49	25	52	31	64	20	80	41	73	41	87	44	81	55	68	36	49	28	38	19	35	22
23	39	19	48	25	48	20	63	32	80	47	75	37	97	48	79	53	71	41	59	36	37	19	29	4
24	40	24	44	23	55	21	59	36	73	47	75	54	95	56	74	52	77	43	52	37	35	17	22	17
25	38	17	39	24	58	24	65	25	72	45	74	44	95	54	77	37	74	48	53	34	42	20	19	-5
26	42	15	38	9	55	35	63	43	82	45	82	40	95	58	83	40	68	44	55	25	43	24	25	1
27	39	30	31	21	50	28	67	36	87	54	81	41	85	58	81	44	78	27	55	24	45	27	38	23
28	30	-2	31	15	46	17	62	48	81	50	81	40	86	59	82	48	79	36	57	20	49	29	37	26
29	11	-12			54	20	49	33	75	35	79	45	82	58	72	47	75	46	60	27	54	25	37	29
30	11	-8			47	31	45	31	71	42	83	42	86	53	70	44	78	56	53	17	54	32	35	20
31	10	-8			41	30			63	39			94	53	74	41			43	18			20	10
AVEMAX	30.6		41.1		44.1		62.9		71.2		74.4		89.3		83.1		77.6		59.4		45.3		28.8	
AVEMIN	13.2		22.7		22.2		30.7		39.8		41.0		50.7		49.5		40.7		31.3		21.0		14.0	

Figure A 11. Air temperature file daily data listing

9. Monthly listings from the pan evaporation file

The command sequence

```
ACCESS
ELEMENT       EVAPORATION
STATION       100010
PERIOD        1/1958 To 1972
LIST          MONTHLY
```

produced the output shown in Figure A 12. The addition of the word PARTIAL would delete the last column.

Values in the table are total monthly evaporation amounts in inches and total monthly wind movement in miles. The following special symbols are used to qualify values of both evaporation and wind movement:

- \- missing values during month;
- * accumulations during month;
- E estimated values during month.

Only one symbol is printed for one month, and the symbol is selected in the above order.

Monthly means are computed excluding those months marked with a minus sign, and the mean annual values are obtained as the sum of the monthly means. The number of months printed is the number of months with complete evaporation data. Annual totals are obtained for all years, but the ratio of the annual total to the annual mean is obtained only for years with no missing values.

10. Daily listings from the pan evaporation file

The command sequence

```
ACCESS
ELEMENT       EVAPORATION
STATION       100010
PERIOD        1/1958 To 12/1958
LIST          DAILY
```

produced the output shown in Figure A 13.

Values in the table are daily evaporation amounts in inches and total daily wind movement in miles. Missing values are left blank. Amounts are qualified by the following special symbols:

- * amount accumulated
- E amount estimated

Only one symbol is printed for one month, and the symbol is selected in the above order.

Monthly totals are also printed.

ABERDEEN EXP STATION BINGHAM STATION NO. 10-0010

TOTAL MONTHLY EVAPORATION IN INCHES AND WIND MOVEMENT IN MILES

	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER	ANNUAL	% AVE
1958	0.00-	0.00-	0.00-	0.00-	6.97-	8.27-	9.88	8.97-	6.27-	4.40-	0.00-	0.00-	44.76	
	1901-	2333-	2364-	3149	2202	2208	1798	1833	2209	1812	2383	2043	26235	
1959	0.00-	0.00-	0.00-	0.00-	6.64-	8.23-	9.58-	10.65-	5.54-	4.20-	0.00-	0.00-	44.84	
	2113	2794	3965	3927	3412	1713	1751	2155	2320	2649	2903	1570	31272	103
1960	0.00-	0.00-	0.00-	0.00-	8.53	10.62	10.91	9.94	7.08	4.22			51.30	
	1555	2438	2791	3584	3288	2618	1419-	2107	1332	1897			23029	
1961					7.91-	9.66	10.80	8.25	5.00-	3.24-			44.86	
					2934-	1669	1604	1304	1939	2402			11852	
1962								5.72-	6.64	3.77			16.13	
								1448-	2015	2919			6382	
1963					5.66-	6.07-	10.74	7.91	4.52	3.38-			38.28	
					2360	2024	1982	1583	1443	2075			11467	
1964					7.28-	6.65-	10.31	10.24	6.76	4.36-			45.60	
					3113-	2694-	2459	2767	2453	2024			15510	
1965					6.43-	8.47-	9.73-	8.06-	5.62-	4.74			43.05	
					3592-	3109	2138-	2151	3435	2362			16787	
1966					9.57-	10.03	11.89	10.23	6.05-	2.75-			50.52	
					3731-	3196	2259	2353	2421-	2579			16539	
1967					7.59-	7.06-	10.73	10.65	6.77	4.15-			46.95	
					3203-	1989	2193	2098	1925	2597			14005	
1968					7.25-	9.34	11.22	7.37	5.88	4.04			45.10	
					3267-	2779	2112	2344	2340	2502			15344	
1969					9.95-	8.28	11.44	11.41	8.28	3.22-			52.58	
					2861-	2879	2516	2340	2347	2990			15933	
1970					7.37-	8.72	8.60-	10.40	6.53	3.79-			45.41	
					2982	2458	2157-	1826	2281	2085-			13789	
1971					6.58-	9.11-		9.43	7.30	3.25-			35.67	
					3625	2866		2153	3131	3110			14885	
1972					7.48-	8.71	11.20	9.06-	6.56-	4.37-			47.38	
					3140	2773	2977	2243	2976	2546			16655	
1973					7.83-								7.83	
					3538								3538	
MEANS	0.00	0.00	0.00	0.00	8.53	9.34	10.91	9.58	6.64	4.19	0.00	0.00		
	1834	2616	3378	3553	3068	2483	2165	2090	2296	2462	2643	1807		
NO. OF MONTHS	0	0	0	0	1	7	10	10	9	4	0	0		
PERCENT ANNUAL	0.0	0.0	0.0	0.0	17.4	19.0	22.2	19.5	13.5	8.6	0.0	0.0		
	6.1	8.7	11.2	11.7	10.1	8.2	7.2	6.9	7.6	8.1	8.7	6.0		

MEAN ANNUAL EVAPORATION 49.19 INCHES
MEAN ANNUAL WIND MOVEMENT 30395 MILES

Figure A 12. Pan evaporation file monthly data listing

ABERDEEN EXP STATION BINGHAM 10-0010

DAILY EVAPORATION IN INCHES AND WIND MOVEMENT IN MILES

1958

	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER
1	82		56	42	91	0.13 23	0.24 32	0.29 45	55	0.13 51	13	16
2	42		126	93	0.30 88	0.18 37	0.18 39	29	0.49 158	0.20 37	22	98
3	6	45	33	85	0.31 86	0.22 87	0.12 80	0.18 54	0.31 68	0.06 23	76	139
4	23	27	53	211	0.54 135	0.24 88	0.27 37	0.40 61	0.37 56	0.14 13	230	195
5	22	105	139	142	0.16 44	0.21 40	0.31 50	0.41 88	0.33 55	0.11 17	126	141
6	24	148	90	32	0.32 101	0.26 73	0.34 20	0.43 80	0.25 21	0.24 97	133	204
7	41	39	61	33	0.23 100	108	0.32 4	0.22 40	0.30 19	0.36 211	217	100
8	37	22	88	90	0.20 70	0.45 97	0.36 96	0.40 40	0.13 15	0.28 240	164	191
9	48	56	131	155	110	0.27 153	0.35 49	108	0.18 35	0.17 140	106	26
10	39	130	30	66	0.27 55	0.23 53	0.39 49	0.27 28	0.28 82	0.19 115	112	9
11	148	95	73	24	0.26 104	0.22 26	0.38 52	0.28 12	0.23 54	0.11 31	38	35
12	37	62	100	17	0.08 203	0.21 63	0.49 66	0.28 26	0.08 35	0.15 21	7	77
13	48	217	94	41	0.19 83	0.19 42	0.81 266	0.54 61	0.26 233	0.14 32	100	22
14	69	152	51	108	0.16 24	0.19 106	0.28 76	0.33 54	0.27 99	0.17 7	172	22
15	25	107	67	111	0.15 20	0.38 77	0.28 20	0.40 43	0.17 97	0.22 43	92	25
16	26	135	84	129	0.29 64	0.21 14	0.30 49	46	0.25 29	0.19 77	111	20
17	44	59	41	77	0.30 80	0.41 70	0.36 49	0.51 98	0.20 52	0.08 5	60	17
18	71	21	105	253	0.29 40	0.25 84	0.34 91	0.37 89	0.19 105	0.17 73	40	13
19	25	32	43	145	30	54	0.38 69	0.37 72	0.28 97	0.14 106	50	34
20	35	22	64	245	0.25 35	0.34 49	0.38 80	0.22 37	0.29 158	0.10 186	52	8
21	91	33	153	187	0.36 67	0.35 29	0.39 79	0.28 7	42	42	18	10
22	68	24	58	209	0.30 32	0.44 70	0.26 15	0.26 36	0.12 30	0.08 22	35	31
23	17	72	51	72	0.23 61	0.21 10	0.20 15	0.14 18	0.14 162	0.13 20	98	10
24	189	77	55	66	0.22 38	0.47 191	0.21 56	16	0.10 117	0.09 48	121	15
25	73	238	117	96	0.29 54	0.35 83	0.35 33	0.37 62	0.21 126	0.12 61	78	64
26	36	221		80	0.23 45	26	0.41 103	0.38 68	0.19 46	0.14 17	15	59
27	85	131	52	189	77	0.54 76	0.18 22	0.37 67	0.13 13	0.18 20	38	82
28	161	63	57	76	0.24 66	0.48 168	0.29 20	0.46 136	0.20 54	0.10 10	25	76
29	85		93	54	0.41 71	0.44 79	0.36 97	0.39 142	0.17 53	0.11 7	22	19
30	204		101	21	0.29 69	0.40 132	0.18 32	0.25 68	0.15 43	0.04 23	12	32
31			98		0.10 59		0.17 52	0.17 102		0.06 17		253
TOTAL	0.00	0.00	0.00	0.00	6.97	8.27	9.88	8.97	6.27	4.40	0.00	0.00
TOTAL	1901	2333	2364	3149	2202	2208	1798	1833	2209	1812	2383	2043

Figure A 13. Pan evaporation file daily data listing

11. Monthly listings from the snowfall file

The command sequence

```
ACCESS
ELEMENT     SNOWFALL
STATION     101956
LIST        MONTHLY
```

produced the output shown in Figure A 14. The addition of the word PARTIAL would delete the last column. Note that the listing begins with July without the use of an additional operand for the LIST command.

Values in the table are total monthly snowfall amount in inches. The following special symbols are used to qualify the monthly amounts:

- \- missing values during month;
- * accumulations during month;
- E estimated values during month;
- T Trace total for month.

Only one symbol is printed for one month, and the symbol is selected in the above order.

Months during the period of record which are blank are assumed to have no snowfall. Monthly means are computed including these months, but excluding months marked with a minus sign. The mean annual snowfall is obtained as the sum of the monthly means. Annual totals are obtained for all years, but the ratio of the annual total to the annual mean is obtained only for years with no missing values.

** CAUTION **

Much snowfall data previous to 1970 is not flagged as given above. Therefore, the listings will seldom show the above symbols for data previous to 1970.

12. Daily listings from the snowfall file

The command sequence

```
ACCESS
ELEMENT     SNOWFALL
STATION     101956
PERIOD      7/1971 To 6/1972
LIST        DAILY
```

produced the output shown in Figure A 15.

Values in the table are daily snowfall amounts in inches, and snow depth on ground at time of observation in inches. Values are qualified by the following special symbols:

- M amount or depth missing;
- * amount accumulated
- E amount or depth estimated
- T trace amount or depth

Combinations of the symbols may be printed as appropriate.

Monthly total snowfall amounts are also printed.

