MODIFICATION OF THE TANGBORN SHORT-TERM HYDROMETEOROLOGICAL MODEL, WITH TRIAL RESULTS FROM THE BAKER RIVER BASIN, WASHINGTON

U.S. GEOLOGICAL SURVEY
Water-Resources Investigations
Open-File Report 81-694

Prepared in Cooperation With
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UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

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GEOLOGICAL SURVEY

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METRIC (SI) CONVERSION FACTORS

Multiply	By	To obtain
cubic foot per second (ft^3/s)	0.02832	cubic meter per second (m^3/s)
degree Fahrenheit (^oF)	subtract 32 and multiply remainder by 0.5556	degree Celsius (^oC)

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ABSTRACT

This report presents a modification of the short-term hydrometeorological model (Tangborn, 1978) for estimating river-basin snowmelt runoff. A multiple linear regression replaces a nonlinear regression scheme to correct for temperature effects of snowmelt runoff. Results based on data from the Baker River basin, Washington, indicate that model performance is improved by the modification in a majority of applications, and, additionally, use of the model is simplified and computer time is reduced.

INTRODUCTION

The short term hydrometeorological model presented by Tangborn (1978) estimates river-basin snowmelt runoff for short prediction periods (1-15 days).

In his model description, Tangborn (1978) states that "several improvements in this model's structure and in the calibration for specific basins are possible." The purpose of this short note is to suggest simple changes in the model structure that are meteorologically more tractable and substantially reduce calibration effort at little or no cost to model accuracy. The analysis evaluating the consequences of these model changes is performed here only for the upper Baker River basin in the northern Cascade Mountains of Washington. Similar results could be expected for other basins for which the basic model is applicable.

MODEL

In order to make runoff predictions, Tangborn's model utilizes observed streamflow, precipitation, and temperature data. These data are incorporated stepwise into the model by means of coefficients obtained from staged regressions of estimation error versus appropriate input variables at each step.

Four sequential steps in the Tangborn model reduce the model's runoff-prediction error (fig. 1). The first step relates predicted seasonal runoff to winter basin-water storage. The primary calibration factors in this step are the definition of the winter season starting date and the selection of the precipitation gage that best relates to basin precipitation. The second step corrects the predictions of step 1 by means of a short, preprediction test season. The critical determination for step 2 is the length of the test season. The third step uses a test-season ablation (temperature) factor to improve upon the step 2 prediction. An optimal temperature station and proportionality constant, alpha, in the ablation term are selected by this step. The final step uses a prediction season weather forecast to make a final adjustment on the prediction. Step 4 also is highly dependent on the ablation proportionality constant.

For a complete description of the model, its calibration and verification procedures, and delineation of all the equations, the reader is referred to Tangborn (1978). The changes described in this report primarily involve the ablation factor correction in steps 3 and 4 of the hydrometeorological model.

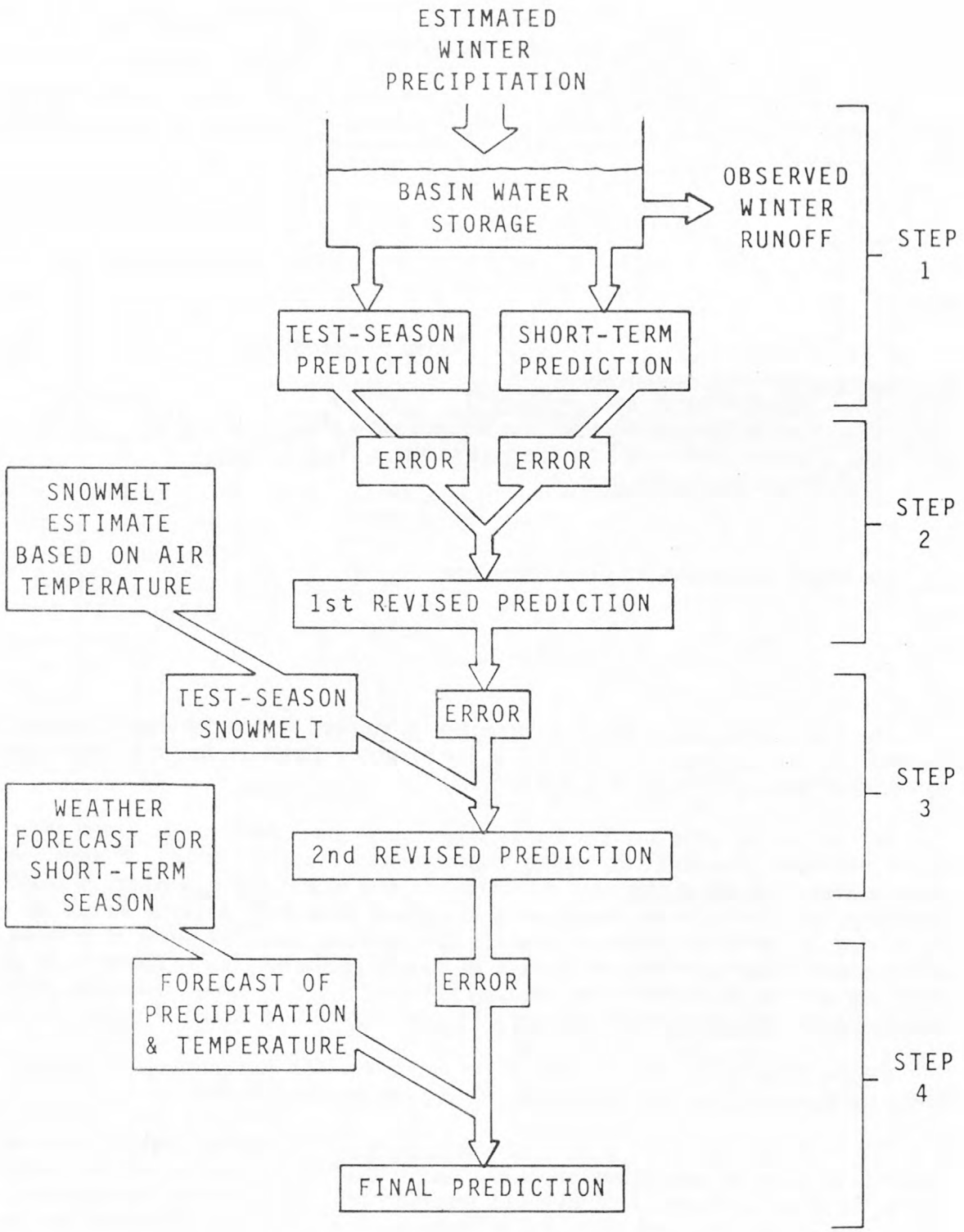

FIGURE 1.--Flow chart of Tangborn hydrometerological model.

MODEL CHANGE

Tangborn (1978) defines $R^*_s(2)$ as the streamflow prediction at the end of step 2. In step 3 the following equation is used to determine the correction for snow ablation during the test season:

$$e^*_s(2) = a_4 A_t + b_4 \quad (1)$$

where

$e^*_s(2)$ = correction term to be applied to step two prediction
a_4, b_4 = regression coefficients
A_t = ablation factor = $\alpha T_t + (1-\alpha)\Delta T_t$
T_t = median temperature for the test season = $(T_{max} + T_{min})/2$
ΔT_t = temperature range for the test season = $(T_{max} - T_{min})$
α = weighting factor $0 \leq \alpha \leq 1$.

The step 3 prediction $R^*_s(3)$ is therefore

$$R_s^*(3) = R_s^*(2) - e_s^*(2) \ . \quad (2)$$

The step 4 ablation prediction correction is similar to that for step 3 except that the T_t and ΔT_t are defined in terms of a temperature forecast for the prediction season rather than temperature for the test season.

Several model runs for the Baker River basin have been made which indicate that the coefficient of prediction, which characterizes model accuracy, is sensitive to the value chosen for alpha (fig. 2). To calibrate the model for a prediction season, many computer runs have to be made using historical data with several values of alpha to determine an optimal choice of alpha. The optimal value of alpha is defined as that alpha which maximizes the coefficient of runoff prediction (CP). There is no guarantee that this optimal alpha will give the best results for a real-time prediction, especially if the particular real-time prediction period happens to be in a season of abnormal weather.

Figure 3 illustrates the results of the procedure for determining an optimal value of alpha for the prediction period January 16 through January 23, 1978.

Curve A of figure 3, a plot of coefficient of prediction versus alpha, shows the optimal alpha to be approximately 0.25. Curve (B) shows model predicted runoff versus alpha based on a forecast of average weather conditions. Using the optimal value of alpha, the predicted runoff is 16,900 ft^3/s-days. The observed runoff for the period was 14,400 ft^3/s-days. From curve B, it can be seen that an alpha value in the range of 0.40 to 0.50 would have given the best model predicted runoff value (15,800 ft^3/s-days). Therefore, the alpha value which yields the maximum coefficient of prediction did not result in the best possible runoff prediction from the model.

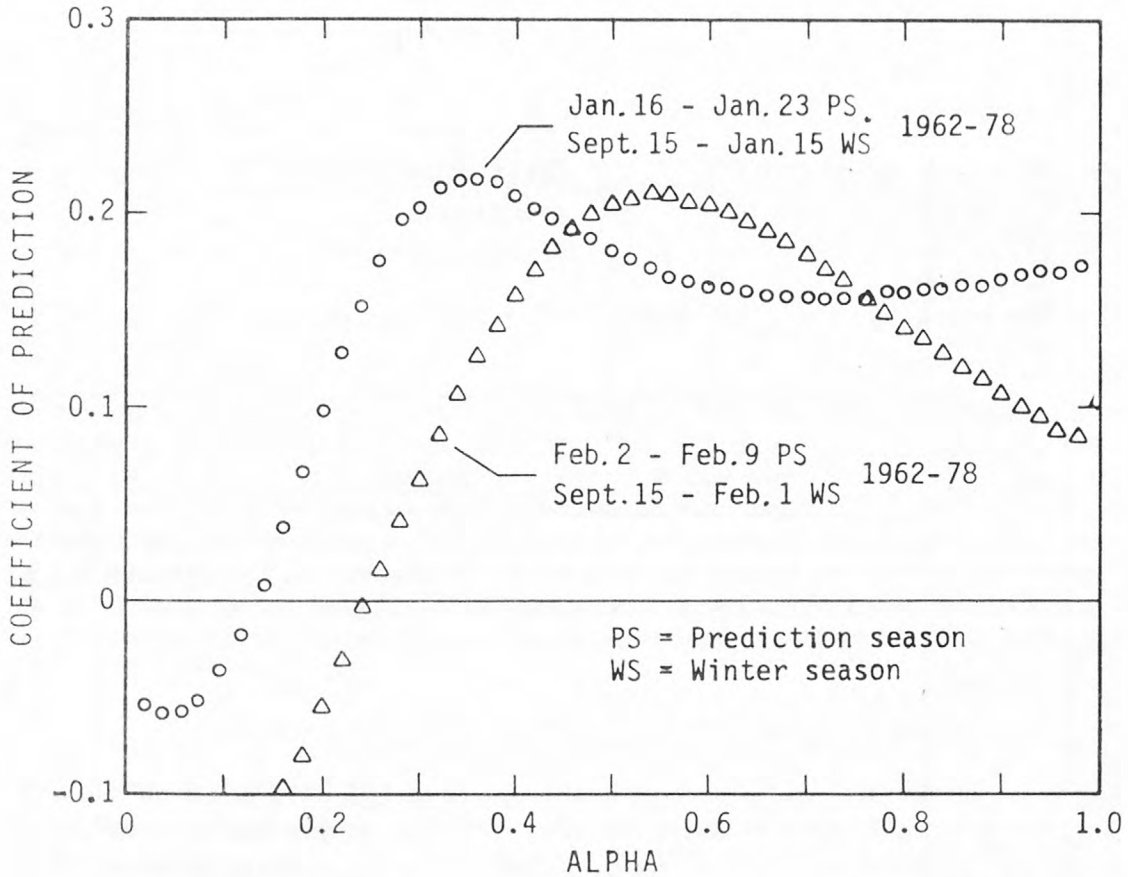

FIGURE 2.--Coefficient of prediction for two prediction periods as a function of alpha for Baker River basin.

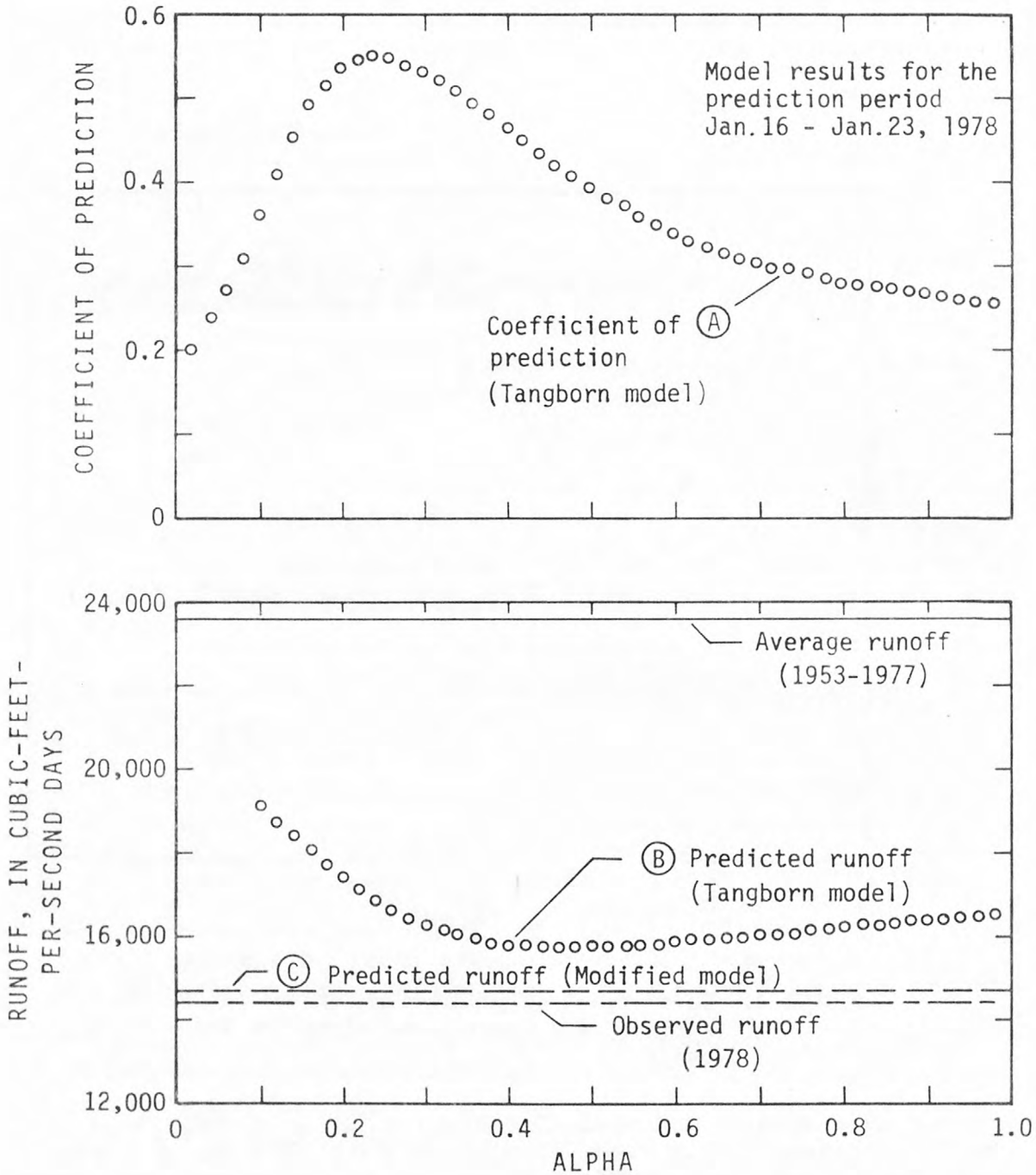

FIGURE 3.--Coefficient of prediction and runoff estimates as a function of alpha and weather forecast for prediction period January 16 to January 23, 1978, for Baker River basin.

To eliminate any arbitrary choice of alpha, the authors suggest that steps 3 and 4 be made independent of alpha but still retain their dependence on maximum and minimum daily temperatures. This is achieved by regressing the correction error from step 2 on T_{max} and T_{min} for the respective time periods. The corresponding correction equation for step 3 in lieu of equation 1 would have the form

$$e^*_s(2) = a'_4 T_{max} + b'_4 T_{min} + c'_4 \quad (1a)$$

where

a'_4, b'_4, c'_4= multiple regression coefficients;
T_{max}= maximum temperature for test season; and
T_{min}= minimum temperature for test season.

A similar correction is used for step 4 where T_{max} and T_{min} are defined for the prediction season.

Curve C in figure 3 represents the runoff predictions obtained from the modified model using a forecast of average weather. Table 1 presents the comparisons of best predictive accuracy of each method for several 8-day prediction periods throughout the winter and spring seasons. The trial winter season starting dates were the 1st and 15th of September through December. The maximum test season length used was 5 days. The CP values could have been increased with a finer division of winter season starts and (or) extension of test season lengths. The parameter values used in the development of table 1 were chosen as a compromise between parameter increments and computer cost.

COMPARISON OF THE MODIFIED AND ORIGINAL MODELS

The runoff predictions for the Baker River basin as computed by the modified model illustrate that the elimination of the coefficient alpha in steps 3 and 4 gives comparable results in terms of average CP when matched against the original model (Tangborn, 1978) predictions. This elimination of alpha also removes the confusion in the original model stemming from the fact that the temperature factor in the weather forecast is a function of alpha. The new version of the model does not require a series of trials to obtain an optimal alpha as needed by the original model, therefore the computer cost of making a final prediction is reduced.

The tradeoff for eliminating alpha is the loss of physical interpretation of the T_t and ΔT_t terms as described in Tangborn (1978). However, since the predictive accuracy is based solely on a statistical analysis in the original model, the physical interpretation of the temperature factor is already reduced. Only with a study of the physical relationships among alpha, cloud cover, surface-energy exchange, and temperature can alpha be most efficiently utilized.

A shortcoming of using T_{max} and T_{min} directly in a multiple-regression analysis is the likelihood of a multicollinearity effect (Johnston, 1972) due to the correlation between T_{max} and T_{min}. One possible means to alleviate this effect is to separate the multiple-regression correction into two single variable regression corrections on T_{max} and T_{min} sequentially. This should be one of the first considerations for any further model improvement.

TABLE 1.--Comparison of model accuracies as indicated by coefficient of runoff prediction (CP) for given prediction seasons for Baker River basin

Prediction season (1978)	Winter start	Test season length (days)	Optimal alpha	CP
		Tangborn Model		
Jan. 1 - Jan. 8	Dec. 1	2	0.30	0.197
Jan. 16 - Jan. 23	Nov. 1	2	.30	.532
Feb. 2 - Feb. 9	Sept. 15	1	.50	.205
Feb. 16 - Feb. 23	Nov. 15	1	.90	*
Mar. 2 - Mar. 9	Dec. 1	1	.10	.376
Mar. 16 - Mar. 23	Nov. 1	3	.90	.511
Apr. 2 - Apr. 9	Nov. 15	3	.70	.123
Apr. 16 - Apr. 23	Nov. 15	2	.10	*
May 2 - May 9	Dec. 1	1	.90	.590
May 16 - May 23	Dec. 1	3	.90	.472
		Modified Model		
Jan. 1 - Jan. 8	Nov. 15	1		0.293
Jan. 16 - Jan 23	Nov. 1	2		.622
Feb. 2 - Feb. 9	Sept. 15	1		.261
Feb. 16 - Feb. 23	Sept.15	1		*
Mar. 2 - Mar. 9	Dec. 1	1		.323
Mar. 16 - Mar. 23	Nov. 1	5		.454
Apr. 2 - Apr. 9	Nov. 15	3		*
Apr. 16 - Apr. 23	Dec. 1	1		.291
May 2 - May 9	Dec. 1	1		.626
May 16- May 23	Nov. 1	4		.354

*Indicates CP is negative value for all parameter combinations used.

SELECTED REFERENCES

Johnston, J., 1972, Econometric methods (2d ed.): New York, McGraw Hill.

Tangborn, W. V., 1978, A model to predict short-term snowmelt runoff using synoptic observations of streamflow, temperature and precipitation in Colbeck and Ray, editors, Proceedings - Modeling of snow cover runoff: U.S. Army Corps of Engineers, Cold Region Research and Engineering Laboratory, Hanover, New Hampshire, p. 26-28, September.

-----1979, Hydrometeorological model for streamflow prediction: U.S. Geological Survey Open-File Report 79-741, 88 p.

APPENDIX A: MODEL DATA INPUT REQUIREMENTS

The model requires four data sets containing daily, historical hydrologic and weather data and two parameter cards which specify the type of model run to be made.

A. Data Sets

1. Runoff data - (logical unit 13)
   Mean daily streamflow discharge (cubic feet per second) from the desired basin.

2. Precipitation data - (logical unit 14)
   Daily accumulated precipitation representing the basin, recorded in inches.

3. Minimum temperature data - (logical unit 15)
   Daily minimum temperature data representing the basin, recorded in degrees Fahrenheit.

4. Maximum temperature data - (logical unit 16)
   Daily maximum temperature data representing the basin, recorded in degrees Fahrenheit.

General Card Format

The card formats for the four data sets are similar, each requiring three cards per month with each card containing up to 12 daily values.

A description of the general format for the daily-values cards (types 1, 2, and 3) follows:

Columns	Format	Description		
		Card 1	Card 2	Card 3
1-5	F5.0	Value 1	Value 13	Value 25
6-10	F5.0	2	14	26
11-15	F5.0	3	15	27
16-20	F5.0	4	16	28
21-25	F5.0	5	17	29
26-30	F5.0	6	18	30
31-35	F5.0	7	19	31
36-40	F5.0	8	20	Not used
41-45	F5.0	9	21	Not used
46-50	F5.0	10	22	Not used
51-55	F5.0	11	23	Not used
55-60	F5.0	12	24	Not used
65		"1"	"2"	"3"
69-72	2X,I2	Water year		
74-75	I2	Month No. (Oct=1)		
77-80	I4	Basin No. for runoff data or Station index No. for precipitation and temperature data		

For additional information on the preparation of data sets, the reader may refer to Tangborn (1978).

B. Parameter Cards

1. Model-year card for split-sample control

Columns	Format	Name	Description
4-5	I2	YR1	Last two digits of the first year of data in the four data sets described in Part A.
9-10	I2	YRPRE	Last two digits of the year specifying the start of a verification period. For each year during this period, the model makes a runoff prediction and computes prediction error using the coefficients developed from all previous years. The prediction made for the first year of the verification period uses initial regression coefficients as determined from the calibration period (YR1 to YRPRE-1).
14-15	I2	YR2	Last two digits of the last year of data to be used. If NCF is left blank, YR2 defines the end of the verification period and prediction statistics will be included for this year as for other years of this period.
19-20	I2	NCF	Leave blank if no runoff forecast is to be made as mentioned above. If a runoff forecast is desired, code last two digits of forecast year (must be same as YR2). In this case, the verification period terminates with the previous year (YR2-1). All averages, standard deviations and CP computations are through the previous year only. The runoff forecast will be based, however, on all data up through the test season of the forecast year.
21-25	F5.0	RMAX	Percent of average runoff for prediction season. If for any year during the verification period the percent of average runoff for the prediction season is less than RMAX, the squared error of the prediction for this year is not included in the cumulative squared error term. Normally RMAX is zero and all years are included, but the user could code a large value for RMAX in order to see how good the model is at predicting high flows. In this case, only years with sufficiently high-prediction season runoff would be considered. In any event, the model parameters are calibrated using all flows.

2. Model parameters and options card (one for each case)

Columns	Format	Name	Description
1-3	A3	M1A	Month winter season begins (three-letter designation)*
4-5	I2	M1D	Day winter season begins
11-13	A3	M2A	Month winter season ends*
14-15	I2	M2D	Day winter season ends, assuming zero test season length (that is, day of prediction)
21-23	A3	M3A	Month prediction season beings*
24-25	I2	M3D	Day prediction season beings
31-33	A3	M4A	Month prediction season ends*
34-35	I2	M4D	Day prediction season ends
36-40	I5	NI	Test-season length (days), right adjusted
42	I1	IX	Output print option

1 - Final year runoff forecast summary.

2 - Verification period data summary with yearly predictions plus winter, test, and prediction season values of precipitation and runoff.

3 - Verification period prediction summary including annual values for the runoff prediction, prediction error, and prediction percent of actual runoff for each of the five model steps.

4 - Final-year prediction root mean squared errors for all five steps.

5 - Final-year coefficients of prediction and accuracy improvements for all five steps. This is the calibration print option useful for determining optimal winter season start date, test season length and method. Method is defined by choices of IPT, IWF, and IPS

6 - Final-year printout of correlation coefficients for the regressions at each step.

---

*Three-letter designations for months:
Sep, Oct, Nov, Dec, Jan, Feb, Mar, Apr, May, Jun, Jul, Aug.