COEUR D'ALENE 1 E — KOOTENAI — STATION NO. 10-1956

TOTAL MONTHLY SNOWFALL IN INCHES

	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	ANNUAL	% AVE
40-41					10.0	1.1	9.3	2.0					22.4	44
41-42					0.5	10.1	4.8	13.5	0.5				29.4	57
42-43					11.4	23.4	26.1	13.6	1.5				76.0	148
43-44							1.8	15.7	1.0				18.5	36
44-45					1.0	10.8	1.4	0.0	0.0-				13.2	
45-46					8.0	8.4	12.7	13.3					42.4	83
46-47					12.5	7.5-	19.0	1.0	1.0				41.0	
47-48					3.3	5.5-	2.1-	8.6	2.5				22.0	
48-49					1.3	31.3	9.9	28.5	5.5				76.5	149
49-50						23.6	56.9-	8.5	5.6		2.0		96.6	
50-51					3.3	9.1	19.7	8.0	21.5				61.6	120
51-52				0.3	6.0	29.4	35.3	10.8	5.5	0.0-			87.3	
52-53						15.0	10.5	2.8	0.5				28.8	56
53-54						3.4	56.2	3.0					63.6	124
54-55						10.0-	13.0	39.5	3.5	0.0-			66.0	
55-56					12.7-	20.8	21.1-	24.8-	7.5				86.9	
56-57					2.4	4.7	33.8	17.6	6.8				65.3	128
57-58				6.8	2.5	11.5	1.5	1.0	0.0-				23.3	
58-59					3.5	7.0	19.0	16.0					45.5	89
59-60					11.3	2.0	13.5	5.5	3.0-				35.3	
60-61					4.0	5.5	10.5	0.0-	5.5				25.5	
61-62					16.3	24.8	23.1	1.0	12.0-				77.2	
62-63						1.0	2.5	13.5	0.8				17.8	35
63-64						22.0	27.0	3.8	5.0	2.5			60.3	118
64-65					12.0	43.0	19.3	4.6					78.9	154
65-66					1.0	16.8	21.4	4.5	7.4				51.1	100
66-67					1.0	8.0	9.1-	3.6	7.8				29.5	
67-68					2.0	15.1	17.9	3.0					38.0	74
68-69					2.3	15.5-	0.0-	6.0	0.5	0.0-	0.0-		24.3	
69-70						10.0	82.0	0.0	9.0	2.0			103.0	201
70-71					7.0	20.0	19.5	6.5	0.5-	0.0-			53.5	
71-72				3.0	5.0	33.5*	30.0*	2.0-	4.0				77.5	
72-73				T	T	7.4	7.8	5.0					20.2	39
MEAN	0.0	0.0	0.0	0.3	4.0	14.4	19.6	8.7	3.7	0.2	0.1	0.0		
NO. OF MONTHS	33	33	33	33	32	29	28	30	28	29	32	33		
PERCENT ANNUAL	0.0	0.0	0.0	0.6	7.9	28.2	38.3	17.0	7.3	0.4	0.2	0.0		

MEAN ANNUAL SNOWFALL 51.0 INCHES

Figure A 14. Snowfall file monthly data listing

COEUR D'ALENE 1 E KOOTENAI 10-1956

DAILY SNOWFALL AND SNOW DEPTH ON GROUND IN INCHES

1971-72

	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE
1					3.0 3		0.0 M	2.0 7				
2							0.0 M	0.0 7	2.0 0			
3						1.0 0	0.0 8	0.0 7				
4							2.5 11	0.0 7				
5						6.0 6	2.5 14	0.0 7				
6						0.0 5	0.0 11	M 7				
7						0.0 5	0.0 7	0.0 4				
8						1.0 6	0.0 M	0.0 4				
9						7.0 13	0.0* M	0.0 3				
10						0.0 13	4.0 10	0.0 3				
11						0.0* M	4.0 10	0.0 3				
12						0.0* M	5.0 13	0.0 2				
13						5.0 18	0.0 M	0.0 1				
14						5.0 22	1.0 12	0.0 T				
15						1.0 22	0.0 10	M T				
16						2.0 23	0.0 8					
17						0.0 18	0.0 7					
18						0.0 16	1.0 8	M M				
19						0.0 14	0.0 8	0.0 M				
20						1.0 13	0.0 4	0.0 M				
21						0.0 9	0.0 2	0.0 M				
22						0.0 8	0.0 2	M M				
23					2.0 2	0.0 8	0.0 2	0.0 M				
24						0.0 8	0.0 2	T M				
25						0.0 8	8.0 10	0.0 M				
26						T 8	0.0 10	0.0 M				
27						T 8	0.0 M	0.0 M				
28						0.0 8	0.0 M	0.0 M	2.0 0			
29						4.5 13	0.0 M	0.0 M				
30						0.0 M	0.0 M					
31				3.0 0		0.0 12	2.0 8					
TOTAL				3.0	5.0	33.5	30.0	2.0	4.0			

Figure A 15. Snowfall file daily data listing

13 Contents of the peak flow file

The command sequence

```
ACCESS
ELEMENT      PEAKFLOW
STATION      13337500
LIST         CONTENTS
```

produced the output shown in Figure A 16. A heading page to identify the codes is also produced.

The following codes are used:

BW - Gage height was due to backwater
NM - Not maximum gage height for water year
MD - Discharge given is a maximum daily
ES - Discharge estimated from another site
DF - Discharge given due to dam failure
LT - Actual discharge is less than indicated value
UR - Unknown effect of regulation or diversion
KR - Known significant effect of regulation or diversion

The data for this listing, and the format of the listing were obtained from the U.S. Geological Survey.

SOUTH FORK CLEARWATER RIVER NEAR ELK CITY, IDA IDAHO STATION 13.3375.00

DRAINAGE AREA = 261
GAGE DATUM = FT.

WATER YEAR	ANNUAL PEAK DISCH,CFS	DATE	CODES	HIGHEST SINCE	GAGE HEIGHT OF ANNUAL PEAK,FT	CODE	ANNUAL MAX GAGE HT.FT	DATE	CODE
1945	1470	05-04-45							
1946	1230	04-19-46							
1947	2200	05-09-47							
1948	3700	05-29-48	MD						
1949	2200	05-16-49							
1950	1720	05-16-50			5.39				
1951	1280	05-12-51			4.72				
1952	1740	04-28-52			5.28				
1953	1460	04-28-53			5.02				
1954	1180	05-10-54			4.51				
1955	1980	05-21-55			5.60				
1956	2200	04-23-56							
1957	2120	05-21-57			5.85				
1958	1690	04-20-58			5.11				
1959	1770	05-16-59			5.35				
1960	1660	04-09-60			5.22	NM	6.88	03-27-60	
1961	1630	05-26-61			5.12				
1962	2240	04-20-62			5.87				
1963	1540	05-08-63			5.07				
1964	4040	06-08-64			7.48				
1965	3060	05-01-65			6.24				
1966	1130	05-07-66			4.12				
1967	2380	05-23-67			5.69				
1968	1360	02-23-68			4.43	NM	5.34	02-19-68	BW
1969	2200	04-24-69			5.42				
1970	2440	05-19-70			5.71				
1971	3270	05-05-71			6.58				
1972	3220	05-17-72			6.77				
1973	706	06-14-73			3.61				

Figure A 16. Annual peak streamflow file listing

14. Hourly listings from hourly rainfall file

The command sequence

```
ACCESS
ELEMENT      HOURRAIN
STATION      456789
PERIOD       3/1951 To 3/1951
LIST         HOURLY
```

produced the output shown in Figure A 17.

Values in the table are hourly precipitation amounts in inches for the hour ending at the time shown (on a 24-hour clock). Amounts are qualified by the following special symbols:

```
--  amount missing;
S   measurement is of melting snow;
*   amount accumulated;
E   amount estimated;
T   trace reported.
```

Only one symbol is printed for one hour, and the symbol is selected in the above order.

15. Daily listings from hourly rainfall file

The command sequence

```
ACCESS
ELEMENT      HOURRAIN
STATION      456789
PERIOD       1/1951 To 12/1951
LIST         DAILY
```

will produce output similar to Figure A 9.

Values in the table are total daily precipitation amounts in inches, measured from midnight to midnight. Amounts are qualified by the following special symbols:

```
--  amounts for entire day missing;
-   missing amounts during day;
S   melting snow measured during day;
*   accumulations during day;
E   estimated values during day;
T   trace total for day.
```

Only one symbol is printed for one day, and the symbol is selected in the above order. Thus if a minus sign appears, there may also be accumulations or estimated values during the day, but if an E is printed, there are neither missing values nor accumulations.

Monthly totals are also printed.

PULLMAN 2 NW WHITMAN 45-6789

HOURLY PRECIPITATION IN INCHES

MARCH, 1951

	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	TOTAL
1													--	--	--	--	--	--	--	--	--	--	--	--	
2																									
3												0.02	0.03	0.02	0.04	0.07	0.08	0.05	0.05	0.05	0.06	0.02	0.01	0.08	0.58
4	0.01		0.01			0.01	0.01							0.01	0.01	0.03	0.01	0.03	0.02						0.15
5											0.02														0.02
6					0.01		0.01		0.02																0.04
7		0.02	0.05	0.02																					0.09
8																		0.02	0.01	0.04	0.01				0.08
9																									
10											0.01	0.02	0.02				0.01								0.06
11																									
12		0.01	0.01	0.02	0.01	0.01		0.01	0.01			0.02					0.03	0.02	0.03		0.03	0.04	0.01	0.01	0.27
13						0.01	0.01																		0.02
14																									
15						0.01	0.03	0.02	0.07	0.17	0.09	0.22													0.61
16																									
17																									
18																									
19																									
20																									
21																							0.01	0.01	0.02
22	0.01																								0.01
23																									
24																									
25																									
26																									
27																									
28																									
29											0.01	0.01	0.04	0.02	0.05										0.13
30																									
31																									

Figure A 17. Hourly precipitation file listing

E. JOB CONTROL CARDS

Each and every submission of a HISARS job requires several cards. The first is a Job Information Card (JIC) stating that disk pack USR001 is to be mounted. This is a white card found in the USER Work Area at the Computer Center. The punch cards are as shown below:

```
//jnumber   JOB    (aaa-bb-cccc,actno,lines),'user',TYPRUN=HOLD
//          EXEC   HISARS
//SYSIN     DD       *
       ----  HISARS    DATA    CARDS  ----
/*
```

It may be well to note that all the data sets referred to by the HISARS PROC above are stored on a private magnetic disc pack. Since this pack must be mounted before the program can be run, turn-around time may be expected to be relatively slow. Batching of jobs is desirable.

Card formats for the job control language are specified by the system, and must be followed rigorously. In particular, blanks are permitted only at points that are clear in the example above, and not otherwise. The number of blanks at any point is arbitrary, however.

1 The JOB Card

The JOB card must be the one supplied by Computer Services and available in the User Work Area. This card has already punched on it the jnumber and word JOB. aaa-bb-cccc is the user's Social Security number, actno is any valid account number (assigned by Computer Services), lines is the number of output lines in 1000's (5 = 5000 lines output, 4000 is default), and user is the user's name. In addition, a TIME parameter may also be punched if more than 60 seconds is required for execution. TYPRUN=HOLD is required and must be punched exactly as shown.

2 The EXEC Card

The EXEC card calls the HISARS PROC and sets up all required file space.

3. The SYSIN card

The SYSIN card indicates that the HISARS command cards are to follow. The HISARS cards are thus placed between this card and the /* card.

4. The /* card

The /* card indicates that the HISARS command cards have all been read and the job terminated.

5. The file cards

If, and only if, water temperatures for the evaporation pans are desired, insert the following two cards between the EXEC and SYSIN cards

```
//ITEM  DD  DSN=IDAHO.INDEX.PANTEMP,DISP=SHR,UNIT=DISK,VOL=SER=USR001

//RTEM  DD  DSN=IDAHO.DATA.PANTEMP,DISP=SHR,UNIT=DISK,VOL=SER=USR001
```

When this is done, the air temperature DD cards are overridden and the air temperature files cannot be accessed during that jobstep. It should be noted that these data are very few and very poor.

II. HISARS USERS' GUIDE: THE PROCESS FACILITIES

A. INTRODUCTION

The processing facilities of HISARS are designed to permit routine types of analysis on data elements stored by the system. Thus the prospective user need not become involved in the complexities of programming and data manipulation in order to obtain the practical results required.

Processing is carried out on data identified by the preceding access group. Acquaintance with the access facilities of HISARS is therefore prerequisite for use of the processing facilities (see Section I.A).

Programs have been selected that are thought to cover most users routine uses. Suggestions for additional programs are welcome. A large number of additional programs are planned and will be added as time becomes available and specific needs are recognized.

The following illustrate the combined uses of the access and processing facilities.

Ex. 1: To obtain a statistical summary of daily rainfall for all rainfall stations in Power County.

```
ACCESS
ELEMENT     RAINFALL
COUNTY      POWER
PROCESS
DAILY STATISTICS
```

Ex. 2: To make a computation of minimum flow for various periods, for station 13.1850.00 and 13.3450.00 during the common period October 1931 to September 1960, with results converted to a unit area basis.

```
ACCESS
ELEMENT       STREAMFLOW
STATION       13185000
              13345000
PERIOD        10/1931 To 9/1960
PROCESS
MINIMUM FLOW ANALYSIS
              13185000    AREA = 830     LENGTH = 7,30
              13345000    AREA = 317     LENGTH = 7,30
```

B. THE COMMAND LANGUAGE

The following commands constitute the process facilities of HISARS:

```
PROCESS
(Process Request card)
   (Optional Parameter cards)
```

The command word PROCESS is punched starting in Column 1. Information in the Process Request card must start in Column 1, but information in the Optional Parameter cards must start in Column 2 or later.

A PROCESS card followed by a Process Request card and Optional Parameter card constitutes a single process group. Several process groups may follow a single access group, in which case all processing is carried out on the same data.