Columns	Format	Name	Description
			7 - Verification-period coefficient summary including annual regression correlations for each step. 8 - Final-year runoff predictions, coefficients of prediction, and predicted percentage of mean runoff for each step.
50	I1	IPT	Test-season precipitation switch: 1 - Test-season precip. not included in independent variable of correction model. It is recommended that this value be used. 2 - Test-season precip. included. If this is used, initial steps of model become independent of test season.
52	I1	IWF	Weather-forecast regression order: 1 - temperature forecast regression first 2 - precipitation forecast regression first
54	I1	IPS	Basic-regression precipitation switch: 1 - precip = winter + test precip 2 - precip = winter + test + prediction season precip
55-60	F6.0	PSD	Precipitation forecast in percent of average precip for prediction season
61-65	F5.1	TFMX	Forecast of maximum temperature delta in degrees with respect to average maxium temperature
66-70	F5.1	TFMN	Forecast of minimum temperature delta in degrees with respect to average minium temperature
72	I1	ITTS	Test-season temperature correction switch: 1 - test-season temperature correction out 2 - test-season temperature correction in

As many cards as necessary giving these parameters may be added. Each successive card needs coded only those parameters that are to be changed. If left blank, the original parameter value will be retained.

APPENDIX B: Computer program listing and results

```
REQUESTED OPTIONS: XREF

OPTIONS IN EFFECT: NAME(MAIN) OPTIMIZE(1) LINECOUNT(54) SIZE(MAX) AUTODBL(NONE)
                   SOURCE EBCDIC NOLIST NODECK OBJECT MAP NOFORMAT GOSTMT XREF NOALC NOANSF NOTERM IBM FLAG(I)

                C TANGBORN HYDROMETEOROLOGICAL SNOWMELT RUNOFF MODEL
                C
                C        HMSM 01  JANUARY  1979
                C
                C MODIFIED BY KARLINGER AND WILSON , MARCH 1980
                C
                C THIS MODEL PREDICTS SHORT-TERM SNOWMELT RUNOFF USING SYNOPTIC
                C OBSERVATIONS OF STREAMFLOW, PRECIPITATION, AND TEMPERATURE
                C
   ISN 0002           DIMENSION RS(30),AX1(30),BX1(30),AX2(30),BX2(30),AX3(30),BX3(30),
                     1  CR(30),ES1(30),RS1(30), RS2(30),ES2(30),AX4(30),BX4(30),
                     2 RS3(30),ES3(30),PTR(30),AX5(30),BX5(30),AX6(30),BX6(30),
                     3 RS4(30),ES4(30),RS5(30),ES5(30),
                     4   RT(30) ,                    MZ(13),NZ(13),ET(30),
                     5                PT(30),SDTOT(60),                PWTS(30),PWX(30)
   ISN 0003           DIMENSION X1(30),X2(30),Y(30),YHAT(30),RESID(30),Z(10),
                     $CX4(30),CX5(30)
   ISN 0004           DIMENSION TTSI(2)
   ISN 0005           COMMON/RAW/PDAY(13,36,30),RDAY(13,36,30),TX(13,36,30),TN(13,36,30)
                     1,NI
                C
   ISN 0006           COMMON /MONTH/ MTH(13),NDAY(13)
   ISN 0007           COMMON /DATE/ M1,M1D,MT,MTD,M2,M2D,M3,M3D,M4,M4D
   ISN 0008           COMMON/DATEX/M1X,M1DX,M2X,M2DX,M3X,M3DX,M4X,M4DX
   ISN 0009           COMMON /SEASN/ PWT(30),PW(30),RWT(30),RWTS(30),PS(30)  ,T(30),
                     1 RTS(30),TS(30)        ,RW(30),TW(30)
   ISN 0010           COMMON/TEMP/ TTB(30),TSB(30),DTT(30),DTS(30)
   ISN 0011           COMMON/CORR/ YXT(30),YNT(30),YXXS(30),YNNS(30)
                C
   ISN 0012           INTEGER YR1,YR2,YRERR,YRPRE,YRCOE,SEP
   ISN 0013           DATA NZ   /30,31,30,31,31,29,31,30,31,30,31,31,30/
   ISN 0014           DATA MZ /             3HSET,3HOCT,3HNOV,3HDEC,3HJAN,3HFEB,3HMAR,
                     13HAPR,3HMAY,3HJUN,3HJUL,3HAUG,3HSEP/,SEP/3HSEP/
   ISN 0015            DATA MD/30/
                C
   ISN 0016           DO 11 I=1,13
   ISN 0017           MTH(I)= MZ(I)
   ISN 0018        11 NDAY(I)= NZ(I)
   ISN 0019           DATA TTSI/'OUT','IN'/
                C
                C             READ IN LIMITS OF DATA BASE
                C
   ISN 0020           READ(5,7000) YR1,YRPRE,YR2,NCF ,RMAX
   ISN 0021           NYR=YR2-YR1 +1
   ISN 0022           CALL READAY(RDAY,NYR,IDR,YR1,13)
   ISN 0023           CALL READAY(PDAY,NYR,IDP,YR1,14)
   ISN 0024           CALL READAY(TN,NYR,IDT,YR1,15)
```

```
ISN 0025            CALL READAY(TX,NYR,IDT,YR1,16)
ISN 0026            IY1=YR1-1
ISN 0027            CALL FEB(NYR,IY1)
ISN 0028            NDAY(6)=28
ISN 0029            J=YRPRE-YR1  +1
ISN 0030            K=J-1
ISN 0031            YRCOE=YRPRE-1
ISN 0032            IFOR=NCF-YR1 +1
ISN 0033            IY1=YR1
ISN 0034             IY2=YR2-1
ISN 0035             IQ=0
ISN 0036             JI=0
ISN 0037            IZ=0
ISN 0038            IY=0
ISN 0039            TSD=9999
ISN 0040             TSDX= .001
ISN 0041             PSDX= 100.
ISN 0042             IPTX=1
ISN 0043             IPSX=1
ISN 0044             IWFX=1
ISN 0045            TFMNN=0.
ISN 0046            TFMXX=0.0
                C
                C              READ IN REPETATIVE DATA BASE
                C
ISN 0047          16 READ(5,1001) M1A,M1D,M2A,M2D,M3A,M3D,M4A,M4D ,NI,IX,IPT,
                     1  IWF,IPS,PSD,TFMX,TFMN,ITTS
ISN 0048       1001 FORMAT(A3,I2,3(5X,A3,I2),I5,I2, 6X ,3I2,F6.0,2F5.1,I2)
                C
                C  NI IS TEST SEASON LENGTH
                C
                C  IX IS PRINT OPTION
                C
                C  IPT= 1--TEST SEASON PRECIP NOT IN INDEP VARIABLE  OF CORRECTION MODEL
                C  IPT=2--TEST SEASON PRECIP IN INDEP VARIABLE OF CORRECTION MODEL
                C
                C  IWF=1  TEMP FORECAST REGRESSION FIRST
                C  IWF=2  PRECIP FORECAST REGRESSION FIRST
                C
                C  IPS=1  PRECIP=WINTER+TEST   IN BASIC MODEL REGRESSION
                C  IPS=2  PRECIP=WINTER+TEST+SUMMER IN BASIC MODEL REGRESSION
                C
                C  PSD= PRECIP FORECAST IN PER CENT OF AVERAGE
                C
                C  TFMX= FORECAST MAX TEMPERATURE DELTA IN DEGREES WRT AVERAGE MAX TEMP
                C  TFMN= FORECAST MIN TEMPERATURE DELTA IN DEGREES WRT AVERAGE MIN TEMP
                C
                C  ITTS=1  TEST SEASON TEMP CORRECTION OUT
                C  ITTS=2  TEST SEASON TEMP CORRECTION IN
                C
ISN 0049            IF(PSD.EQ.0) PSD=PSDX
ISN 0051            PSDX=PSD
```

```
ISN 0052          IF(TFMN.EQ.0.) TFMN=TFMNN
ISN 0054          TFMNN=TFMN
ISN 0055          IF(TFMX.EQ.0.)TFMX=TFMXX
ISN 0057          TFMXX=TFMX
ISN 0058           IF(IPS.EQ.0) IPS=IPSX
ISN 0060           IPSX=IPS
ISN 0061           IF(TSD.EQ.0) TSD=TSDX
ISN 0063           TSDX=TSD
ISN 0064           IF(IWF.EQ.0) IWF=IWFX
ISN 0066           IWFX=IWF
ISN 0067          IF(ITTS.EQ.0)ITTS=ITTSX
ISN 0069          ITTSX=ITTS
ISN 0070          IF(M1D.EQ.99)STOP
ISN 0072          IF(M1A.EQ.SEP) M1A=MTH(1)
ISN 0074          IF(M2A.EQ.SEP) M2A=MTH(1)
ISN 0076           IF (IPT.EQ.0) IPT=IPTX
ISN 0078           IPTX = IPT
ISN 0079           SMRS=0.0
ISN 0080           SMPW=0.0
ISN 0081           SMPT=0.0
ISN 0082           SMRT=0.0
ISN 0083           SMRWT=0.0
ISN 0084           SMTTB=0.0
ISN 0085           SMDTT=0.0
ISN 0086           SMTSB=0.0
ISN 0087           SMDTS=0.0
ISN 0088           SMPS=0.0
ISN 0089          SMYXXS=0.0
ISN 0090          SMYNNS=0.0
ISN 0091          CALL ALPHA(M1A,MTA,M2A,M3A,M4A,NI,JI,IX,JX)
ISN 0092          RSPS=0
ISN 0093           RSMP=0
ISN 0094           RSMS=0
ISN 0095           SET1=0
ISN 0096           SET2=0
ISN 0097           SET3=0
ISN 0098          SUMES =0
ISN 0099          SUME1=0
ISN 0100          SUME2=0
ISN 0101          SUME3=0.
ISN 0102          SUME4=0.
ISN 0103           SMTW=0.0
ISN 0104          LCT=K
ISN 0105          NCT=0
ISN 0106          JYEAR= YRPRE -1
ISN 0107          DO 100 N=1,K
ISN 0108          CALL SUM123(N)
ISN 0109          RS(N)=RWTS(N)-RWT(N)
ISN 0110           PWTS(N)=PWT(N)+PS(N)
ISN 0111           IF(IPS.EQ.1) PWX(N)=PWT(N)
ISN 0113           IF(IPS.EQ.2) PWX(N)=PWTS(N)
ISN 0115           PT(N)=PWT(N)-PW(N)
```

```
ISN 0116            RT(N)=RWT(N)-RW(N)
ISN 0117            SMTW=SMTW+TW(N)
ISN 0118            SMPW=SMPW+PW(N)
ISN 0119            SMPT=SMPT+PT(N)
ISN 0120            SMRT=SMRT+RT(N)
ISN 0121            SMRWT=SMRWT+RWT(N)
ISN 0122            SMTTB=SMTTB+TTB(N)
ISN 0123            SMDTT=SMDTT+DTT(N)
ISN 0124            SMTSB=SMTSB+TSB(N)
ISN 0125            SMDTS=SMDTS+DTS(N)
ISN 0126            SMPS=SMPS+PS(N)
ISN 0127            SMRS=SMRS+RS(N)
ISN 0128           SMYXXS=SMYXXS+YXXS(N)
ISN 0129           SMYNNS=SMYNNS+YNNS(N)
ISN 0130       100 CONTINUE
                C
                C              PERFORM BASIC REGRESSIONS FOR CALIBRATION PERIOD
                C
ISN 0131           CALL LIN(K,PW,RWT,A1,B1,XB1,YB1,RSQ1,R1,MD)
ISN 0132           CALL LIN(K,PWT,RWT,A2,B2,XB2,YB2,RSQ2,R2,MD)
ISN 0133            CALL LIN(K,PWX ,RWTS,A3,B3,XB3,YB3,RSQ3,R3,MD)
ISN 0134           AX1(K)=A1
ISN 0135           BX1(K)=B1
ISN 0136           AX2(K)=A2
ISN 0137           BX2(K)=B2
ISN 0138           BX3(K)=B3
ISN 0139           AX3(K)=A3
ISN 0140           SME1=0.0
ISN 0141           SME2=0.0
ISN 0142           SME3=0.0
ISN 0143           SME4=0.0
                C
                C              TEST SEASON CORRECTION FACTOR DETERMINATION