1. The Processing request card

The Process Request card must contain one or more names that identify the types of processing requested. Permissible names are given with the program specifications in Section II.C. The only formatting restrictions are that the first name must start in Column 1, and not more than one card may be used. Information on multiple processing requests is given in Section II.D.1.

2. Optional parameter card

Some of the processing programs do not require any parameters for execution, whereas others require one or more parameters. Parameter requirements are given in the program specifications in Section II.C. The specifications also list default values that will be supplied automatically unless replaced by the user. Thus, if no parameter cards are included in the access group, standard system defaults will be used.

If the user wishes to provide parameter values, he needs to give only those values which are not satisfactory by default. Two further options exist:

a) Data for all stations are to be processed using the same values. In this case, only one group of parameter cards is used, and the list of parameters applies to all stations.

b) Different parameter values are required for each station. In this case, one group of parameter cards is used for each station, and the parameters apply to that station (but see Section II.D.3 for optional usage). The station number is punched first on the first card, starting in Column 2 or later, and the list of parameters follow. The parameter cards must be ordered so that the station numbers are in the same order as retrieved by the access group. The second example in Section II.A uses this format.

The list of parameters for either case contains the identifying name and value for each parameter. Column 1 may not be used, but the only other formatting requirement is that the name and value must each be punched without intervening spaces. The parameters may be punched in any order, and punctuation between parameters is optional.

The list of parameters will normally be punched on a single card. However, particularly when using the LENGTH or CLASS parameters, the length of the list may be too long for a single card. In this case, the list can be interrupted at any convenient point and continued on the next card, subject to two conventions:

a) A numerical value cannot be split across two cards:

b) The identification of the parameter being continued must be repeated on the second and following cards, leaving Col. 1 blank.

An example of this usage is shown in Section II.C.9 below.

C. PROCESSING PROGRAMS

Following is a listing of the processing programs now implemented in HISARS. For each program, the following are given:

a) NAME - the standardized name to be used on the Processing Request card;
b) INPUT - the data files which can be used to provide data for the program;
c) OUTPUT - identification of output results obtained from the program;
d) OPTIONS - optional features that are controlled by parameters. Standard default values are also given;

e) An example showing the complete set of HISARS cards required and consequent output.

Several of the programs permit limiting the months for which the analysis is carried out. Assuming the sequence January-December followed by Annual, processing can begin with any month and terminate with the same or any later month. The form of this parameter can best be illustrated by examples:

a) ONLY APRIL TO JULY - will result in processing only of the months April, May, June, July;

b) ONLY MARCH - will result in processing only for March;

c) ONLY ANNUAL - will result in processing only for the entire year combined, i.e. separate monthly analyses will not be obtained.

1. Statistical analysis

NAME - DAILY STATISTICS or MONTHLY STATISTICS
INPUT - STREAMFLOW or RAINFALL
OUTPUT - the following results are tabulated for each month:

a) Number of observations
b) Proportion of zeros
c) Mean
d) Standard deviation
e) Variance
f) Third moment
g) Fourth moment
h) Serial correlation

OPTIONS - Processing period

Standard Defaults - ONLY JANUARY TO ANNUAL

Note: If DAILY STATISTICS is used, the analysis is made on daily values from the input files. If MONTHLY STATISTICS is used, the analysis is made on monthly totals. In the latter case, the serial correlation is between months, and the number of pairs used for calculation is also given. For streamflow files, months with missing daily values are skipped.

Example: The command sequence

```
ACCESS
ELEMENT      RAINFALL
STATION      100491
PROCESS
MONTHLY STATISTICS
```

produced the output shown in Figure B 1 .

ATLANTA ELMORE STATICN NO. 10-0491

STATISTICAL ANALYSIS OF MONTHLY RAINFALL
01/1962 TO 12/1973

MONTH	NUMBER OF OBS.	PROPORTION OF ZEROS	MEAN	STANDARD DEVIATION	VARIANCE	THIRD MOMENT	FOURTH MOMENT	SERIAL CORRELATION
JANUARY	12	0.0833	4.7083E+00	3.5279E+00	1.2446E+01	1.9137E+01	2.8969E+02	0.5830 (11)
FEBRUARY	12	0.0000	2.4608E+00	1.2708E+00	1.6148E+00	9.6183E-01	6.1586E+00	0.0129 (12)
MARCH	12	0.0000	1.9642E+00	9.2696E-01	8.5926E-01	2.0992E-01	2.6707E+00	-0.1041 (12)
APRIL	12	0.0833	1.6167E+00	8.6060E-01	7.4064E-01	-6.0986E-02	1.3431E+00	0.3644 (12)
MAY	12	0.0000	1.2550E+00	1.0633E+00	1.1305E+00	1.7929E+00	6.4892E+00	0.2974 (12)
JUNE	12	0.0833	2.1683E+00	1.4793E+00	2.1882E+00	2.0661E-01	9.1728E+00	0.1369 (12)
JULY	12	0.1667	3.8667E-01	3.9815E-01	1.5852E-01	3.5237E-02	4.2080E-02	0.4991 (12)
AUGUST	12	0.0833	9.4583E-01	1.1352E+00	1.2886E+00	2.3029E+00	7.5081E+00	-0.2210 (12)
SEPTEMBER	12	0.0000	1.2025E+00	5.1064E-01	2.6075E-01	2.4562E-02	1.6115E-01	0.2540 (12)
OCTOBER	12	0.0833	1.3283E+00	1.0068E+00	1.0136E+00	3.2853E-01	1.7150E+00	0.5205 (12)
NOVEMBER	12	0.0000	3.3967E+00	1.5047E+00	2.2640E+00	-8.6353E-02	1.2374E+01	0.1322 (12)
DECEMBER	12	0.0000	4.0125E+00	2.9324E+00	8.5992E+00	4.0888E+01	3.9224E+02	0.3439 (12)
ANNUAL	144	0.0486	2.1205E+00	2.0710E+00	4.2892E+00	1.8849E+01	1.6881E+02	

Figure B 1. Statistical analysis of monthly precipitation data output

2. Frequency analysis

NAME - DAILY FREQUENCY or MONTHLY FREQUENCY

INPUT - STREAMFLOW or RAINFALL

OUTPUT - Tabulation of standard statistics, including those given in the statistical summary, as well as deciles and quartiles. A plot of the cumulative frequency distribution is also printed. There is separate output for each month, and also for the entire year.

OPTIONS - Processing period
RANGE - the limits of the frequency plot
Standard Defaults - ONLY JANUARY TO ANNUAL
Daily streamflow -
RANGE 0 To 1000
Monthly streamflow -
RANGE 0 To 10000
Daily rainfall -
RANGE 0 To 1
Monthly rainfall -
Range 0 To 10

Note: The values of the RANGE parameter are the limits of the plot of the cumulative frequency distribution. This does not affect computation of the statistics. For streamflow files, months with missing daily values are skipped.

Example: The command sequence

```
ACCESS
ELEMENT      RAINFALL
STATION      106152
PROCESS
DAILY FREQUENCY
     ONLY FEBRUARY    RANGE 0 To 0.5
```

produced the output shown in Figure B 2.

MOSCOW-UNIV OF IDAHO LATAH STATION NO. 10-6152

FREQUENCY ANALYSIS OF DAILY RAINFALL FOR THE MONTH OF FEBRUARY
01/1900 TO 12/1973

MAXIMUM VALUE	= 1.40			S(X)	= 1.5353E+02
UPPER DECILE	= 0.25	NUMBER OF OBS.	= 2090	S(X*X)	= 5.8595E+01
UPPER QUARTILE	= 0.09	MEAN	= 0.073	S(X*X*X)	= 3.5795E+01
MEDIAN	= 0.00	STD. DEVIATION	= 0.150	S(X*X*X*X)	= 2.9442E+01
LOWER QUARTILE	= 0.00	SKEWNESS	= 3.447	3RD MOMENT	= 1.1740E-02
LOWER DECILE	= 0.00	KURTOSIS	= 16.267	4TH MOMENT	= 9.8749E-03

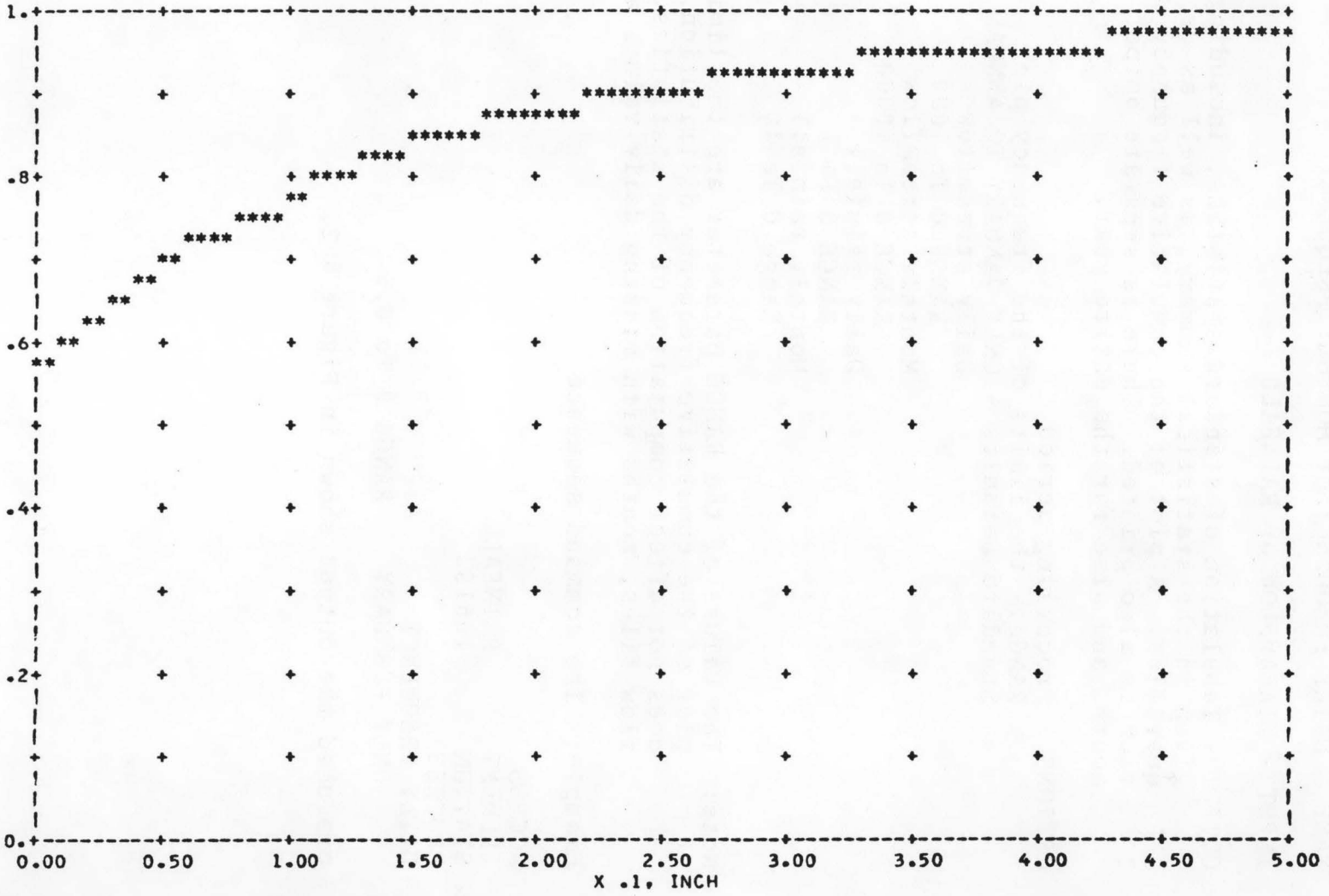

Figure B 2. Frequency analysis of daily precipitation data output

3. Highest/maximum value

NAME - HIGHEST or MAXIMUM
INPUT - RAINFALL or TEMPERATURE
OUTPUT - Tabulation of the highest value for each month
OPTIONS - Processing period
Standard Default - ONLY JANUARY TO ANNUAL

Note: Choice of names is arbitrary. For temperature files, the highest values of the maximum and minimum temperatures are given.

An M indicates an incomplete month.

Example: The command sequence

```
ACCESS
ELEMENT      TEMPERATURE
STATION      106152
PERIOD       1/1955 To 12/1972
PROCESS
MAXIMUM
```

produced the output shown in Figure B 3.

4. Lowest/minimum value

NAME - LOWEST or MINIMUM
INPUT - TEMPERATURE
OUTPUT - Tabulation of the lowest value for each month.
OPTIONS - Processing period
Standard Default - ONLY JANUARY TO ANNUAL

Note: Choice of names is arbitrary. For temperature files, the lowest values of the maximum and minimum temperatures are given.

Example: The command sequence

```
ACCESS
ELEMENT      TEMPERATURE
PERIOD       1/1955 To 12/1972
STATION      106152
PROCESS
MINIMUM
```

would produce output similiar in appearance to Figure B 3 .

MOSCOW-UNIV OF IDAHO LATAH STATION NO. 10-6152

HIGHEST DAILY MAXIMUM AND MINIMUM TEMPERATURES IN DEGREES F.