                C
ISN 0144           DO 200 N=1,K
ISN 0145           CALL SUM123(N)
ISN 0146           IF(IPT.EQ.1) ET(N)=A1*PW(N)+B1-RWT(N)
ISN 0148           IF(IPT.EQ.2) ET(N)=A2*PWT(N)+B2-RWT(N)
ISN 0150            ES1(N)=A3*PWX (N)+B3 -RWTS(N)
ISN 0151           SME1=SME1+ET(N)*ET(N)
ISN 0152           SME2=SME2+ES1(N)*ET(N)
ISN 0153           C = SME2/SME1
ISN 0154       200 CONTINUE
ISN 0155            IF(NI .LT.1) C=0.0
ISN 0157            CR(K)= C
                C
                C              TEST SEASON CORRECTION LOOP(TO 300)
                C
ISN 0158           DO 300 N=1,K
ISN 0159           CALL SUM123(N)
ISN 0160            RS1(N)=A3*PWX (N)+B3 -RWT(N)
ISN 0161           RS2(N)=RS1(N)- C    *ET(N)
```

```
ISN 0162            ES2(N)=RS2(N)-RS(N)
ISN 0163          300 CONTINUE
                  C
                  C               TEST SEASON TEMPERATURE CORRECTION REGRESSION
                  C
ISN 0164            CALL RGRTWO(YXT,YNT,K,ES2,YHAT,RESID,Z)
ISN 0165            AX4(K)=Z(4)
ISN 0166            BX4(K)=Z(5)
ISN 0167            CX4(K)=Z(10)
ISN 0168            RSQ4=Z(9)
                  C
                  C               TEST SEASON TEMPERATURE CORRECTION LOOP(TO 400)
                  C
ISN 0169            DO 400 N=1,K
ISN 0170            CALL SUM123(N)
ISN 0171            RS3(N)=RS2(N)-(Z(4)*YXT(N)+Z(5)*YNT(N)+Z(10))
ISN 0172            ES3(N)=RS3(N)-RS(N)
ISN 0173          400 CONTINUE
                  C
                  C               FIRST FORECAST CORRECTION REGRESSION-SEE IWF FOR ORDER
                  C
ISN 0174            IF(IWF.EQ.2) GO TO 41
ISN 0176            IF(ITTS .EQ. 2) GO TO 401
ISN 0178            CALL RGRTWO(YXXS,YNNS,K,ES2,YHAT,RESID,Z)
ISN 0179            GO TO 402
ISN 0180          401 CALL RGRTWO(YXXS,YNNS,K,ES3,YHAT,RESID,Z)
ISN 0181          402 AX5(K)=Z(4)
ISN 0182            BX5(K)=Z(5)
ISN 0183            CX5(K)=Z(10)
ISN 0184            RSQ5=Z(9)
                  C
                  C               FIRST FORECAST CORRECTION LOOP(TO 425)
                  C
ISN 0185            DO 425  N=1,K
ISN 0186            CALL SUM123(N)
ISN 0187            IF(ITTS .EQ. 2) GO TO 420
ISN 0189            RS4(N)=RS2(N)-(Z(4)*YXXS(N)+Z(5)*YNNS(N)+Z(10))
ISN 0190            GO TO 421
ISN 0191          420 RS4(N)=RS3(N)-(Z(4)*YXXS(N)+Z(5)*YNNS(N)+Z(10))
ISN 0192          421  ES4(N)=RS4(N)-RS(N)
ISN 0193          425 CONTINUE
                  C
                  C               SECOND FORECAST CORRECTION REGRESSION
                  C
ISN 0194            CALL LIN(K,PS,ES4,A6,B6,XB6,YB6,RSQ6,R6,MD)
ISN 0195            AX6(K)=A6
ISN 0196            BX6(K)=B6
                  C
                  C               SECOND FORECAST CORRECTION LOOP(TO 450)
                  C
ISN 0197            DO 450 N=1,K
ISN 0198            CALL SUM123(N)
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ISN 0199            RS5(N)=RS4(N)-(A6*PS(N)+B6)
ISN 0200            ES5(N)=RS5(N)-RS(N)
ISN 0201          450 CONTINUE
ISN 0202            GO TO 42
ISN 0203           41 IF(ITTS.EQ.2) GO TO 403
ISN 0205            CALL LIN(K,PS,ES2,A6,B6,XB6,YB6,RSQ5,R6,MD)
ISN 0206            GO TO 404
ISN 0207          403 CALL LIN(K,PS,ES3,A6,B6,XB6,YB6,RSQ5,R6,MD)
ISN 0208          404 AX6(K)=A6
ISN 0209            BX6(K)=B6
ISN 0210            DO 405 N=1,K
ISN 0211            CALL SUM123(N)
ISN 0212            IF(ITTS.EQ.2) GO TO 406
ISN 0214            RS4(N)=RS2(N)-(A6*PS(N)+B6)
ISN 0215            GO TO 407
ISN 0216          406 RS4(N)=RS3(N)-(A6*PS(N)+B6)
ISN 0217          407 ES4(N)=RS4(N)-RS(N)
ISN 0218          405 CONTINUE
ISN 0219            CALL RGRTWO(YXXS,YNNS,K,ES4,YHAT,RESID,Z)
ISN 0220            AX5(K)=Z(4)
ISN 0221            BX5(K)=Z(5)
ISN 0222            CX5(K)=Z(10)
ISN 0223            RSQ6=Z(9)
ISN 0224            DO 408 N=1,K
ISN 0225            CALL SUM123(N)
ISN 0226            RS5(N)=RS4(N)-(Z(4)*YXXS(N)+Z(5)*YNNS(N)+Z(10))
ISN 0227            ES5(N)=RS5(N)-RS(N)
ISN 0228          408 CONTINUE
ISN 0229           42 CONTINUE
                  C
                  C              COUNTERS FOR REPEATING HEADINGS ON PRINTOUT
                  C
ISN 0230            IF (IZ.GT.1) GO TO 1716
ISN 0232             IF(IX.EQ.8) IQ=IQ+1
ISN 0234             IF(IQ.EQ.12) IQ=1
ISN 0236             IF(IX.EQ.4) IZ=IZ+1
ISN 0238            IF(IX.EQ.5) IY=IY+1
ISN 0240            IF (IX.EQ.6) IZ=IZ+1
ISN 0242            IF(IY.EQ.15) IY=1
ISN 0244             IF(IZ.EQ.24) IZ =1
ISN 0246            CALL DATES(NT,NTD,N2,N2D)
ISN 0247            IF (IX.EQ.2.OR.IX.EQ.3.OR.IX.EQ.7) GO TO 91
ISN 0249             IF(IQ.GT.1) GO TO 90
ISN 0251            IF (IZ.GT.1) GO TO 90
ISN 0253            IF(IY.GT.1) GO T O 90
ISN 0255           91 WRITE(6,3000)IDR,IDP,MTH(M3),M3D,MTH(M4),M4D,M1A     ,M1D,
                     1              NI ,              MTH(M2),M2D,IY1,YRPRE,YR2,IDT,RMAX
ISN 0256            IF(IX.EQ.4.OR.IX.EQ.5.OR.IX.EQ.6) GO TO 95
ISN 0258             IF(IX.EQ.1.OR.IX.EQ.8) GO TO 95
ISN 0260             WRITE(6,3500) IPT,IWF,IPS
ISN 0261           95  IF(IX.EQ.8.AND.NCF.EQ.YR2) WRITE(6,4010) YR2
ISN 0263             IF(IX.EQ.8.AND.NCF.NE.YR2) WRITE(6,4015)
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ISN 0265            IF(IX.EQ.2) WRITE(6,4020)
ISN 0267            IF(IX.EQ.3) WRITE(6,4030)
ISN 0269            IF(IX.EQ.4) WRITE(6,4040)
ISN 0271           IF(IX .EQ. 5 .AND. ITTS .EQ. 1) WRITE(6,4050)
ISN 0273           IF(IX .EQ. 5 .AND. ITTS .EQ. 2) WRITE(6,4052)
ISN 0275            IF(IX.EQ.6) WRITE(6,4060)
ISN 0277            IF(IX.EQ.7) WRITE(6,4070)
ISN 0279            IF(IX.EQ.2) WRITE(6,1200)
ISN 0281            IF(IX.EQ.3) WRITE(6,1300)
ISN 0283            IF (IX.EQ.7) WRITE (6,2700)
ISN 0285         90 CONTINUE
ISN 0286            IF (IY.GT.1) GO TO 1716
ISN 0288           IF (IX.EQ.2.OR.IX.EQ.3.OR.IX.EQ.7)  WRITE(6,3100) NI
ISN 0290            IF (IX.EQ.6.AND.IR.NE.2) WRITE(6,2600)
ISN 0292            IF (IX.EQ.6.AND.IR.EQ.2) WRITE(6,2610)
ISN 0294            IF(IX.EQ.4) WRITE(6,1400)
ISN 0296            IF(IX.EQ.5) WRITE(6,1500)
ISN 0298       1716  SER1=0.0
ISN 0299            SER2=0.0
ISN 0300            SER3=0.0
ISN 0301            SER4 =0.0
ISN 0302            SER5=0.0
ISN 0303           RSM=0.0
ISN 0304           SMRS2=0.0
ISN 0305            PWSM=0.0
ISN 0306            TWSM=0.0
ISN 0307            PTSM=0.0
ISN 0308            RWTSM=0.0
ISN 0309            RTSM=0.0
ISN 0310            TTBSM=0.0
ISN 0311            DTTSM=0.0
ISN 0312            TSBSM=0.0
ISN 0313            DTSSM=0.0
ISN 0314            PSSM=0.0
ISN 0315            RSSM=0.0
ISN 0316            MCT=0
ISN 0317            SMX=0.0
ISN 0318            SRX1=0.0
ISN 0319            SRX2=0.0
ISN 0320            SRX3=0.0
ISN 0321            SRX4=0.0
ISN 0322            SRX5=0.0
                 C
                 C              BEGIN SPLIT SAMPLE PREDICTION PERIOD(LOOP TO 500)
                 C
ISN 0323           DO 500 N=J,NYR
ISN 0324           NCT=NCT+1
ISN 0325           LCT=LCT+1
ISN 0326            IF(N.EQ.IFOR) RS(N)=0.0
ISN 0328           IF(N.EQ.IFOR) PS(N)=0.
ISN 0330           IF(N.EQ.IFOR) DTS(N)=0.
ISN 0332           IF(N.EQ.IFOR) TSB(N)=0.0
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ISN 0334            IF(N.EQ.IFOR) YNNS(N)=0.
ISN 0336            IF(N.EQ.IFOR) YXXS(N)=0.0
ISN 0338            CALL SUM123(N)
ISN 0339            PT(N) = PWT(N)- PW(N)
ISN 0340             PWTS(N)=PWT(N)+PS(N)
ISN 0341             IF(IPS.EQ.1) PWX(N)=PWT(N)
ISN 0343             IF(IPS.EQ.2) PWX(N)=PWTS(N)
ISN 0345             RT(N)=RWT(N)-RW(N)
ISN 0346             SMTW=SMTW+TW(N)
ISN 0347             SMPW=SMPW+PW(N)
ISN 0348             SMPT=SMPT+PT(N)
ISN 0349             SMRT=SMRT+RT(N)
ISN 0350             SMRWT=SMRWT+RWT(N)
ISN 0351             SMTTB=SMTTB+TTB(N)
ISN 0352             SMDTT=SMDTT+DTT(N)
ISN 0353             SMTSB=SMTSB+TSB(N)
ISN 0354             SMDTS=SMDTS+DTS(N)
ISN 0355             PWSM=PWSM+PW(N)
ISN 0356             TWSM=TWSM+TW(N)
ISN 0357             PTSM=PTSM+PT(N)
ISN 0358             RWTSM=RWTSM+RWT(N)
ISN 0359             TTBSM=TTBSM+TTB(N)
ISN 0360             DTTSM=DTTSM+DTT(N)
ISN 0361             PWA=SMPW/LCT
ISN 0362             PTA=SMPT/LCT
ISN 0363             PWTA=PWA+PTA
ISN 0364             RTA=SMRT/LCT
ISN 0365             RWTA=SMRWT/LCT
ISN 0366             TTBA=SMTTB/LCT
ISN 0367             DTTA=SMDTT/LCT
ISN 0368            PWTM=(PWT(N)/(PWA+PTA))*100.
ISN 0369            RWTM=(RWT(N)/RWTA )*100.
ISN 0370             TWA=SMTW/LCT
ISN 0371             TWM=TW(N)-TWA
ISN 0372             IF(N.EQ.IFOR) GO TO 455
ISN 0374            RS(N) = RWTS(N) - RWT(N)
ISN 0375             SMRS=SMRS+RS(N)
ISN 0376             SMPS=SMPS+PS(N)
ISN 0377             PSA    =SMPS/LCT
ISN 0378             RSA=SMRS/LCT
ISN 0379            RSM=RSM+RS(N)
ISN 0380             RTSM=RTSM+RT(N)
ISN 0381            SMYXXS=SMYXXS+YXXS(N)
ISN 0382            SMYNNS=SMYNNS+YNNS(N)
ISN 0383             TSBSM=TSBSM+TSB(N)
ISN 0384             DTSSM=DTSSM+DTS(N)
ISN 0385             PSSM=PSSM+PS(N)
ISN 0386             RSSM=RSSM+RS(N)
ISN 0387             TSBA=SMTSB/LCT
ISN 0388             DTSA=SMDTS/LCT
ISN 0389            YXXSA=SMYXXS/LCT
ISN 0390            YNNSA=SMYNNS/LCT
```

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                  C
                  CXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
                  C              BEGIN UPDATING CALIBRATION
                  C
                  C              PERFORM BASIC REGRESSIONS
                  C
ISN 0391                CALL LIN(N,PW,RWT,A1,B1,XB1,YB1,RSQ1,R1,MD)
ISN 0392                CALL LIN(N,PWT,RWT,A2,B2,XB2,YB2,RSQ2,R2,MD)
ISN 0393                 CALL LIN(N,PWX ,RWTS,A3,B3,XB3,YB3,RSQ3,R3,MD)
ISN 0394                AX1(N)=A1
ISN 0395                BX1(N)=B1
ISN 0396                AX2(N)=A2
ISN 0397                BX2(N)=B2
ISN 0398                AX3(N)=A3
ISN 0399                BX3(N)=B3
ISN 0400                IF(IPT.EQ.1) ET(N)=AX1(N)*PW(N)+BX1(N)-RWT(N)
ISN 0402                IF(IPT.EQ.2) ET(N)=AX2(N)*PWT(N)+BX2(N)-RWT(N)
ISN 0404                 ES1(N)=AX3(N)*PWX  (N)+BX3(N)-RWTS(N)
ISN 0405                SME1=SME1+ET(N)*ET(N)
ISN 0406                SME2=SME2+ET(N)*ES1(N)
                  C
                  C              DETERMINE TEST SEASON CORRECTION
                  C
ISN 0407                 CR(N)=SME2/SME1
ISN 0408                 IF(NI .LT.1) CR(N)=0.0
ISN 0410                 RS1(N)=AX3(N)*PWX  (N)+BX3(N)-RWT(N)
ISN 0411                RS2(N)=RS1(N)- CR(N)*ET(N)
ISN 0412                ES2(N)=RS2(N)-RS(N)
                  C
                  C              (DEFUNCT LINEAR TEST SEASON CORRECTION)
                  C
ISN 0413                CALL LIN(N,ET,ES1,A0,B0,XB0,YB0,RSQ0,R0,MD)
ISN 0414            455 IF(N.EQ.IFOR) YXXS(N)=YXXSA+TFMX
ISN 0416                IF(N.EQ.IFOR) YNNS(N)=YNNSA+TFMN
ISN 0418                 IF(N.EQ.IFOR)PS(N)=PSA    *PSD/100.
ISN 0420                IF(N.EQ.IFOR) GO TO 460
                  C
                  C              TEST SEASON TEMPERATURE CORRECTION REGRESSION
                  C
ISN 0422                CALL RGRTWO(YXT,YNT,N,ES2,YHAT,RESID,Z)
ISN 0423                RSQ4=Z(9)
ISN 0424                AX4(N)=Z(4)
ISN 0425                BX4(N)=Z(5)
ISN 0426                CX4(N)=Z(10)
ISN 0427                RS3(N)=RS2(N)-(Z(4)*YXT(N)+Z(5)*YNT(N)+Z(10))
ISN 0428                ES3(N)=RS3(N)-RS(N)
                  C
                  C              FIRST FORECAST CORRECTION REGRESSION(SEE IWF FOR ORDER)
                  C
ISN 0429                IF(IWF.EQ.2) GO TO 52
ISN 0431                IF(ITTS .EQ. 2) GO TO 451
ISN 0433                CALL RGRTWO(YXXS,YNNS,N,ES2,YHAT,RESID,Z)
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ISN 0434          GO TO 452
ISN 0435      451 CALL RGRTWO(YXXS,YNNS,N,ES3,YHAT,RESID,Z)
ISN 0436      452 AX5(N)=Z(4)
ISN 0437          BX5(N)=Z(5)
ISN 0438          CX5(N)=Z(10)
ISN 0439          RSQ5=Z(9)
            C
            C               FIRST FORECAST CORRECTION APPLICATION
            C
ISN 0440          IF (ITTS .EQ. 2) GO TO 457
ISN 0442          RS4(N)=RS2(N)-(AX5(N)*YXXS(N)+BX5(N)*YNNS(N)+CX5(N))
ISN 0443          GO TO 458
ISN 0444      457 RS4(N)=RS3(N)-(AX5(N)*YXXS(N)+BX5(N)*YNNS(N)+CX5(N))
ISN 0445     458  ES4(N)=RS4(N)-RS(N)
            C
            C               SECOND FORECAST CORRECTION REGRESSION
            C
ISN 0446          CALL LIN(N,PS,ES4,A6,B6,XB6,YB6,RSQ6,R6,MD)
ISN 0447          AX6(N)=A6
ISN 0448          BX6(N)=B6
ISN 0449          RS5(N)=RS4(N)-(AX6(N)*PS(N)+BX6(N))
            C
            C               SECOND FORECAST CORRECTION APPLICATION
            C
ISN 0450          ES5(N)=RS5(N)-RS(N)
ISN 0451          GO TO 53
ISN 0452       52 IF(ITTS.EQ.2) GO TO 503
ISN 0454          CALL LIN(N,PS,ES2,A6,B6,XB6,YB6,RSQ5,R6MMD)
ISN 0455          GO TO 504
ISN 0456      503 CALL LIN(N,PS,ES3,A6,B6,XB6,YB6,RSQ5,R6MMD)
ISN 0457      504 AX6(N)=A6
ISN 0458          BX6(N)=B6
ISN 0459          IF(ITTS.EQ.2) GO TO 505
ISN 0461          RS4(N)=RS2(N)-(AX6(N)*PS(N)+BX6(N))
ISN 0462          GO TO 506
ISN 0463      505 RS4(N)=RS3(N)-(AX6(N)*PS(N)+BX6(N))
ISN 0464      506 ES4(N)=RS4(N)-RS(N)
ISN 0465          CALL RGRTWO(YXXS,YNNS,N,ES4,YHAT,RESID,Z)
ISN 0466          AX5(N)=Z(4)
ISN 0467          BX5(N)=Z(5)
ISN 0468          CX5(N)=Z(10)
ISN 0469          RS5(N)=RS4(N)-(AX5(N)*YXXS(N)+BX5(N)*YNNS(N)+CX5(N))
ISN 0470          ES5(N)=RS5(N)-RS(N)
ISN 0471          RSQ6=Z(9)
ISN 0472       53 CONTINUE
ISN 0473      460 JYEAR=JYEAR+1
            C
            C               END OF CALIBRATION UPDATE
            C
            CXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
            C
            C               BEGIN MAKING PREDICTIONS USING PREVIOUS
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C               YEAR'S COEFFICIENTS (SUBSCRIPT NM1)
C
ISN 0474        NM1=N-1
ISN 0475         IF(IPT.EQ.1) ET(N)=AX1(NM1)*PW (N)+BX1(NM1)-RWT(N)
ISN 0477         IF(IPT.EQ.2) ET(N)=AX2(NM1)*PWT(N)+BX2(NM1)-RWT(N)
ISN 0479         IF(IPS.EQ.2)PWX(N)=PWT(N)+PSA
ISN 0481         IF(N.EQ.IFOR .AND.IPS.EQ.2) PWX(N)=PWT(N)+PSA*PSD/100.
C
C               TEST SEASON CORRECTION
C
ISN 0483         RS1(N)=AX3(NM1)*PWX (N)+BX3(NM1)-RWT(N)
ISN 0484        RS2(N)=RS1(N)- CR(NM1)*ET(N)
C
C               TEST SEASON TEMPERATURE CORRECTION
C
ISN 0485        RS3(N)=RS2(N)-(AX4(NM1)*YXT(N)+BX4(NM1)*YNT(N)   +CX4(NM1))
C
C               FORECAST CORRECTIONS
C
ISN 0486        IF(IWF.EQ.2) GO TO 63
ISN 0488        IF(ITTS.EQ.2) GO TO 461
ISN 0490        RS4(N)=RS2(N)-(AX5(NM1)*YXXS(N)+BX5(NM1)*YNNS(N)+CX5(NM1))
ISN 0491        GO TO 462
ISN 0492      461 RS4(N)=RS3(N)-(AX5(NM1)*YXXS(N)+BX5(NM1)*YNNS(N)+CX5(NM1))
ISN 0493      462 RS5(N)=RS4(N)-(AX6(NM1)*PS(N)+BX6(NM1))
ISN 0494        GO TO 67
ISN 0495       63 IF(ITTS.EQ.2) GO TO 65
ISN 0497        RS4(N)=RS2(N)-(AX6(NM1)*PS(N)+BX6(NM1))
ISN 0498        GO TO 66
ISN 0499       65 RS4(N)=RS3(N)-(AX6(NM1)*PS(N)+BX6(NM1))
ISN 0500       66 RS5(N)=RS4(N)-(AX5(NM1)*YXXS(N)+BX5(NM1)*YNNS(N)+CX5(NM1))
ISN 0501       67 CONTINUE
ISN 0502         RCPC1=(RS1(N)/RSA)  *100.
ISN 0503         RCPC2=(RS2(N)/RSA)  *100.
ISN 0504         RCPC3=(RS3(N)/RSA)  *100.
ISN 0505         RCPC4=(RS4(N)/RSA)  *100.
ISN 0506         RCPC5=(RS5(N)/RSA)  *100.
C
C               CALCULATE PREDICTION ERRORS
C
ISN 0507        ES1(N)=RS1(N)-RS(N)
ISN 0508        ES2(N)=RS2(N)-RS(N)
ISN 0509        ES3(N)=RS3(N)-RS(N)
ISN 0510        ES4(N)=RS4(N)-RS(N)
ISN 0511        ES5(N)=RS5(N)-RS(N)
ISN 0512         IF(N.EQ.IFOR) RSPC=0.0
ISN 0514         IF(N.EQ.IFOR) GO TO 465
ISN 0516         PSPC=(PS(N)/PSA)*100.
ISN 0517         RSPC=(RS(N)/RSA)  *100.
C
C               DETERMINE IF PARTIAL SERIES OR NOT  I.E. SUM
C               ONLY THOSE ERRORS FROM PREDICTIONS OF FLOWS
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                C              ABOVE BASE
                C
ISN 0518              IF(RSPC.LT.RMAX) GO TO 485
ISN 0520              SRX1=SRX1+ES1(N)**2
ISN 0521              SRX2=SRX2+ES2(N)**2
ISN 0522              SRX3=SRX3+ES3(N)**2
ISN 0523              SRX4=SRX4+ES4(N)**2
ISN 0524              SRX5=SRX5+ES5(N)**2
ISN 0525              SMX=SMX+RS(N)
ISN 0526              MCT=MCT+1
ISN 0527              MXAV=SMX/MCT
ISN 0528              RMX1=SQRT(SRX1/MCT)
ISN 0529              RMX2=SQRT(SRX2/MCT)
ISN 0530              RMX3=SQRT(SRX3/MCT)
ISN 0531              RMX4=SQRT(SRX4/MCT)
ISN 0532              RMX5=SQRT(SRX5/MCT)
                C
                C              SUM ALL SQUARED PREDICTION ERRORS
                C
ISN 0533          485 SER1=SER1+ES1(N)**2
ISN 0534              SER2=SER2+ES2(N)**2
ISN 0535              SER3=SER3+ES3(N)**2
ISN 0536              SER4=SER4+ES4(N)**2
ISN 0537              SER5=SER5+ES5(N)**2
                C
                C              CALCULATE ROOT MEAN SQUARED PREDICTION ERROR
                C
ISN 0538              RMSE1=SQRT(SER1/NCT)
ISN 0539              RMSE2=SQRT(SER2/NCT)
ISN 0540              RMSE3=SQRT(SER3/NCT)
ISN 0541              RMSE4=SQRT(SER4/NCT)
ISN 0542              RMSE5=SQRT(SER5/NCT)
ISN 0543              R1PC=(RS1(N)/RS(N))*100.
ISN 0544              R2PC=(RS2(N)/RS(N))*100.
ISN 0545              R3PC=(RS3(N)/RS(N))*100.
ISN 0546              R4PC=(RS4(N)/RS(N))*100.
ISN 0547              R5PC=(RS5(N)/RS(N))*100.
                C
                C              CALCULATE PERCENT IMPROVEMENTS IN PREDICTIONS
                C              OVER PREVIOUS CORRECTION STEPS
                C
ISN 0548              AI2=(1.-(RMSE2/RMSE1))*100.
ISN 0549              AI3=(1.-(RMSE3/RMSE2))*100.
ISN 0550            IF (ITTS. EQ. 2) GO TO 463
ISN 0552            AI4=(1.-(RMSE4/RMSE2)) *100
ISN 0553            GO TO 464
ISN 0554         463  AI4=(1.-(RMSE4/RMSE3))*100.
ISN 0555         464  AI5=(1.-(RMSE5/RMSE4))*100.
ISN 0556            SMRS2=SMRS2+RS(N)*RS(N)
ISN 0557            VAR=(SMRS2/NCT-((RSM/NCT)**2))