	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER	ANNUAL
1955	43	47	54	68	75	94	97	94	95	73	57	51	97
	36	34	39	41	52	58	66	64	55	51	43	38	66
1956	49	49	59	79	86	85	98	99	87	69	57	52	99
	37	35	40	50	57	53	67	65	60	47	43	40	67
1957	42	53	60	80	83	88	94	90	91	75	54	50	94
	32	40	41	48	66	60	63	56	58	53	40	38	66
1958	47	63	63	69	90	93	98	98	95	80	55	58	98
	36	48	40	44	56	63	68	65	57	52	42	41	68
1959	51	47	58	70	83	87	102	97	92	71	62	49	102
	39	37	41	50	58	57	68	59	66	51	41	36	68
1960	48	48	72	72	82	85	103	95	89	82	55	48	103
	37	37	44	47	56	57	65	58	55	52	39	35	65
1961	46	54	61	71	87	96	98	109	79	79	57	46	109
	40	42	45	48	52	59	63	69	51	51	40	36	69
1962	51	58	57	79	70	89	95	96	88	80	60	51	96
	36	38	41	52	50	52	60	59	54	49	45	40	60
1963	44	56	67	74	81	90	88	95	92	85	63	42	95
	37	41	42	46	56	57	56	63	60	52	48	32	63
1964	46	45	67	63	83	82	96	90	82	82	60	51	96
	37	32	42	47	56	58	63	60	50	50	45	39	63
1965	50	56	67	72	81	86	95	98	79	80	65	52	98
	38	36	37	51	52	53	62	68	50	52	43	41	68
1966	49	49	70	71	90	82M	90	100	94	78	57	48	100
	36	33	45	47	53	53M	58	69	62	50	44	40	69
1967	52	55	53	62	80	86	103	100	98	75	57	48	103
	38	41	40	39	58	60	69	62	62	52	47	35	69
1968	49	61	64	79M	83	89	97	92	90	72	56	53	97
	37	44	48	45M	50	57	59	54	56	47	42	35	59
1969	42	42	65	76	83	89	94	98	92	73	57	47	98
	35	34	43	49	57	62	61	57	59	45	42	38	62
1970	46	54	53	60	83	94	95	99	84	83	60	49	99
	37	39	40	38	51	72	62	66	55	50	40	39	72
1971	58	56	54	69	82	88	96	100	85	80	55	44	100
	44	37	38	44	51	57	63	65	54	52	43	32	65
1972	46	56	65	70	85	89	93	101	86	73	52	52	101
	34	44	43	42	55	60	63	67	52	45	43	38	67
PERIOD	58	63	72	80	90	96	103	109	98	85	65	58	
	44	48	48	52	66	72	69	69	66	53	48	41	

HIGHEST MAXIMUM 109 DEGREES F.
HIGHEST MINIMUM 72 DEGREES F.

Figure B 3. Highest daily maximum and minimum temperature output

5. Extreme values

NAME - EXTREME
INPUT - TEMPERATURE
OUTPUT - Tabulation of the extreme values for each month.
OPTIONS - Processing period
Standard Default - ONLY JANUARY TO ANNUAL

Example: The command sequence

```
ACCESS
ELEMENT      TEMPERATURE
PERIOD       1/1955 To 12/1972
STATION      106152
PROCESS
EXTREME
```

would produce output similiar in appearance to Figure B 3 .

6. Rank ordering

NAME - RANK ORDER
INPUT - STREAMFLOW
OUTPUT - Listing of the n largest amounts and their dates ranked from largest to smallest, where n is five times the number of years.
OPTIONS - Processing period
Standard Default - ONLY JANUARY TO ANNUAL

Note: The default processing period is the entire period of record.

Missing data values are ignored.

Example: The command sequence

```
ACCESS
ELEMENT      STREAMFLOW
STATION      13337500
PROCESS
RANK ORDER
```

produced the output shown in Figure B 4.

SOUTH FORK CLEARWATER RIVER NEAR ELK CITY, IDA IDAHO STATION NO. 13.3375.00

LARGEST DAILY STREAMFLOW IN DESCENDING ORDER (CFS)
10/1944 TO 09/1973
ANNUAL

3700.00	5/29/1948	2410.00	5/ 3/1971	2100.00	4/23/1956	1950.00	4/24/1965	1860.00	5/20/1967
3670.00	6/ 8/1964	2410.00	5/12/1971	2100.00	4/24/1956	1950.00	4/26/1965	1860.00	5/12/1972
3390.00	5/22/1948	2400.00	5/14/1972	2100.00	5/17/1964	1950.00	5/21/1970	1850.00	4/25/1956
3090.00	6/ 9/1964	2390.00	5/20/1964	2100.00	5/21/1972	1950.00	5/30/1972	1850.00	5/30/1964
3000.00	5/23/1948	2390.00	5/21/1964	2090.00	5/22/1967	1940.00	5/22/1964	1850.00	5/17/1965
2950.00	5/17/1972	2380.00	5/11/1971	2080.00	5/18/1970	1940.00	5/ 2/1971	1850.00	5/22/1970
2930.00	5/16/1972	2370.00	4/21/1965	2080.00	5/10/1972	1930.00	5/ 5/1947	1840.00	5/12/1949
2900.00	5/27/1948	2350.00	5/19/1972	2070.00	6/ 4/1964	1930.00	5/22/1957	1830.00	5/15/1965
2890.00	5/ 4/1971	2330.00	5/14/1971	2060.00	6/ 1/1948	1930.00	5/26/1970	1820.00	5/ 3/1947
2890.00	5/ 5/1971	2330.00	5/ 8/1972	2060.00	4/23/1965	1930.00	5/23/1972	1820.00	5/14/1949
2820.00	5/26/1948	2320.00	4/29/1965	2050.00	6/ 5/1964	1920.00	5/13/1949	1820.00	5/27/1970
2810.00	5/20/1948	2320.00	5/ 9/1972	2050.00	5/16/1971	1920.00	5/16/1964	1810.00	5/10/1947
2800.00	5/21/1948	2280.00	6/ 7/1964	2050.00	5/22/1972	1920.00	4/25/1965	1810.00	5/17/1949
2780.00	5/18/1972	2260.00	6/ 3/1964	2040.00	5/15/1971	1920.00	5/25/1970	1810.00	6/ 1/1964
2760.00	5/15/1972	2250.00	5/31/1948	2040.00	5/13/1972	1910.00	5/16/1965	1800.00	6/ 2/1948
2750.00	5/28/1948	2250.00	5/ 2/1965	2040.00	6/ 1/1972	1910.00	5/ 7/1972	1800.00	5/20/1949
2750.00	5/30/1948	2240.00	5/19/1948	2030.00	5/21/1957	1900.00	5/ 4/1947	1800.00	5/22/1955
2750.00	4/30/1965	2240.00	5/19/1970	2030.00	4/24/1969	1900.00	5/15/1949	1800.00	5/17/1970
2730.00	5/ 1/1965	2240.00	5/20/1970	2020.00	4/27/1965	1900.00	5/21/1955	1800.00	5/29/1972
2700.00	5/24/1948	2200.00	5/17/1948	2020.00	5/24/1967	1900.00	4/22/1956	1790.00	4/22/1948
2620.00	5/25/1948	2200.00	5/19/1964	2010.00	5/31/1972	1900.00	6/ 2/1972	1790.00	5/ 6/1972
2610.00	5/13/1971	2200.00	4/22/1965	2000.00	4/20/1962	1890.00	5/29/1964	1780.00	5/ 6/1947
2540.00	5/18/1948	2180.00	5/23/1967	2000.00	6/ 2/1964	1890.00	6/12/1964	1780.00	5/23/1957
2530.00	5/ 8/1971	2160.00	6/11/1964	1990.00	5/16/1949	1890.00	5/ 3/1965	1760.00	6/ 3/1948
2510.00	5/ 6/1971	2160.00	5/20/1972	1970.00	5/ 9/1947	1890.00	5/19/1967	1760.00	5/14/1965
2490.00	5/ 9/1971	2140.00	6/ 6/1964	1970.00	5/28/1964	1880.00	5/21/1967	1740.00	5/ 8/1947
2470.00	6/10/1964	2140.00	4/28/1965	1970.00	5/24/1970	1880.00	5/11/1972	1740.00	5/31/1964
2440.00	5/10/1971	2130.00	5/18/1964	1960.00	5/20/1957	1870.00	5/18/1967	1740.00	4/23/1969
2420.00	5/ 7/1971	2110.00	5/23/1970	1960.00	4/20/1965	1870.00	5/24/1972	1740.00	4/25/1969

Figure B 4. Rank ordering of daily streamflow output

7. Mass analysis

NAME - MONTHLY MASS ANALYSIS or MONTHLY MASS FLOW ANALYSIS
INPUT - STREAMFLOW or RAINFALL
OUTPUT - A plot through time of the accumulated total.
OPTIONS - SCALE - the units per inch of plot
INTERVAL - the number of time units per line of plot
RATE - a specified constant rate
Standard Defaults - INTERVAL = 1
RATE = 0
Monthly streamflow - SCALE = 100000
Monthly rainfall - SCALE = 10

Notes:

a) SCALE - the units are volume units equivalent to the data units. The user is cautioned against selecting too small a value for SCALE, since the axis labeling will repeat so often that the plot will not be visible.

b) INTERVAL - This parameter may be used to reduce the length of the graph, particularly for daily values. Corresponding detail will be lost.

c) RATE - This parameter is designed primarily for streamflow analysis by the Rippl method, but it could also be used for other purposes such as the effect of moving a rain gage. If the value is 0, only the basic plot is produced. If the value is greater than 0, the following additional output is produced:

i) Plots of a constant rate, extending across periods of deficient accumulation.

ii) Values of the deficiencies, listed along the right margin in scientific notation.

d) The name MONTHLY MASS FLOW ANALYSIS applies only to the streamflow file. The other name may be used with any file.

Examples: The command sequence

```
ACCESS
ELEMENT      STREAMFLOW
STATION      12414500
PROCESS
MONTHLY MASS ANALYSIS
     SCALE = 1000000    INTERVAL = 3
```

A portion of the output is shown in Figure B 5.

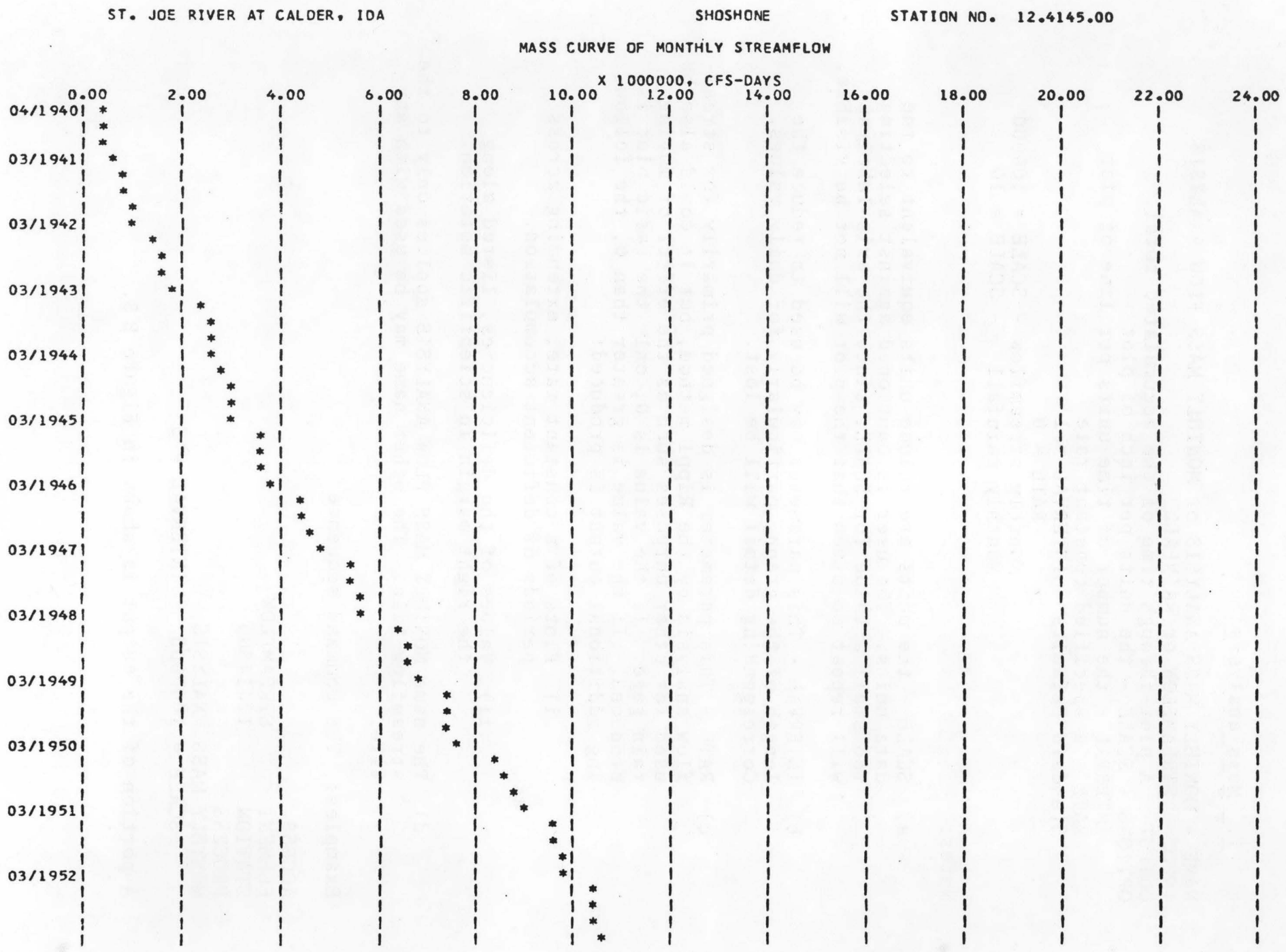

Figure B 5. Mass curve of monthly streamflow output

8. Maximum/minimum flow analysis

NAME - MAXIMUM FLOW ANALYSIS or MINIMUM FLOW ANALYSIS
INPUT - STREAMFLOW
OUTPUT - A listing of the average maximum/minimum flows for each of up to 10 period lengths in days for each year in the period of record. Results are in cubic feet per second (cfs), unless an area is given , in which case the results are converted to cubic feet per second per square mile (cfsm). Statistics of the frequency distribution are also given, and the 10-year frequency discharge is also listed.
OPTIONS - AREA - the drainage area, if results in cfs are desired.
LENGTH - lengths of periods required
Standard Defaults - AREA = 1
LENGTH = 7, 30, 60, 90, 120, 183, 274