ISN 0558            IF(VAR.LT.0.) VAR=1.0
ISN 0560            SD1=SQRT(VAR)
```

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ISN 0561        465  IF(IX.EQ.7)WRITE(6,1700) JYEAR,A1,B1,A2,B2,A3,B3,A4,B4,
                    1 A5,B5,   A6,B6,CR(N),RSQ1,RSQ2,RSQ3,RSQ4,RSQ5,RSQ6,RSQ0
ISN 0563             IF(IX.EQ.2) WRITE(6,4000) JYEAR,PW(N),TW(N),PT(N),RT(N),RWT(N),
                    1 TTB(N),DTT(N),TSB(N),DTS(N),PS(N),RS(N) ,          PSPC,RSPC
ISN 0565             IF(IX.EQ.3) WRITE(6,5000) JYEAR,ET(N),RS1(N),ES1(N),RS2(N),ES2(N),
                    *RS3(N),ES3(N),RS4(N),ES4(N),RS5(N),ES5(N),R1PC,R2PC,R3PC,R4PC,R5PC
ISN 0567        500  CONTINUE
ISN 0568             N=NYR
ISN 0569              PWAV=PWSM/NCT
ISN 0570              TWAV=TWSM/NCT
ISN 0571              PTAV=PTSM/NCT
ISN 0572              RWTAV=RWTSM/NCT
ISN 0573              RTAV=RTSM/NCT
ISN 0574              TTBAV=TTBSM/NCT
ISN 0575              DTTAV=DTTSM/NCT
ISN 0576              TSBAV=TSBSM/NCT
ISN 0577              DTSAV=DTSSM/NCT
ISN 0578              PSAV=PSSM/NCT
ISN 0579              RSAV=RSSM/NCT
ISN 0580              SEF1=RMSE1/RSAV
ISN 0581              SEF2=RMSE2/RSAV
ISN 0582              SEF3=RMSE3/RSAV
ISN 0583              SEF4=RMSE4/RSAV
ISN 0584              SEF5=RMSE5/RSAV
ISN 0585              SX1=RMX1/MXAV
ISN 0586              SX2=RMX2/MXAV
ISN 0587              SX3=RMX3/MXAV
ISN 0588              SX4=RMX4/MXAV
ISN 0589              SX5=RMX5/MXAV
                C
                C              CALCULATE COEFFICIENTS OF PREDICTION AT VARIOUS
                C              CORRECTION STEPS
                C
ISN 0590             CP1=1.-(RMSE1**2)/VAR
ISN 0591             CP2=1.-(RMSE2**2)/VAR
ISN 0592             CP3=1.-(RMSE3**2)/VAR
ISN 0593             CP4= 1.-(RMSE4**2)/VAR
ISN 0594             CP5= 1.-(RMSE5**2)/VAR
ISN 0595             CPMAX=AMAX1(CP1,CP2,CP3,CP4,CP5)
ISN 0596              CV=SD1/RSAV
                C
                C              DETERMINE BEST PREDICTION FOR YEAR
                C              NUMBER IFOR(ACTUAL PREDICTION)  BASED ON ALL
                C              3 NON-FORECAST CORRECTIONS
                C
ISN 0597              IF(RMSE1.LT.RMSE2.AND.RMSE1.LT.RMSE3) GO TO 111
ISN 0599              IF(RMSE2.LT.RMSE1.AND.RMSE2.LT.RMSE3) GO TO 222
ISN 0601              IF(RMSE3.LT.RMSE1.AND.RMSE3.LT.RMSE2) GO TO 333
                C
                C              RFOR IS PREDICTION FOR YEAR IFOR(NO FORECAST CORRECTIONS)
                C              SEFOR IS PREDICTION ERROR
                C
```

```
ISN 0603        111  METH=1
ISN 0604             RFOR=RS1(NYR)
ISN 0605             CPF=CP1
ISN 0606             SEFOR=RMSE1
ISN 0607             GO TO 444
ISN 0608        222  METH=2
ISN 0609             RFOR=RS2(NYR)
ISN 0610             CPF=CP2
ISN 0611             SEFOR=RMSE2
ISN 0612             GO TO 444
ISN 0613        333  METH=3
ISN 0614             RFOR=RS3(NYR)
ISN 0615             CPF=CP3
ISN 0616             SEFOR=RMSE3
ISN 0617        444  CONTINUE
ISN 0618             RFPC=(RFOR/RSA)*100.
ISN 0619             SEFR=SEFOR/RSA
                C
                C              95 %  CONFIDENCE CALCULATION
                C
ISN 0620             R95PC=RFOR-(1.645*SEFOR)
ISN 0621            IF(R95PC.LT.0.) R95PC=0.
ISN 0623             R95M=(R95PC/RSA)*100.
                C
                C              DETERMINE BEST PREDICTION BASED ON FORECAST CORRECTIONS
                C
ISN 0624             IF(RMSE4.LT.RMSE5) GO TO 533
ISN 0626             IF(RMSE5.LT.RMSE4) GO TO 544
ISN 0628        533  RPRJ=RS4(NYR)
ISN 0629             IR=1
ISN 0630             CPJ=CP4
ISN 0631             GO TO 548
ISN 0632        544  RPRJ=RS5(NYR)
ISN 0633             CPJ=CP5
ISN 0634             IR=2
ISN 0635        548  CONTINUE
ISN 0636             RPJPC=(RPRJ/RSA)*100.
ISN 0637            TSJ=9999
ISN 0638             IF(IX.EQ.2)WRITE(6,2200) PWAV,TWAV,PTAV,RTAV,RWTAV,TTBAV,
                    1 DTTAV,TSBAV,DTSAV,PSAV,RSAV ,                PWA,TWA,
                    2     PTA,RTA,RWTA,TTBA,DTTA,TSBA,DTSA,PSA,RSA
ISN 0640             IF(IX.EQ.3) WRITE(6,5500) RMSE1,RMSE2,RMSE3,RMSE4,RMSE5,
                    1 SEF1,SEF2,SEF3,SEF4,SEF5,SX1,SX2,SX3,SX4,SX5,CV ,
                    2 CP1,CP2,CP3,CP4,CP5
ISN 0642             IF(IX.EQ.7) WRITE(6,7500) RSQ1,RSQ2,RSQ3,RSQ4,RSQ5,RSQ6,RSQ0,
                    1 CP1,CP2,CP3,CP4,CP5
ISN 0644             IF(M1A.EQ.MTH(1 )) M1A=MTH(13)
ISN 0646             IF(IX.EQ.1) WRITE(6,1111)METH,IPT,IWF,IPS,      NI,TTSI(ITTS),
                    *MTH(M3),M3D,
                    1 MTH(M4),M4D,YR2,RFOR,RFPC,SEFOR,SEFR,R95PC,R95M,SD1,CV,YR1,
                    2 IY2,RSA,YRPRE,CPF,M1A,M1D,MTH(NT),NTD,PWTM,PWTA,RWTM,RWTA,TWM,
                    3 TWA
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ISN 0648            IF(IX.EQ.1) WRITE(6,1211) RPRJ,RPJPC,PSD,PSA,TFMX,TFMN,YXXSA,
                   *YNNSA,CPJ,RS4(NYR),RS5(NYR)
ISN 0650            IF (IX.EQ.8) WRITE(6,1100)     MTH(M3),M3D,MTH(M4),M4D,M1A,M1D,
                   1 MTH(NT),NTD,NI,     PSD,TSD,RS1(N),RS2(N),RS3(N),RS4(N),RS5(N),
                   * RS(N), RSPC,
                   2  CP1,CP2,CP3,CP4,CP5    ,RCPC1,RCPC2,RCPC3,RCPC4,RCPC5,IPT,IWF,IPS
ISN 0652            IF(IX.EQ.4) WRITE(6,6000)     MTH(M3),M3D,MTH(M4),M4D,M1A,M1D,
                   *MTH(NT),NTD,NI,         RMSE1,RMSE2,RMSE3,RMSE4,RMSE5,IPT,IWF,IPS
ISN 0654            IF(IX.EQ.5) WRITE(6,8000)     MTH(M3),M3D,MTH(M4),M4D,M1A,M1D,
                   *MTH(NT),NTD,NI,         AI2,AI3,AI4,AI5,
                   * CP1,CP2,CP3,CP4,CP5,IPT,IWF,IPS,TTSI(ITTS),CPMAX
ISN 0656            IF(IX.EQ.6) WRITE(6,1600)     MTH(M3),M3D,MTH(M4),M4D,M1A,M1D,
                   1 MTH(NT),NTD,NI,         RSQ1,RSQ2,RSQ3,RSQ4,RSQ5,RSQ6,RSQ0,
                   2  IPT,IWF,IPS
ISN 0658              IF(IX.EQ.4.OR.IX.EQ.5.OR.IX.EQ.6.OR.IX.EQ.8) GO TO 600
ISN 0660              IF(IWF.EQ.1.AND.IR.EQ.1) WRITE(6,1811)
ISN 0662              IF(IWF.EQ.1.AND.IR.EQ.2) WRITE(6,1812)
ISN 0664              IF(IWF.EQ.2.AND.IR.EQ.1) WRITE(6,1821)
ISN 0666              IF(IWF.EQ.2.AND.IR.EQ.2) WRITE(6,1822)
ISN 0668              EFOR=RFOR - RS(N)
ISN 0669            IF(IX.EQ.1.AND.NYR.NE.IFOR) WRITE(6,1112) RS(N),EFOR
ISN 0671         600 CONTINUE
ISN 0672            GOT O 16
ISN 0673        1000 FORMAT(10I5)
ISN 0674        1100 FORMAT(1H ,   1X,A3,I2,'-',A3,I2,2X,A3,I2,'-',A3,I2,I4, 5X ,F5.0,
                   1  F5.1,5F8.0/10X,'OBSERVED=',F10.0,F7.0,' %',4X,'CP=',1X,5F8.3/
                   2 25X,'PREDICTED,% OF MEAN=',1X,5F8.0,3I2/)
ISN 0675        1111 FORMAT(1H,5X,'METHOD=',1X,I2,1X,3I2,6X,'TEST-SEAS LENGTH',I4,
                   11X,'DAY(S)',//2X,'STEP 4 TEST SEASON  TEMPERATURE CORRECTION ',
                   2 A3,//2X,'PREDICTED RUNOFF BASED ON NORMAL WEATHER '//5X,
                   4'PREDICTION SEASON',2X,A3,1X,I2,'-',A3,1X,I2,2X,'19',I2//5X,
                   5'RUNOFF PREDICTION',F8.0,1X,'CFS-DAYS',5X,'% OF MEAN',F5.0/5X,
                   6'STANDARD ERROR',4X,F7.0,1X,'CFS-DAYS',2X,'FRACTION OF MEAN=',
                   6F5.2,//5X,'95 % CONFIDENCE',F7.0,'  CFS-DAYS',2X,'% OF MEAN=',
                   7 F5.0//5X,'STANDARD DEVIATION',1X,F7.0,1X,'CFS-DAYS',6X,'CV=',
                   8 1X,F6.3//5X,'19',I2,'-','19',I2,1X,'MEAN',F9.0,1X,
                   9 'CFS-DAYS',6X,'CP SINCE 19',I2,F7.3//5X,'WINTER SEASON',1X,A3,I2,
                   *'-',A3,I2,1X,/10X,'WINTER PRECIP, % OF MEAN',F5.0,2X,'MEAN=',F6.2,
                   *' INCHES'/10X,'WINTER RUNOFF,% OF MEAN',F5.0,4X,'MEAN',F8.0,1X,
                   *'CFS-DAYS'/10X,'WINTER TEMP,DIFF FROM MEDIAN',F5.2,5X,'MEDIAN=',
                   *F6.2,' DEGREES'///)
ISN 0676        1112 FORMAT(//10X,'OBSERVED RUNOFF =',F8.0,5X,'ERROR =',F7.0)
ISN 0677        1200  FORMAT(1H ,'YEAR',3X,'PW',4X,'TW',5X,'PT',4X,'RT',4X,'RWT',4X,
                   * 'TB(T)',
                   1 1X,'DT(T)',1X,'TB(S)',1X,'DT(S)',3X,'PS',4X,'RS'/)
ISN 0678        1211 FORMAT(           2X,'PREDICTED RUNOFF BASED ON WEATHER FORECAST
                   *AND BEST CP OF VERIFICATION PERIOD'
                   *//5X,'PROJECTED RUNOFF',F8.0,1X,'CFS-DAYS',3X,'% OF MEAN=',F5.0
                   *//5X,'PRECIPITATION FORECAST(% OF MEAN)',F6.0,2X,'MEAN=',
                   *F6.2,' INCHES'//5X,'TEMP FORECAST(DELTA DEGREES F)',' MAX= ',
                   *F5.1,2X,'MIN= ',F5.1,' DEGREES F'//5X,' PRED SEAS--AVE MAX= ',
                   *F5.1,' --AVE MIN= ',F5.1,' DEGREES F',//5X,'CP FOR PERFECT WEATHER
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     *  FORECAST ',F7.3//5X,'STEP 4 PREDICTION = ', F8.0,//
     *5X,'STEP 5 PREDICTION = ',F8.0)
ISN 0679  1300  FORMAT (1H ,
     *       'YEAR',4X,'ET',4X,'RS(1)',3X,'ES(1)',3X,'RS(2)',3X,'ES(2)',