Notes:

a) For maximum flow analysis, a water year (October - September) is used. For minimum flow analysis, a climatic year (April - March) is used. Values are listed only for complete years.

b) If a value of AREA is given which is not equal to 1, the drainage area will be obtained from the index entry for the station. If no area is listed in the index, the given value will be used.

Example: The command sequence

```
ACCESS
ELEMENT      STREAMFLOW
STATION      12414500
PROCESS
MINIMUM FLOW ANALYSIS
     LENGTH = 1, 3, 7, 15, 30, 45, 60
```

produced the output shown in Figure B 6.

ST. JOE RIVER AT CALDER, IDA SHOSHONE STATION NO. 12.4145.00

LOW FLOW ANALYSIS FOR YEAR BEGINNING APRIL 1
MEAN MINIMUM DISCHARGE
CFS
LENGTH OF PERICD, DAYS

YEAR	1	3	7	15	30	45	60
1940-41	298.00	300.00	310.29	315.20	333.50	339.29	355.17
1941-42	390.00	395.67	407.29	416.73	440.77	468.20	478.83
1942-43	329.00	333.67	339.00	355.93	364.70	375.80	395.43
1943-44	207.00	269.00	327.14	356.27	369.03	400.44	409.03
1944-45	180.00	190.00	213.57	238.47	302.63	321.36	327.92
1945-46	326.00	327.33	331.71	340.40	386.70	409.98	412.18
1946-47	342.00	343.33	349.43	364.27	382.37	405.69	426.32
1947-48	382.00	386.00	400.00	446.00	473.13	485.27	513.65
1948-49	320.00	343.33	360.00	362.67	369.00	383.78	395.10
1949-50	330.00	331.33	341.43	359.87	395.93	415.93	417.55
1950-51	444.00	445.67	459.00	490.13	513.73	553.51	585.65
1951-52	380.00	384.33	385.57	401.67	441.63	469.64	511.87
1952-53	100.00	116.67	154.00	208.13	255.53	262.07	272.28
1953-54	302.00	303.33	303.71	310.40	321.83	339.04	357.42
1954-55	390.00	423.00	469.00	516.33	574.47	603.40	630.93
1955-56	444.00	460.67	488.29	505.93	531.07	554.80	608.12
1956-57	230.00	256.67	352.86	399.33	443.33	461.16	488.13
1957-58	240.00	283.33	318.14	347.33	364.33	380.24	393.07
1958-59	347.00	353.67	363.57	385.87	408.20	418.40	430.67
1959-60	510.00	513.33	551.43	585.13	622.57	637.71	686.57
1960-61	270.00	280.00	322.86	361.20	415.13	432.96	446.52
1961-62	190.00	210.00	286.57	349.07	383.03	390.82	404.35
1962-63	381.00	389.33	402.14	433.20	457.43	469.18	485.05
1963-64	250.00	306.67	321.57	333.33	348.33	357.11	368.17
1964-65	505.00	510.00	526.43	568.33	581.37	588.89	596.42
1965-66	382.00	394.00	405.43	423.27	443.60	447.47	467.70
1966-67	308.00	330.00	337.86	349.13	361.80	372.36	381.42
1967-68	330.00	333.33	338.86	355.80	392.60	409.07	425.88
1968-69	496.00	499.00	506.71	548.40	605.43	623.27	681.85
1969-70	250.00	250.00	253.57	269.87	324.53	354.24	360.35
1970-71	390.00	399.67	410.00	448.80	465.97	469.82	474.57
M	2.49703	2.51874	2.54998	2.58169	2.61563	2.63309	2.65039
S	0.14988	0.13380	0.11279	0.10234	0.09146	0.09016	0.09483
G	-1.28905	-1.33432	-1.00511	-0.34304	0.15817	0.10405	0.23755
Q 10	197.76	218.54	250.46	280.13	316.29	330.07	340.04

Figure B 6. Low flow analysis output

9. Flow duration table

NAME - FLOW DURATION TABLE
INPUT - STREAMFLOW
OUTPUT - A tabulation of the number of days that the flow was within various class intervals for each complete water year. A second table gives the frequency of discharge greater than or equal to each class interval. Class intervals are listed in cubic feet per second, in cubic feet per second per square mile, and as a ratio to the mean daily discharge.
OPTIONS - CLASS - upper limits of class intervals
Standard Defaults - CLASS = 1, 10, 100, 1000, 10000, 100000, 1000000

Notes:

a) A maximum of 32 class intervals may be specified.

b) The drainage area is obtained from the index entry for the station. If no area is given in the index, the column of class intervals in cubic feet per second per square mile will be omitted.

c) Days with missing values are not counted.

Example: The command sequence

```
ACCESS
ELEMENT     STREAMFLOW
STATION     12414500
PROCESS
FLOW DURATION TABLE
     CLASS  70 100 150 200 250 300 400 500 700 1000 2000
     CLASS  2500 3000 4000 5000 7000 10000 15000 20000
```

produced the output shown in Figure B 7.

ST. JOE RIVER AT CALDER, IDA SHOSHONE STATION NO. 12.4145.00

FLOW DURATION TABLE

CLASS / WATER YEAR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
	NUMBER OF DAYS IN CLASS																		
1941	0	0	0	0	0	42	59	54	63	70	36	20	17	2	2	0	0	0	0
1942	0	0	0	0	0	9	23	40	67	98	20	29	40	20	11	8	0	0	0
1943	0	0	0	0	0	35	25	71	69	49	5	4	6	11	47	28	15	0	0
1944	0	0	0	1	7	106	76	58	22	31	14	16	20	11	4	0	0	0	0
1945	0	0	3	10	19	75	30	45	39	58	15	14	11	10	16	10	10	0	0
1946	0	0	0	0	0	34	32	92	47	57	11	17	14	5	14	28	14	0	0
1947	0	0	0	0	0	19	30	44	25	83	28	21	34	25	28	12	13	2	1
1948	0	0	0	0	0	1	10	34	49	159	24	11	8	6	13	17	21	7	6
1949	0	0	0	0	0	58	67	70	29	49	11	8	7	9	14	22	13	8	0
1950	0	0	0	0	0	22	23	57	46	69	18	10	21	16	22	25	30	6	0
1951	0	0	0	0	0	10	27	38	22	110	33	20	21	20	25	33	6	0	0
1952	0	0	0	0	0	9	33	90	75	63	15	11	9	11	11	31	5	3	0
1953	0	4	3	8	41	53	20	25	35	72	18	12	10	6	23	27	8	0	0
1954	0	0	0	0	0	46	19	67	52	64	14	8	12	11	32	19	14	7	0
1955	0	0	0	0	0	2	15	107	78	59	12	9	20	7	23	20	11	2	0
1956	0	0	0	0	0	1	20	35	63	101	19	20	25	11	11	18	25	16	1
1957	0	0	0	1	2	39	57	69	35	47	18	14	12	14	19	13	19	6	0
1958	0	0	0	1	4	69	63	62	27	40	16	17	12	12	8	17	17	0	0
1959	0	0	0	0	0	8	15	45	26	86	45	21	23	12	34	34	16	0	0
1960	0	0	0	0	0	9	21	28	60	113	20	13	16	17	38	24	7	0	0
1961	0	0	0	0	4	25	71	67	23	46	8	16	22	20	19	22	22	0	0
1962	0	0	2	3	2	29	75	65	49	43	7	5	9	12	17	39	8	0	0
1963	0	0	0	0	0	23	32	42	46	83	25	19	42	24	28	1	0	0	0
1964	0	0	0	0	1	110	42	59	26	27	10	12	18	10	12	15	16	8	0
1965	0	0	0	0	0	0	12	82	29	84	38	22	15	12	21	31	14	3	2
1966	0	0	0	0	0	24	71	101	32	42	6	6	20	21	27	9	6	0	0
1967	0	0	0	0	0	52	26	45	42	85	18	20	25	4	13	22	11	2	0
1968	0	0	0	0	0	8	13	71	67	74	22	19	24	27	31	9	1	0	0
1969	0	0	0	0	0	21	26	23	62	106	29	9	10	5	30	28	14	2	0
1970	0	0	0	0	13	50	48	43	26	80	26	11	12	7	14	15	20	0	0

TOTAL DISCHARGE 26182551.00 CFS-DAYS
MEAN DAILY DISCHARGE 2389.57 CFS
DRAINAGE AREA 1030 SQ MI

CLASS	CFS	TOTAL COUNTS	ACCUM	PERCENT	CFS/ SQ MI	CFS/ MEAN DAILY	CLASS	CFS	TOTAL COUNTS	ACCUM	PERCENT	CFS/ SQ MI	CFS/ MEAN DAILY
1	70	0	10957	100.0	0.1	0.0	11	2000	581	3550	32.4	1.9	0.8
2	100	4	10957	100.0	0.1	0.0	12	2500	434	2969	27.1	2.4	1.0
3	150	8	10953	100.0	0.1	0.1	13	3000	535	2535	23.1	2.9	1.3
4	200	24	10945	99.9	0.2	0.1	14	4000	378	2000	18.3	3.9	1.7
5	250	93	10921	99.7	0.2	0.1	15	5000	607	1622	14.8	4.9	2.1
6	300	989	10828	98.8	0.3	0.1	16	7000	577	1015	9.3	6.8	2.9
7	400	1081	9839	89.8	0.4	0.2	17	10000	356	438	4.0	9.7	4.2
8	500	1729	8758	79.9	0.5	0.2	18	15000	72	82	0.7	14.6	6.3
9	700	1331	7029	64.1	0.7	0.3	19	20000	10	10	0.1	19.4	8.4
10	1000	2148	5698	52.0	1.0	0.4							

DRAINAGE AREA 1030 SQ MI

Figure B 7. Flow duration analysis output

10. Flow duration curve

NAME - FLOW DURATION CURVE
INPUT - STREAMFLOW
OUTPUT - A plot of the frequency of discharge greater than or equal to given rates plotted in cubic feet per second, cubic feet per second per square mile, and as a ratio to mean discharge.
OPTIONS - CLASS - upper limits of class intervals
Standard Defaults - CLASS = 1, 10, 100, 1000, 10000, 100000, 1000000

Notes: (same as for the flow duration table, II.C.9.

Example: The command sequence

```
ACCESS
ELEMENT      STREAMFLOW
STATION      12414500
PROCESS
FLOW DURATION CURVE
     CLASS 70 100 150 200 250 300 400 500 700 1000 2000
     CLASS 2500 3000 4000 5000 7000 10000 15000 20000
```

produced the output shown in Figure B 8.

11. Interstation correlation

NAME - CORRELATION
INPUT - RAINFALL
OUTPUT - Tabulations of cross correlations between daily values for each pair of up to 10 stations, with the number of pairs of days used in the calculations. Results are listed separately for each month.
OPTIONS - PROCESSING PERIOD
Standard Default - ONLY JANUARY TO ANNUAL

Example: The command sequence

```
ACCESS
ELEMENT      RAINFALL
STATION      100491  101663  102385  108676
PERIOD       07/1966 To 12/1973
PROCESS
CORRELATION
     ONLY MAY
```

produced the output shown in Figure B 9.