     1 3X,'RS(3)',3X,'ES(3)',3X,'RS(4)',3X,'ES(4)',3X,'RS(5)',3X,
     2 'ES(5)'/)
ISN 0680  1400 FORMAT(1H ,       ' PRED SEAS',5X,'WINTER',5X,'TL',5X        ,4X,
     1 2X,'RMSE1',2X,'RMSE2',2X,'RMSE3',2X,'RMSE4',2X,'RMSE5',
     2 /20X,'SEASON',2X,'METH'/)
ISN 0681  1500 FORMAT(1H ,       ' PRED SEAS',5X,'WINTER',6X,'TL',3X,
     1 'IMPROVEMENT IN ACCURACY/ COEFF OF PRED'/ 19X,'SEASON',12X,
     2 'STEP 1',2X,'STEP 2',2X,'STEP 3',2X,'STEP 4',2X,'STEP 5'/
     3  38X,'CP1',5X,'CP2',5X,'CP3',5X,'CP4',5X,'CP5',2X,'METH',
     *1X,'STEP 3'/)
ISN 0682  1600 FORMAT(1H ,   1X,A3,I2,'-',A3,I2,2X,A3,I2,'-',A3,I2,I4,5X,
     1 7F6.3,3I2/)
ISN 0683  1700  FORMAT(1H , '19',I2,1X,10F7.0,F6.0,F8.0,F6.3/3X,6F14.3,1X,F6.3)
ISN 0684  1811  FORMAT(5X,'TEMP REGRESSED FIRST,ONLY TEMP SIGNIFICANT')
ISN 0685  1812 FORMAT(5X,'TEMP REGRESSED FIRST,BOTH TEMP AND PRECIP SIGNIFICANT')
ISN 0686  1821  FORMAT (5X,'PRECIP REGRESSED FIRST,ONLY PRECIP SIGNIFICANT')
ISN 0687  1822 FORMAT(5X,'PRECIP REGRESSED FIRST,BOTH PRECIP AND TEMP SIGNIF')
ISN 0688  2200  FORMAT(/T4 ,'AVE' ,3F6.2,2F8.0,4F6.1,F6.2,F8.0,
     *' OVER VERIFICATION PERIOD',//,
     1T3,'MEAN',3F6.2,2F8.0,4F6.1,F6.2,F8.0,' OVER TOTAL PERIOD')
ISN 0689  2600 FORMAT(1H ,       ' PRED SEAS',5X,'WINTER',6X,'TL',6X,
     1 1X,'PW',4X,'PWT',3X,'PWT',2X,'  AT ',1X,'  TS',4X,'PS',4X,'ET',
     2 /30X,  4X  ,3X,'RWT',3X,'RWT',2X,'RWTS',3X,'ES2',3X,'ES3',
     3 3X,'ES4',4X,'ES',1X,'METH'/)
ISN 0690  2610 FORMAT(1H ,       ' PRED SEAS',5X,'WINTER',6X,'TL',6X,
     1 1X,'PW',4X,'PWT',3X,'PWT',2X,'  AT ',1X,'  TS',4X,'PS',4X,'ET',
     2 /30X,  4X  ,3X,'RWT',3X,'RWT',2X,'RWTS',3X,'ES2',3X,'ES3',
     3 3X,'ES4',4X,'ES',1X,'METH'/)
ISN 0691  2700  FORMAT (1H ,'YEAR',6X,'PW/RWT',7X,'PWT/RWT', 7X,'PWT/RWTS',
     1 6X,'AT/ES2',8X,'TS/ES3',
     2 7X,'PS/ES4',5X,'C'/)
ISN 0692  3000 FORMAT(1H1,2X,'BASIN',I5,3X,'PRECIPITATION STATION',I5,3X,'PREDICT
     1ION SEASON', 1X,A3,I3,'-',A3,I3/3X,'WINTER STARTS ',A3,I3,
     2     3X,'TEST-SEAS  LENGTH', I3,' DAYS',' FORECAST ',A3,I3,/
     36X,'FIRST YEAR',I3,4X,'FORECASTS BEGIN',I3,4X,  'LAST YEAR',I3,
     4                  10X, 'HMSM01 ' /5X,'TEMPERATURE STATION',I5,
     5 5X,'RMAX=',F5.0,/)
ISN 0693  3100 FORMAT (5X,'TS LENGTH =' ,I3,' DAYS'/)
ISN 0694  3500 FORMAT (10X,'METHOD =',3I2/)
ISN 0695  4000  FORMAT(1H ,' 19',I2,3F6.2,2F8.0,4F6.1,F6.2,F8.0,/
     1 63X,F6.0,2X,F6.0)
ISN 0696  4010  FORMAT(5X,'PRINT OPTION NO 8',25X,'19',I2,1X,'FORECAST'//
     1       1X ,       ' PRED SEAS',5X,'WINTER',5X,'TL',1X,'ALFA',
     2 1X,'D(PS)',1X,'D(TS)',2X,'1',7X,'2',7X,'3',7X,'4',7X,'5' //)
ISN 0697  4015  FORMAT(5X,'PRINT OPTION NO 8'/
     1       1X ,       ' PRED SEAS',5X,'WINTER',5X,'TL',1X,'ALFA',
     2 1X,'D(PS)',1X,'D(TS)',2X,'1',7X,'2',7X,'3',7X,'4',7X,'5' //)
ISN 0698  4020  FORMAT(5X,'PRINT OPTION NO 2,  PRECIP,TEMP AND RUNOFF DATA'/)
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ISN 0699      4030  FORMAT(5X,'PRINT OPTION NO 3 ,  PREDICTIONS AND ERRORS / % OF OBS
                   1ERVED'/)
ISN 0700      4040  FORMAT(5X,'PRINT OPTION NO 4 ,  ROOT MEAN SQUARE ERRORS'/)
ISN 0701      4050  FORMAT(5X,'PRINT OPTION NO 5 ,  ACCURACY IMPROVEMENT AND CP'/)
ISN 0702      4052  FORMAT(5X,'PRINT OPTION NO 5 ,  ACCURACY IMPROVEMENT AND CP'/)
ISN 0703      4060  FORMAT (1H ,'PRINT OPTION NO 6,  R SQUARED FOR REGRESSIONS'/)
ISN 0704      4070  FORMAT (1H ,'PRINT OPTION NO 7 ,  PREDICTION COEFFICIENTS'/)
ISN 0705      5000  FORMAT(1H ,' 19',I2,11F8.0/13X,F6.0,4(8X,F6.0))
ISN 0706      5500  FORMAT(/1H ,1X,'RMSE',14X,F7.0,4(7X,F7.0),
                   1 //2X,'SEF',14X,F7.3,4(7X,F7.3)//2X,'SEFX =',12X,F7.3,
                   2 4(7X,F7.3)//2X,'CV =',F6.3,3X,'CP=  ',5(F7.3,7X))
ISN 0707      6000 FORMAT(1H ,   1X,A3,I2,'-',A3,I2,2X,A3,I2,'-',A3,I2,I4,5X,
                   1  4X,5F7.0,3I2/)
ISN 0708      7000  FORMAT (4I5,F5.0)
ISN 0709      7500  FORMAT(/1H ,'RSQ',2X,6(4X,F6.3,4X),
                   1 F6.3,/2X,'CP',20X,F6.3,4(8X,F6.3))
ISN 0710      8000 FORMAT(1H ,   1X,A3,I2,'-',A3,I2,2X,A3,I2,'-',A3,I2,I4,11X,
                   1 4F8.1,/33X,5F8.3 ,3I2,2X,A4,F15.3/)
ISN 0711      9000  FORMAT(5X,'SUMMER PRECIP IN INITIAL REGRESSION'/)
ISN 0712            END
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*****F O R T R A N C R O S S R E F E R E N C E L I S T I N G*****

SYMBOL	INTERNAL STATEMENT NUMBERS																			
C	0153	0155	0157	0161																
I	0016	0017	0017	0018	0018															
J	0029	0030	0323																	
K	0030	0104	0107	0131	0132	0133	0134	0135	0136	0137	0138	0139	0144	0157	0158	0164	0165	0166	0167	
	0169	0178	0180	0181	0182	0183	0185	0194	0195	0196	0197	0205	0207	0208	0209	0210	0219	0220	0221	
	0222	0224																		
N	0107	0108	0109	0109	0109	0110	0110	0110	0111	0111	0113	0113	0115	0115	0115	0116	0116	0116	0117	
	0118	0119	0120	0121	0122	0123	0124	0125	0126	0127	0128	0129	0144	0145	0146	0146	0146	0148	0148	
	0148	0150	0150	0150	0151	0151	0152	0152	0158	0159	0160	0160	0160	0161	0161	0161	0162	0162	0162	
	0169	0170	0171	0171	0171	0171	0172	0172	0172	0185	0186	0189	0189	0189	0189	0191	0191	0191	0191	
	0192	0192	0192	0197	0198	0199	0199	0199	0200	0200	0200	0210	0211	0214	0214	0214	0216	0216	0216	
	0217	0217	0217	0224	0225	0226	0226	0226	0226	0227	0227	0227	0323	0326	0326	0328	0328	0330	0330	
	0332	0332	0334	0334	0336	0336	0338	0339	0339	0339	0340	0340	0340	0341	0341	0343	0343	0345	0345	
	0345	0346	0347	0348	0349	0350	0351	0352	0353	0354	0355	0356	0357	0358	0359	0360	0368	0369	0371	
	0372	0374	0374	0374	0375	0376	0379	0380	0381	0382	0383	0384	0385	0386	0391	0392	0393	0394	0395	
	0396	0397	0398	0399	0400	0400	0400	0400	0400	0402	0402	0402	0402	0402	0404	0404	0404	0404	0404	
	0405	0405	0406	0406	0407	0408	0410	0410	0410	0410	0410	0411	0411	0411	0411	0412	0412	0412	0413	
	0414	0414	0416	0416	0418	0418	0420	0422	0424	0425	0426	0427	0427	0427	0427	0428	0428	0428	0433	
	0435	0436	0437	0438	0442	0442	0442	0442	0442	0442	0442	0444	0444	0444	0444	0444	0444	0444	0445	
	0445	0445	0446	0447	0448	0449	0449	0449	0449	0449	0450	0450	0450	0454	0456	0457	0458	0461	0461	
	0461	0461	0461	0463	0463	0463	0463	0463	0464	0464	0464	0465	0466	0467	0468	0469	0469	0469	0469	
	0469	0469	0469	0470	0470	0470	0474	0475	0475	0475	0477	0477	0477	0479	0479	0481	0481	0481	0483	
	0483	0483	0484	0484	0484	0485	0485	0485	0485	0490	0490	0490	0490	0492	0492	0492	0492	0493	0493	
	0493	0497	0497	0497	0499	0499	0499	0500	0500	0500	0500	0502	0503	0504	0505	0506	0507	0507	0507	
	0508	0508	0508	0509	0509	0509	0510	0510	0510	0511	0511	0511	0512	0514	0516	0517	0520	0521	0522	
	0523	0524	0525	0533	0534	0535	0536	0537	0543	0543	0544	0544	0545	0545	0546	0546	0547	0547	0556	
	0556	0561	0563	0563	0563	0563	0563	0563	0563	0563	0563	0563	0563	0565	0565	0565	0565	0565	0565	
	0565	0565	0565	0565	0565	0568	0650	0650	0650	0650	0650	0650	0668	0669						

*****F O R T R A N C R O S S R E F E R E N C E L I S T I N G*****

SYMBOL	INTERNAL STATEMENT NUMBERS																	
T	0009																	
Y	0003																	
Z	0003	0164	0165	0166	0167	0168	0171	0171	0171	0178	0180	0181	0182	0183	0184	0189	0189	0189	0191
	0191	0191	0219	0220	0221	0222	0223	0226	0226	0226	0422	0423	0424	0425	0426	0427	0427	0427	0433
	0435	0436	0437	0438	0439	0465	0466	0467	0468	0471									
A0	0413																		
A1	0131	0134	0146	0391	0394	0561													
A2	0132	0136	0148	0392	0396	0561													
A3	0133	0139	0150	0160	0393	0398	0561												
A4	0561																		
A5	0561																		
A6	0194	0195	0199	0205	0207	0208	0214	0216	0446	0447	0454	0456	0457	0561					
B0	0413																		
B1	0131	0135	0146	0391	0395	0561													
B2	0132	0137	0148	0392	0397	0561													
B3	0133	0138	0150	0160	0393	0399	0561												
B4	0561																		
B5	0561																		
B6	0194	0196	0199	0205	0207	0209	0214	0216	0446	0448	0454	0456	0458	0561					
CR	0002	0157	0407	0408	0411	0484	0561												
CV	0596	0640	0646																
ET	0002	0146	0148	0151	0151	0152	0161	0400	0402	0405	0405	0406	0411	0413	0475	0477	0484	0565	
IQ	0035	0232	0232	0234	0234	0249													
IR	0290	0292	0629	0634	0660	0662	0664	0666											
IX	0047	0091	0232	0236	0238	0240	0247	0247	0247	0256	0256	0256	0258	0258	0261	0263	0265	0267	0269
	0271	0273	0275	0277	0279	0281	0283	0288	0288	0288	0290	0292	0294	0296	0561	0563	0565	0638	0640
	0642	0646	0648	0650	0652	0654	0656	0658	0658	0658	0658	0669							
IY	0038	0238	0238	0242	0242	0253	0286												
IZ	0037	0230	0236	0236	0240	0240	0244	0244	0251										
JI	0036	0091																	
JX	0091																		
MD	0015	0131	0132	0133	0194	0205	0207	0391	0392	0393	0413	0446							
MT	0007																		
MZ	0002	0014	0017																
M1	0007																		
M2	0007	0255																	
M3	0007	0255	0646	0650	0652	0654	0656												