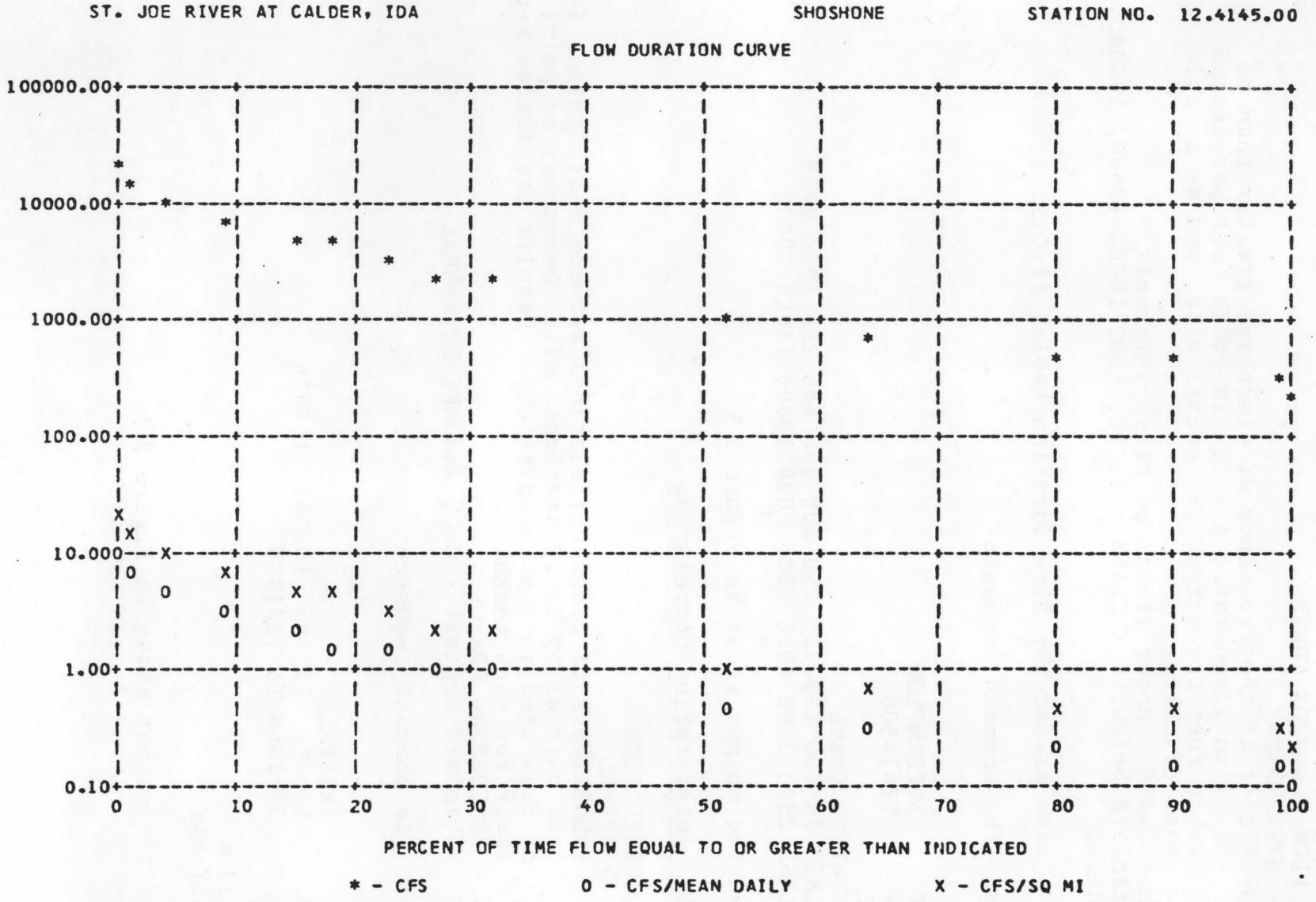

Figure B 8. Flow duration curve output

CORRELATION ANALYSIS OF DAILY RAINFALL - MAY
07/1966 TO 12/1973

STATIONS:

0491	10-0491	ATLANTA	
1663	10-1663	CHALLIS	
2385	10-2385	DEADWOOD DAM	
8676	10-8676	STANLEY	
			ELMORE
			CUSTER
			VALLEY
			CUSTER

	0491	1663	2385	8676
0491	1.0000	0.3482 155	0.6787 155	0.5050 93
1663		1.0000	0.3543 217	0.4729 155
2385			1.0000	0.7882 155
8676				1.0000

Figure B 9. Interstation correlation analysis output

12. Temperature occurrences

NAME - OCCURRENCES
INPUT - TEMPERATURE
OUTPUT - A tabulation of the number of days that the temperature exceeded various threshold amounts for each complete year. The mean number of occurrences per year is also given.
OPTIONS - Processing period
THRESHOLD - the threshold in degrees F.
Standard Defaults - ONLY JANUARY TO ANNUAL
THRESHOLD 80

Notes:

a) A maximum of 10 threshold values may be specified

b) If a processing period is specified, only records during the processing period must be complete.

EXAMPLE: The command sequence

```
ACCESS
ELEMENT       TEMPERATURE
STATION       106152
PROCESS
OCCURRENCES
     THRESHOLD 60 65 70 75 80 85 90
```

produced the output shown in Figure B 10.

MOSCOW-UNIV OF IDAHO LATAH STATION NO. 10-6152

YEAR	NUMBER OF DAYS TEMPERATURE ABOVE 60 DEGREES	65 DEGREES	70 DEGREES	75 DEGREES	80 DEGREES	85 DEGREES	90 DEGREES	95 DEGREES	100 DEGREES
1955	148	125	94	74	61	41	20	3	0
1956	161	144	117	90	65	36	15	4	0
1957	159	144	131	98	59	30	3	0	0
1958	177	155	123	97	83	58	26	4	0
1959	152	123	88	68	45	31	11	6	1
1960	185	150	121	94	66	37	21	8	2
1961	157	140	122	98	77	58	33	17	6
1962	164	129	109	86	52	25	13	1	0
1963	176	153	126	102	60	39	15	0	0
1964	163	126	95	67	37	15	1	1	0
1965	176	144	105	71	41	28	10	2	0
1967	152	139	121	105	84	54	26	15	1
1969	164	138	111	90	62	31	4	1	0
1970	143	121	107	93	73	51	28	3	0
1971	151	130	104	79	56	43	30	8	0
1972	162	139	107	78	61	32	14	4	1
1973	162	130	117	91	67	46	27	4	0
MEAN	160.67	134.18	106.58	80.01	55.25	31.69	13.13	3.27	0.33

NUMBER OF COMPLETE YEARS 67

Figure B 10. Air temperature occurrences output

13_ Snowfall_occurrences

NAME - OCCURRENCES
INPUT - SNOWFALL
OUTPUT - A tabulation of the number of days that the snowfall was equal to or exceeded a threshold amount during snow season (assumed Sept. 1 - Aug. 31), the dates of the first and last snowfall of this magnitude, and the depth of snow on the ground on the first day of December, January, February and March. Averages of these amounts are also given.
OPTIONS - THRESHOLD - the threshold amount in inches
Standard Default - THRESHOLD 1

Notes:

a) Only one threshold value may be specified

b) In calculating the average depth of snow on the ground for the various dates, days for which the depth was missing are not counted.

Example: The command sequence

```
ACCESS
ELEMENT    SNOWFALL
STATION    101956
PROCESS
OCCURRENCES
```

produced the output shown in Figure B 11.

COEUR D'ALENE 1 E KOOTENAI STATION NO. 10-1956

SNOWFALL SEASON	NUM OF DAYS >= 1.0 INCH	FIRST SNOWFALL >= 1.0 INCH	LAST SNOWFALL >= 1.0 INCH	DEPTH OF SNOW ON FIRST DAY OF: DEC	JAN	FEB	MAR
1948/49	24	11/30/1948	3/16/1949	1	20	22	15
1949/50	29	12/12/1949	5/ 6/1950		M	23	10
1950/51	22	11/20/1950	3/11/1951	5		1	
1951/52	31	11/14/1951	3/19/1952		24	22	18
1952/53	11	12/ 1/1952	2/16/1953	2	2		
1953/54	15	12/ 2/1953	2/19/1954			18	
1954/55	13	12/29/1954	3/10/1955		M	2	16
1955/56	26	11/ 2/1955	3/ 9/1956	1	0	5	M
1956/57	24	11/16/1956	3/17/1957			22	5
1957/58	10	10/22/1957	2/ 5/1958				
1958/59	12	11/18/1958	2/25/1959				
1959/60	13	11/12/1959	3/14/1960		M		M
1960/61	9	11/10/1960	3/13/1961	M	M		M
1961/62	19	11/ 3/1961	3/ 5/1962	M		M	6
1962/63	5	12/28/1962	2/14/1963		M	12	
1963/64	22	12/ 9/1963	4/16/1964		2	4	
1964/65	22	11/12/1964	2/14/1965		10	5	
1965/66	12	11/25/1965	3/21/1966		M	M	2
1966/67	14	11/ 9/1966	3/30/1967				
1967/68	11	11/29/1967	2/17/1968		0	11	
1968/69	12	11/16/1968	2/26/1969		M	M	M
1969/70	21	12/ 9/1969	4/26/1970		16	7	M
1970/71	18	11/27/1970	2/25/1971	M			1
1971/72	25	10/31/1971	3/28/1972		M	7	
1972/73	8	12/12/1972	2/15/1973		1	T	
1973/74	10	11/ 4/1973	12/28/1973	1			

NUMBER OF YEARS RECORDED 75
AVERAGE OBSERVED NUMBER OF DAYS SNOWFALL WAS >= 1.0 INCH 12.92
AVERAGE DEPTH ON DECEMBER 1 : 0.30
AVERAGE DEPTH ON JANUARY 1 : 2.45
AVERAGE DEPTH ON FEBRUARY 1 : 4.13
AVERAGE DEPTH ON MARCH 1 : 1.47

Figure B 11. Snowfall depths occurrences output

14 Daily or monthly occurrence

NAME - DAILY OCCURRENCES or MONTHLY OCCURRENCES
INPUT - RAINFALL
OUTPUT - A tabulation of the number of time periods that the rainfall was equal to or exceeded various threshold amounts for each complete year. The mean number of occurrences per year is also given.
OPTIONS - Processing period
THRESHOLD - the threshold amounts in inches
Standard Defaults - ONLY JANUARY TO ANNUAL
Daily - THRESHOLD 1
Monthly-THRESHOLD 5

Notes:

a) A maximum of 10 threshold values may be specified

b) If a processing period is specified, only records during the processing period must be complete.

Example: The command sequence

```
ACCESS
ELEMENT      RAINFALL
STATION      106152
PROCESS
DAILY OCCURRENCES
     THRESHOLD  .05  .1  .2  .3  .5  1  1.5  2  3
```

produced the output shown in Figure B 12.

MOSCOW-UNIV OF IDAHO LATAH STATION NO. 10-6152

YEAR	NUMBER OF DAYS RAINFALL EQUALLED OR EXCEEDED								
	0.0 INCH	0.1 INCH	0.2 INCH	0.3 INCH	0.5 INCH	1.0 INCH	1.5 INCH	2.0 INCH	3.0 INCH
1920	83	72	49	31	6	1	1	0	0
1922	85	57	24	12	5	1	0	0	0
1923	91	70	39	26	9	5	1	0	0
1924	73	54	34	22	5	0	0	0	0
1925	83	65	36	20	6	0	0	0	0
1926	87	67	45	30	18	1	0	0	0
1928	74	50	26	18	3	0	0	0	0
1930	75	57	34	24	10	0	0	0	0
1931	81	59	38	23	9	1	1	0	0
1932	103	76	44	34	14	1	0	0	0
1933	96	70	45	33	15	5	2	0	0
1935	80	57	32	10	4	1	0	0	0
1936	86	61	26	16	5	1	0	0	0
1940	102	84	58	32	10	3	0	0	0
1941	100	74	44	28	13	0	0	0	0
1943	75	55	35	21	8	1	0	0	0
1944	61	45	26	15	5	0	0	0	0
1948	100	79	63	42	23	3	0	0	0
1949	78	60	31	19	8	0	0	0	0
1950	115	85	54	33	9	0	0	0	0
1951	81	60	40	27	11	1	0	0	0
1952	65	52	28	14	8	0	0	0	0
1953	96	65	44	30	12	2	0	0	0
1954	88	74	44	27	7	0	0	0	0
1955	97	66	39	20	8	2	0	0	0
1956	87	64	37	20	12	1	0	0	0
1957	83	62	40	20	7	0	0	0	0
1958	105	80	45	23	12	0	0	0	0
1959	92	57	36	26	13	0	0	0	0
1960	90	70	39	23	9	2	0	0	0
1961	111	84	47	31	8	1	0	0	0
1962	90	69	41	20	9	2	0	0	0
1965	74	49	25	17	8	1	0	0	0
1970	104	86	54	38	17	0	0	0	0
1971	107	84	52	36	13	4	1	0	0
1972	112	85	50	31	14	5	1	0	0
MEAN	89.17	66.78	40.11	24.78	9.81	1.25	0.19	0.00	0.00

NUMBER OF COMPLETE YEARS 36

Figure B 12. Precipitation occurrences output

15 High/low occurrences

NAME - HIGH OCCURRENCES or LOW OCCURRENCES
INPUT - TEMPERATURE
OUTPUT - A tabulation of the number of days that the temperature was above/below a threshold amount for each complete year, and the first and last dates of occurrence. For LOW OCCURRENCES, the length of the period in days that the temperature was always equal to or greater than the threshold is also listed.
OPTIONS - Processing period
THRESHOLD - the threshold in degrees F.
Standard Defaults - ONLY JANUARY TO ANNUAL
HIGH - THRESHOLD 90
LOW - THRESHOLD 32

Notes:

a) Only one threshold value may be specified.

b) If a processing period is specified, only records during the processing period must be complete.

Example: The command sequence

```
ACCESS
ELEMENT      TEMPERATURE
STATION      102385
PROCESS
LOW OCCURRENCES
```

produced the output shown in Figure B 13.

DEADWOOD DAM VALLEY STATION NO. 10-2385

YEAR	NUM OF DAYS TEMPERATURE BELOW 32 DEGREES	LAST DAY BELOW 32 DEGREES	FIRST DAY BELOW 32 DEGREES	LENGTH OF PERIOD >= 32 DEGREES
1930	245	7/20/1930	8/21/1930	31
1931	270	7/ 3/1931	8/ 7/1931	34
1932	269	7/ 8/1932	8/ 6/1932	28
1935	282	7/28/1935	8/ 1/1935	3
1936	274	7/26/1936	8/19/1936	23
1938	258	6/19/1938	8/ 2/1938	43
1939	272	7/20/1939	8/ 6/1939	16
1940	236	7/27/1940	8/ 2/1940	5
1942	277	7/29/1942	8/ 1/1942	2
1943	300	7/30/1943	8/ 5/1943	5
1944	280	7/24/1944	8/ 9/1944	15
1945	307	7/31/1945	8/ 1/1945	0
1947	238	7/ 5/1947	8/10/1947	35
1948	254	7/28/1948	8/ 6/1948	8
1949	251	7/29/1949	8/ 8/1949	9
1950	262	7/30/1950	9/11/1950	42
1951	279	7/11/1951	8/13/1951	32
1952	277	7/22/1952	8/16/1952	24
1953	254	7/21/1953	8/ 6/1953	15
1954	273	7/23/1954	8/ 1/1954	8
1955	273	7/29/1955	8/ 4/1955	5
1956	248	7/ 1/1956	8/ 3/1956	32
1957	241	7/18/1957	8/ 2/1957	14
1958	227	6/29/1958	9/ 3/1958	65
1959	247	7/29/1959	8/13/1959	14
1962	257	7/20/1962	8/23/1962	33
1963	216	7/31/1963	8/21/1963	20
1964	259	7/24/1964	8/14/1964	20
1965	258	7/23/1965	8/29/1965	36
1966	253	7/26/1966	8/12/1966	16
1967	250	6/14/1967	8/ 8/1967	54
1968	257	7/23/1968	8/29/1968	36
1969	259	7/ 4/1969	8/ 5/1969	31
1970	253	7/31/1970	8/ 3/1970	2
1971	263	7/12/1971	8/23/1971	41
1972	233	7/23/1972	9/ 1/1972	39
MEAN	259.78			23.22

NUMBER OF COMPLETE YEARS 36

Figure B 13. Minimum air temperature occurrences output

D. OPTIONAL FEATURES

A number of options are available that add to the flexibility of use of the process facilities. While they do not add any features not previously discussed, they do permit somewhat more freedom of use.

1. Multiple processing

In section II.B, the possibility of processing one set of data in several ways was discussed. When this is done using several processing groups, the user retains control of the ordering of the output.

It is also possible, under certain restrictions, to execute several processing programs with a single processing group. This is done by listing more than one name on the Process Request card, and putting all parameters together on the Optional Parameter card.

The programs are assumed to fall into several natural categories, and only programs which are in the same category may be used together. The categories are:

a) General statistics

DAILY STATISTICS	(DA TIS)
MONTHLY STATISTICS	(MON TIS)
DAILY FREQUENCY	(DA FRE)
MONTHLY FREQUENCY	(MON FRE)
HIGHEST OR MAXIMUM	(HIG or MAX)
LOWEST OR MINIMUM	(LOW or MIN)
EXTREME	(EXT)
RANK ORDER	(RAN)
MONTHLY MASS ANALYSIS	(MON MAS)

b) Flow analysis programs

MONTHLY MASS FLOW ANALYSIS	(MON MAS FLO)
MAXIMUM FLOW ANALYSIS	(MAX FLO)
MINIMUM FLOW ANALYSIS	(MIN FLO)
FLOW DURATION TABLE	(FLO DUR TAB)
FLOW DURATION CURVE	(FLO DUR CUR)

c) Multiple-station programs

CORRELATION	(COR)

d) Occurrence programs

OCCURRENCES	(OCC)
DAILY OCCURRENCES	(DA OCC)
MONTHLY OCCURRENCES	(MON OCC)
HIGH OCCURRENCES	(HIG OCC)
LOW OCCURRENCES	(LOW OCC)

The occurrence of a single identifiable name applies it to all possible programs on the card. Thus, if the Processing Request card contained

DAILY AND MONTHLY STATISTICS AND FREQUENCY

four programs would be executed. Similarly, if the card contained

DAILY AND MONTHLY STATISTICS AND MASS ANALYSIS

expected results would be obtained, but a warning message would also be printed that the daily mass analysis was not yet supported.

Programs are executed in order as listed above regardless of ordering on the Processing Request card.

2. Abbreviations

Since the entire words in the names as listed in Section II.C are not required to determine the programs uniquely, only short groups of letters are used to identify the programs. Consequently, it is possible for the user to use these abbreviations if desired.

Abbreviations of the processing program names are given in parentheses in Section II.D.1 above. Any occurrence of the letters in the combinations shown will lead to execution of the corresponding program. Thus, the Process Request card

DAMONTIS FREMAXLOW EXTRANMAS

would lead to execution of every program in the general statistics category (assuming data appropriate to each program were available).

To separate the two distinct uses of the word MAXIMUM and MINIMUM, the word FLO is searched for first. If it is found, only combinations in the flow analysis category will be identified. Otherwise, combinations in the other categories will be identified.

For the parameters also, only the first three letters need be specified. It should be stressed that future additions of processing programs may require that the above abbreviations be changed to conform with the names of new programs. Thus, if errors occur because of the use of abbreviations, just revert to using the full names.

III. HISARS USERS' GUIDE: THE COPY FACILITIES

A. INTRODUCTION

The COPY command is part of the access facility of HISARS. Those records which have been accessed by the preceding group of instructions will be copied onto an external data set. As such, familiarity with the access facilities as described in the Users' Guide to the Access Facilities is prerequisite to application of material in this guide.

The main purpose of the COPY facility is to permit users with programs in other languages to obtain copies of the data for their use. Sample applications are shown for FORTRAN since users of that language would not otherwise be able to access the data files. The user can create a permanent file if one wishes to repeatedly use the same data, or a temporary file can be created that will be deleted at the end of the job.

The PL/I programmer can access the files directly as any ISAM file is accessed. The file formats are available upon request to the author. Should the PL/I programmer desire, the copying facilities can be used as shown in the example but ISAM files will not result, only sequential. A utility is available that will allow an ISAM copy. Again, the author should be contacted.

There are two reasons for separating the guide to the copying facility from the rest of the access commands. First, the user is here assumed to have some competence in a programming language. Secondly, some additional job control language requirements are needed to use the copying procedure. This guide, then, presumes experience in computer use that was not requisite for the access guide.

Five operands are available for use with the COPY command:

INTEGER, INTEGER FORMATTED, REAL, REAL FORMATTED and DIRECT.

a) If the word INTEGER is used, each word in the output file will be a full-word (4 byte) binary integer.
b) If the word REAL is used, each word in the output file will be a single precision floating point number.
c) If the word FORMATTED is used, the output files will be written with format (in the FORTRAN sense). Otherwise, the files will be written without format.
d) If either of the words INTEGER or REAL is used, output records will be organized as described in Section III.B If the word DIRECT is used, output records will be organized exactly as the regular data files are organized (contact the author for formats), except that the indexed sequential access method is not used, the records being organized sequentially. These records can be read in other languages, and they contain all information from the data files, but they are more difficult to use than

the records described in Section III.B. An example of use is given in Section III.C.1 under retrieval in FORTRAN.

B. OUTPUT FILES

1 File Formats

For some files - Streamflow, Rainfall - a single value is copied for each day. For other files - Temperature, Evaporation and Snowfall - two values are copied for each day. Therefore, two different output file formats are used. For the single value format, each record contains 38 words, organized as follows:

Word 1 - Station identification number
Word 2 - Year
Word 2 - Month
Words 4, 5 - Codes (not implemented yet)
Word 6 - Number of days in month
Word 7-37 - Daily values
Word 38 - Monthly total

For the two-value format, each record contains 70 words. The first six words are as above, Words 7-68 contain daily values, and Words 69, 70 contain monthly summaries. A pair of words is used for each day, e.g. Words 7, 8 for day 1, Words 9, 10 for day 2, etc. For each file, the contents of each daily pair and the summary pair are:

Temperature -
Daily A - Daily maximum temperature
Daily B - Daily minimum temperature
Summary A - Monthly average maximum temperature
Summary B - Monthly average minimum temperature

Evaporation -
Daily A - Daily total wind movement
Daily B - Daily total evaporation
Summary A - Monthly total wind movement
Summary B - Monthly total evaporation

Snowfall -
Daily A - Daily total snowfall
Daily B - Depth of snow on ground
Summary A - Monthly total snowfall
Summary B - Blank

In the following examples, any place the dimension (38) appears, it must be replaced with (70) for two-value data.

Scaling varies according to the file item and operand. The table below shows the scaling used:

File Item	Operand INTEGER	Operand REAL
Daily or monthly streamflow	x100	-
Daily or monthly rainfall	x100	-
Daily max or min temperature	-	-
Monthly max or min temperature	x10	-
Daily rainfall	x100	-
Daily or monthly wind movement	-	-
Daily or monthly evaporation	x100	-
Daily or monthly snowfall	x10	-
Daily snow depth	-	-

On output, the records for each station are put in a separate file. To aid in finding the output file, supplemental output is printed. This consists of the station identification, a statement that the records have been copied, and the name of the file on which the copy was made. Names of files are discussed more fully in Section III.D.

Files are copied in the order in which they are accessed. This is determined first by the order of the elements and second by the order of the stations. In the example below, the streamflow file for station 12.3645.00 will be copied first, and the rainfall file for station 10-1645 second. This would be true even if the order of the station numbers was reversed. However, if the order of the elements was reversed, the rainfall file would be written first.

Example: To copy streamflow and rainfall records for stations 12.3645.00 and 10-1645 for the period 1949-1960. Output is to be in the form of fullword floating point numbers.

```
ACCESS
ELEMENT          STREAMFLOW
                 RAINFALL
STATION          12364500
                 101645
PERIOD           1/1941 to 12/1960
COPY             REAL
```

2 Storage requirements

The output format of copied records has been designed to achieve maximum compatibility for several languages. Unformatted records are specified as variable length,blocked, with maximum record length 284 and maximum block length 3128. Formatted records are fixed length, blocked, with record length 380 and

block length 3040. The DCB portion of the DD card is included within HISARS and therefore does not have to be included with the copy DD cards.

Unformatted: DCB=(RECFM=VB, BLKSIZE=3128,LRECL=284)
Formatted: DCB =(RECFM=FB,BLKSIZE=3040,LRECL=380)

Records copied using the DIRECT operand will vary according to the individual file characteristics. Blocking of such records is left to the user.

The following table shows the number of records per block and records per track on the 3330 disk pack and on a 2400 ft. tape at 1600 BPI,

	RECFM	Records per block	LRECL	BLKSIZE	Records per 2400 foot tape	Records per track 3330 Disk Pack
Single value per day						
Formatted	FB	8	380	3040	90,064	32
Unformatted	VB	20	284	3128	220,000	80
Two values per day						
Formatted	FB	8	380	3040	90,064	32
Unformatted	VB	11	284	3128	120,800	44

C. READING THE COPIED RECORDS

After the records have been copied, they can be read by several other languages.

Files created by any of the five operands can be read in FORTRAN or PL/1. A statement must define the storage format, the REWIND or OPEN statement is used to start reading from the beginning of the file, and the appropriate READ statement given.

FORTRAN	PL/I
Nonformatted	Integer
INTEGER DATA(38) REWIND (9) READ (9) DATA	DCL 1 DATA1,2(INFO(6),DATA(32)FIXED BIN(31) DCL IN FILE RECORD INPUT; READ FILE (IN) INTO (DATA1);
	Real
REAL Data (38) REWIND (9) READ (9) DATA	DCL 1 DATA1, 2(INFO(6),DATA(32)) FLOAT BINARY (21); DCL IN FILE RECORD INPUT; READ FILE (In) INTO (DATA1);
Formatted (one value per day, streamflow, rainfall)	
FORMAT (38I10) or	DCL IN FILE STREAM INPUT; DCL DATA (38) FIXED or FLOAT BIN (38); GET FILE (IN) EDIT(DATA)(38-FC10); 38 F (10));
FORMAT (38F10.0)	or GET FILE (IN)EDIT(DATA)(38 E(10,0,5));
Formatted (2 value per day)	
Temperature:	
FORMAT (6110,64I5) or FORMAT (6110,64F5.1)	(6 F(10), 64 F(5)); (6 F(10), 64 F (5,1));
Evaporation:	
FORMAT (6110,64I5) or FORMAT (6110,32(I5,F5.2))	(6 F(10), 64 F(5)); (6 F(10), 32 (F(5),F(5,2)));
Snowfall:	
FORMAT (6110,6415) FORMAT (6110,32(F5.1, I5))	(6 F(10), 64 F(5)); (6 F(10),32 (F(5,1),F(5)));

Direct (evaporation only)

FORTRAN

```
INTEGER * 4   ID,CODE(8),YEAR
INTEGER * 2   DB,STATE,BLK,MONTH,WIND(31),EVAP(31),TW,TE
 REWIND  9
READ(9,15)   DB,STATE,ID,BLK,YEAR,MONTH,CODE,WIND,EVAP,
             TW,TE
15  FORMAT(2A2,2(A4,A2),8A4,64(A2))
```

PL/I

```
DCL   IN FILE RECORD INPUT;
DCL   1 DATA,
      2 (NDY,CODE)BIT(8),
      2  STATION CHAR(4), 2 BLK CHAR(2),
      2 YEAR CHAR(4), 2 MONTH CHAR(2),
      2 DCIDE(32) BIT(8),
      2 (WIND(31),EVAP(31),TW,TE) FIXED BINARY(15);
READ FILE(IN) INTO(DATA);
```

Direct copies of other files can be read using appropriate modification of the above examples. However, it is recommended that whenever possible, unformatted records using the REAL or INTEGER commands be used since it consumes less space and time. Also the bother and worry about the read format is eliminated.

D. JOB CONTROL REQUIREMENTS

Job control requirements for access have been described in Section I.E. Since output files are being created, additional Job Control Language (JCL) cards must be supplied to define the output data sets. These output file cards must be inserted between the EXEC card and the SYSIN card.

It is possible to create up to 26 output files in a single HISARS run. The file names are OUTA, OUTB, . . ., in that order. These must be related to data set names by DD cards in the job control language. Examples of the format of such cards are given below.

There are two types of output files that can be created, permanent and temporary. A permanent file may be kept after the end of the job for as long as the user wishes. This requires that the user meet certain conventions established by the computing center. The prospective user

should therefore discuss requirements with Computer Services. A temporary file is automatically deleted at the end of a job. Because of this, the user does not have to meet any of the computing center conventions, and the facility is readily available.

Generally, a user who has a repeated need for the same data set will choose to create a permanent file. Similarly, a user who is developing a program and requires test data during debugging runs will wish to have a set of data only once, a temporary data set will be preferable. A charge is made for files stored on disk packs, so that a user should check before creating extensive permanent files. There is no charge for temporary files. It may be noted also that the use of FORMATTED operands will more than double storage requirements, although copying cost is not noticeably affected.

1 Permanent Files

Output file cards required to create permanent files should be in the following form:

```
//OUTA DD DSN=aaa.bbb.ccc,UNIT=DISK,
//  SPACE=(TRK,m),DISP=(NEW,CATLG)
```

1) File name OUTA must always be used for the first output file. If additional output files are required, names must be OUTB, OUTC, ..., OUTZ.

2) The DSN is usually a three level qualified name. The first level is the account number to which storage is to be charged. The other two levels are identifiers provided by the user. The last level identifier must be different for each OUTA, OUTB, etc. and must be different from any identifier previously used to store data. It is recommended that bbb be the users name, although this can be omitted.

3) In the SPACE parameter, the number of tracks required must be provided as an integer. This may be calculated as described in Section III.B.2. For example, if 42 months will be stored per track, and 240 months are to be copied, 5.7 tracks are required, rounded up to 6, so that SPACE=(TRK,6).

4) A user may also store data sets on tape. In this case, UNIT=TAPE, the SPACE parameter is left out, and the VOL=SER= number is for a tape. A JIC card and a write label are also required.

5) Since DCB information is provided by HISARS, no such parameter should be given on the DD card, unless the DIRECT operand is used.

6) When file is no longer needed, you must remember to DELETE the file or you will be charged for the space until Computer Services purges the files at the end of the year. This is most easily done using PGM=IEFBR14.

2 Temporary Files

Output file cards required to create temporary files should be in the following form:

```
//OUTA DD DSNAME=&&OUTA,UNIT=DISK,SPACE=(TRK,m),DISP=(NEW,PASS)
```

Note that in this case a temporary data set name is used, identified by the leading ampersands. The only variable information required is the number of tracks in the space parameter, which is calculated as above.

The user who wishes to create temporary files will be executing a two-step job, the first copying the file, and the second executing the program which uses the file.

3 FORTRAN Applications

To illustrate use of HISARS with FORTRAN programs, two examples are given below. These examples show the entire card deck required, including JCL cards, HISARS commands and FORTRAN statements.

The first example produces a listing of daily streamflow similar to that given in Section I.D.4.

```
//jname          JOB
//     EXEC      HISARS
//OUTA     DD     UNIT=DISK,SPACE=(TRK,1),DISP=(NEW,PASS),DSN=&&OUTA
//SYSIN    DD     *
ACCESS
ELEMENT   STREAMFLOW
STATION   12414500
PERIOD    10/1962 to 9/1963
COPY INTEGER FORMATTED
/*
. . . . . .
//               EXEC FORTGCLD
//FORT.SYSIN     DD     *
                  REAL YEAR (12,32)
                  INTEGER DATA (38)
                  REWIND 10
               15 FORMAT (38 I10)
                  DO 23 I=1,12
                  READ (10,15) DATA
                  DO 21 J=1,32
                  K = J + 6
               21 YEAR (I,J) = 0.01*DATA(K)
               23 CONTINUE
                  WRITE (6,17) YEAR
               17 FORMAT (1HO,12F10.2)
                  END
/*
//GO.FT10F001 DD DSN=&&OUTA,DISP=(OLD,DELETE),UNIT=DISK
//GO.SYSIN    DD *
/*
```

The program could also look like this:

```
                  REAL YEAR (12,32)
                  INTEGER DATA (32), INFO (6)
                  REWIND 10
               15 FORMAT (38I10)
                  DO 23  I=1,12
                  READ (10,15) INFO, DATA
                  DO 21 J=1 TO INFO (6)
               21 YEAR (I,J) = 0.01 * DATA (J)
               23 YEAR (I,32) = 0.01 * DATA (32)
                  WRITE (6,17) YEAR
               17 FORMAT
                  END
```

Many times, the user wants to have all days of the year in a single dimensioned variable such as YEAR(366) rather than YEAR (12,32). This can be done as shown in this FORTRAN example for COPY REAL and a streamflow record 12 months long on a water year basis (October = 1)

```
      DIMENSION YEAR(366), IMO(12), DATA (32), FORM(6)
      DATA IMO/1,32,62,93,124,152,183,213,244,274,305,336/
      REWIND 10
      L = 0
      DO 50 I = 1,12
      READ (10) FORM,DATA
      IDA = FORM (6)
      DO 50 J = 1, IDA
      L = L + 1
   50 YEAR (L) = DATA (J)
      STOP
      END
```

For files which may have missing months (EVAPORATION and SNOWFALL), only months with data are copied so the following strategy must be used:

```
      DO 50 I = 1,12
      MON = FORM (5)
      IDA = FORM (6)
      IYR = FORM (4)
      L = IMO(MON)
      IF (MOD(IYR,4).EQ.0.AND.MON.GT.2.AND.MON.LT.10)
     *LL = L + IDA -1
      K = 0
      DO 50 J = L,LL
      K = K + 1
   50 YEAR (J) = DATA(K)
```

The second example is used to calculate and print monthly weighted average rainfall computed from data for stations 10-4772, 10-5283 and 10-7499 with weights of 0.3, 0.5, and 0.2 respectively.

```
//jname       JOB
//     EXEC  HISARS
//OUTA   DD  DSN=&&OUTA,UNIT=DISK,SPACE=(TRK,2),DISP=(NEW,PASS)
//OUTB   DD  DSN=&&OUTB,UNIT=DISK,SPACE=(TRK,2),DISP=(NEW,PASS)
//OUTC   DD  DSN=&&OUTC,UNIT=DISK,SPACE=(TRK,2),DISP=(NEW,PASS)
//SYSIN  DD  *
ACCESS
ELEMENT  RAINFALL
STATION  104772
         105283
         107499
PERIOD   10/1951 TO 9/1956
COPY     REAL
/*
. . . . . .
//       EXEC FORTGCLD
//FORT.SYSIN DD  *
         REAL DATAA(38),DATAB(38),DATAC(38)
         REWIND 8
         REWIND 9
         REWIND 10
         DO 19 I=1,60
         READ (8) DATAA
         READ (9) DATAB
         READ (10) DATAC
         NYR=DATAA(2)
         NMO=DATAA(3)
         AVE=0.3*DATAA(38)+0.5*DATAB(38)+0.2*DATAC(38)
      19 WRITE (6,10) NYR,NMO,AVE
      10 FORMAT (16, 13,F8.2)
         STOP
         END
/*
//GO.FTO8F001 DD DSN=&&OUTA,DISP=(OLD,DELETE),UNIT=DISK
//GO.FTO9FOO1 DD DSN=&&OUTB,DISP=(OLD,DELETE),UNIT=DISK
//GO.FT1OFOO1 DD DSN=&&OUTC,DISP=(OLD,DELETE),UNIT=DISK
//GO.SYSIN  DD   *
/*
```

From this example, it is seen that the requested data for each station are on a separate file. If there had been 7 stations, the DD card would have to be named OUTA to OUTG.

4 PL/I Application

The second example of Section 3 could look like this in PL/I:

```
AVE:PROC OPTIONS(MAIN);
  DECLARE  (INA,INB,INC)FILE INPUT RECORD;
  ON ENDFILE(INA) GO TO LAST;
  DECLARE  1 DATAA, 2 (PART1(6),DATA(32))FLOAT BINARY(21);
  DECLARE  1 DATAB LIKE DATAA;
  DECLARE  1 DATAC LIKE DATAA;
TOP:READ FILE(INA)INTO(DATAA);
    READ FILE(INB)INTO(DATAB);
    READ FILE(INC)INTO(DATAC);
AVG=0.3*DATAA.DATA(32)+0.5*DATAB.DATA(32)+0.2*DATAC.DATA(32);
  PUT EDIT(DATAA.PART1(2),DATAA.PART1(3),AVG)(SKIP,F(6),F(3),F(8,2));
  GO TO TOP;
LAST:END AVE;
```

All the DD cards are the same except that the names on the GO file card change to GO.INA, GO.INB, and GO.INC.

The same program could be done without structures as shown below:

```
AVE:PROC OPTIONS(MAIN);
  DECLARE  (INA,INB,INC)FILE INPUT RECORD;
  ON ENDFILE(INA) GO TO LAST;
DECLARE (DATAA(38),DATAB(38),DATAC(38))FLOAT BINARY(21);
TOP: READ FILE(INA)INTO(DATAA);
     READ FILE(INB)INTO(DATAB);
     READ FILE(INC)INTO(DATAC);
   AVG=0.3*DATAA(38) + 0.5*DATAB(38) + 0.2*DATAC(38);
   PUT SKIP LIST(DATAA(2),DATAA(3),AVG);
   GO TO TOP;
LAST:END AVE;
```

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20.

U.S. Geological Survey
Surface Water Records in Water-Supply Papers

	Part 10	Part 12	Part 13
Beginning of record through 1950 (monthly)	1314	1315	1316
1951-1960	1734	1736	1737
1961-1965	1927	1933	1934
1966-1970	2127	2133	2134
1971-Present	Water Resources Data for Idaho. Part 1. Surface water records.		

21.

U.S. Geological Survey
Water Quality Records in Water-Supply Papers

Year	Parts 9-14	Year	Parts 9-14	Year	Parts 9-11	Parts 12-14
1947	1102	1956	1453	1964	1958	1959
1948	1133	1957	1523	1965	1965	1966
1949	1163	1958	1574	1966	1995	1996
1950	1189	1959	1645	1967	2015	2016
1951	1200	1960	1745	1968	2098	2100
1952	1253	1961	1885	1969	2148	2150
1953	1293	1962	1945			
1954	1353	1963	1951			
1955	1401					
1970-Present	Water Resources Data for Idaho. Part 2. Water Quality Records.					