M4	0007	0255	0646	0650	0652	0654	0656												
NI	0005	0047	0091	0155	0255	0288	0408	0646	0650	0652	0654	0656							
NT	0246	0646	0650	0652	0654	0656													
NZ	0002	0013	0018																
N2	0246																		
PS	0009	0110	0126	0194	0199	0205	0207	0214	0216	0328	0340	0376	0385	0418	0446	0449	0454	0456	0461
	0463	0493	0497	0499	0516	0563													
PT	0002	0115	0119	0339	0348	0357	0563												
PW	0009	0115	0118	0131	0146	0339	0347	0355	0391	0400	0475	0563							
RS	0002	0109	0127	0162	0172	0192	0200	0217	0227	0326	0374	0375	0379	0386	0412	0428	0445	0450	0464
	0470	0507	0508	0509	0510	0511	0517	0525	0543	0544	0545	0546	0547	0556	0556	0563	0650	0668	0669
RT	0002	0116	0120	0345	0349	0380	0563												

*****F O R T R A N C R O S S R E F E R E N C E L I S T I N G*****

SYMBOL	INTERNAL STATEMENT NUMBERS														
RW	0009	0116	0345												
R0	0413														
R1	0131	0391													
R2	0132	0392													
R3	0133	0393													
R6	0194	0205	0207	0446											
TN	0005	0024													
TS	0009														
TW	0009	0117	0346	0356	0371	0563									
TX	0005	0025													
X1	0003														
X2	0003														
AI2	0548	0654													
AI3	0549	0654													
AI4	0552	0554	0654												
AI5	0555	0654													
AX1	0002	0134	0394	0400	0475										
AX2	0002	0136	0396	0402	0477										
AX3	0002	0139	0398	0404	0410	0483									
AX4	0002	0165	0424	0485											
AX5	0002	0181	0220	0436	0442	0444	0466	0469	0490	0492	0500				
AX6	0002	0195	0208	0447	0449	0457	0461	0463	0493	0497	0499				
BX1	0002	0135	0395	0400	0475										
BX2	0002	0137	0397	0402	0477										
BX3	0002	0138	0399	0404	0410	0483									
BX4	0002	0166	0425	0485											
BX5	0002	0182	0221	0437	0442	0444	0467	0469	0490	0492	0500				
BX6	0002	0196	0209	0448	0449	0458	0461	0463	0493	0497	0499				
CPF	0605	0610	0615	0646											
CPJ	0630	0633	0648												
CP1	0590	0595	0605	0640	0642	0650	0654								
CP2	0591	0595	0610	0640	0642	0650	0654								
CP3	0592	0595	0615	0640	0642	0650	0654								
CP4	0593	0595	0630	0640	0642	0650	0654								
CP5	0594	0595	0633	0640	0642	0650	0654								
CX4	0003	0167	0426	0485											
CX5	0003	0183	0222	0438	0442	0444	0468	0469	0490	0492	0500				
DTS	0010	0125	0330	0354	0384	0563									
DTT	0010	0123	0352	0360	0563										
ES1	0002	0150	0152	0404	0406	0413	0507	0520	0533	0565					
ES2	0002	0162	0164	0178	0205	0412	0422	0433	0454	0508	0521	0534	0565		
ES3	0002	0172	0180	0207	0428	0435	0456	0509	0522	0535	0565				
ES4	0002	0192	0194	0217	0219	0445	0446	0464	0465	0510	0523	0536	0565		
ES5	0002	0200	0227	0450	0470	0511	0524	0537	0565						
FEB	0027														
IDP	0023	0255													
IDR	0022	0255													
IDT	0024	0025	0255												
IPS	0047	0058	0058	0060	0111	0113	0260	0341	0343	0479	0481	0646	0650	0652	0654	0656

*****F O R T R A N C R O S S R E F E R E N C E L I S T I N G*****

SYMBOL	INTERNAL STATEMENT NUMBERS																		
IPT	0047	0076	0076	0078	0146	0148	0260	0400	0402	0475	0477	0646	0650	0652	0654	0656			
IWF	0047	0064	0064	0066	0174	0260	0429	0486	0646	0650	0652	0654	0656	0660	0662	0664	0666		
IY1	0026	0027	0033	0255															
IY2	0034	0646																	
LCT	0104	0325	0325	0361	0362	0364	0365	0366	0367	0370	0377	0378	0387	0388	0389	0390			
LIN	0131	0132	0133	0194	0205	0207	0391	0392	0393	0413	0446	0454	0456						
MCT	0316	0526	0526	0527	0528	0529	0530	0531	0532										
MTA	0091																		
MTD	0007																		
MTH	0006	0017	0072	0074	0255	0255	0255	0644	0644	0646	0646	0646	0650	0650	0650	0652	0652	0652	0654
	0654	0654	0656	0656	0656														
M1A	0047	0072	0072	0091	0255	0644	0644	0646	0650	0652	0654	0656							
M1D	0007	0047	0070	0255	0646	0650	0652	0654	0656										
M1X	0008																		
M2A	0047	0074	0074	0091															
M2D	0007	0047	0255																
M2X	0008																		
M3A	0047	0091																	
M3D	0007	0047	0255	0646	0650	0652	0654	0656											
M3X	0008																		
M4A	0047	0091																	
M4D	0007	0047	0255	0646	0650	0652	0654	0656											
M4X	0008																		
NCF	0020	0032	0261	0263															
NCT	0105	0324	0324	0538	0539	0540	0541	0542	0557	0557	0569	0570	0571	0572	0573	0574	0575	0576	0577
	0578	0579																	
NM1	0474	0475	0475	0477	0477	0483	0483	0484	0485	0485	0485	0490	0490	0490	0492	0492	0492	0493	0493
	0497	0497	0499	0499	0500	0500	0500												
NTD	0246	0646	0650	0652	0654	0656													
NYR	0021	0022	0023	0024	0025	0027	0323	0568	0604	0609	0614	0628	0632	0648	0648	0669			
N2D	0246																		
PSA	0377	0418	0479	0481	0516	0638	0648												
PSD	0047	0049	0049	0051	0418	0481	0648	0650											
PTA	0362	0363	0368	0638															
PTR	0002																		
PWA	0361	0363	0368	0638															
PWT	0009	0110	0111	0115	0132	0148	0339	0340	0341	0368	0392	0402	0477	0479	0481				
PWX	0002	0111	0113	0133	0150	0160	0341	0343	0393	0404	0410	0479	0481	0483					
RSA	0378	0502	0503	0504	0505	0506	0517	0618	0619	0623	0636	0638	0646						
RSM	0303	0379	0379	0557															
RS1	0002	0160	0161	0410	0411	0483	0484	0502	0507	0543	0565	0604	0650						
RS2	0002	0161	0162	0171	0189	0214	0411	0412	0427	0442	0461	0484	0485	0490	0497	0503	0508	0544	0565
	0609	0650																	
RS3	0002	0171	0172	0191	0216	0427	0428	0444	0463	0485	0492	0499	0504	0509	0545	0565	0614	0650	
RS4	0002	0189	0191	0192	0199	0214	0216	0217	0226	0442	0444	0445	0449	0461	0463	0464	0469	0490	0492
	0493	0497	0499	0500	0505	0510	0546	0565	0628	0648	0650								
RS5	0002	0199	0200	0226	0227	0449	0450	0469	0470	0493	0500	0506	0511	0547	0565	0632	0648	0650	
RTA	0364	0638																	
RTS	0009																		

*****F O R T R A N C R O S S R E F E R E N C E L I S T I N G*****

SYMBOL	INTERNAL STATEMENT NUMBERS																		
RWT	0009	0109	0116	0121	0131	0132	0146	0148	0160	0345	0350	0358	0369	0374	0391	0392	0400	0402	0410
	0475	0477	0483	0563															
SD1	0560	0596	0646																
SEP	0012	0014	0072	0074															
SMX	0317	0525	0525	0527															
SX1	0585	0640																	
SX2	0586	0640																	
SX3	0587	0640																	
SX4	0588	0640																	
SX5	0589	0640																	
TSB	0010	0124	0332	0353	0383	0563													
TSD	0039	0061	0061	0063	0650														
TSJ	0637																		
TTB	0010	0122	0351	0359	0563														
TWA	0370	0371	0638	0646															
TWM	0371	0646																	
VAR	0557	0558	0558	0560	0590	0591	0592	0593	0594										
XB0	0413																		
XB1	0131	0391																	
XB2	0132	0392																	
XB3	0133	0393																	
XB6	0194	0205	0207	0446	0454	0456													
YB0	0413																		
YB1	0131	0391																	
YB2	0132	0392																	
YB3	0133	0393																	
YB6	0194	0205	0207	0446	0454	0456													
YNT	0011	0164	0171	0422	0427	0485													
YR1	0012	0020	0021	0022	0023	0024	0025	0026	0029	0032	0033	0646							
YR2	0012	0020	0021	0034	0255	0261	0261	0263	0646										
YXT	0011	0164	0171	0422	0427	0485													
DTSA	0388	0638																	
DTTA	0367	0638																	
EFOR	0668	0669																	
IFOR	0032	0326	0328	0330	0332	0334	0336	0372	0414	0416	0418	0420	0481	0512	0514	0669			
IPSX	0043	0058	0060																
IPTX	0042	0076	0078																
ITTS	0047	0067	0067	0069	0176	0187	0203	0212	0271	0273	0431	0440	0452	0459	0488	0495	0550	0646	0654
IWFX	0044	0064	0066																
METH	0603	0608	0613	0646															
MXAV	0527	0585	0586	0587	0588	0589													
M1DX	0008																		
M2DX	0008																		
M3DX	0008																		
M4DX	0008																		
NDAY	0006	0018	0028																
PDAY	0005	0023																	
PSAV	0578	0638																	
PSDX	0041	0049	0051																

*****F O R T R A N C R O S S R E F E R E N C E L I S T I N G*****

SYMBOL	INTERNAL STATEMENT NUMBERS								
PSPC	0516	0563							
PSSM	0314	0385	0385	0578					
PTAV	0571	0638							
PTSM	0307	0357	0357	0571					
PWAV	0569	0638							
PWSM	0305	0355	0355	0569					
PWTA	0363	0646							
PWTM	0368	0646							
PWTS	0002	0110	0113	0340	0343				
RDAY	0005	0022							
RFOR	0604	0609	0614	0618	0620	0646	0668		
RFPC	0618	0646							
RMAX	0020	0255	0518						
RMX1	0528	0585							
RMX2	0529	0586							
RMX3	0530	0587							
RMX4	0531	0588							
RMX5	0532	0589							
RPRJ	0628	0632	0636	0648					
RSAV	0579	0580	0581	0582	0583	0584	0596	0638	
RSMP	0093								
RSMS	0094								
RSPC	0512	0517	0518	0563	0650				
RSPS	0092								
RSQ0	0413	0561	0642	0656					
RSQ1	0131	0391	0561	0642	0656				
RSQ2	0132	0392	0561	0642	0656				
RSQ3	0133	0393	0561	0642	0656				
RSQ4	0168	0423	0561	0642	0656				
RSQ5	0184	0205	0207	0439	0454	0456	0561	0642	0656
RSQ6	0194	0223	0446	0471	0561	0642	0656		
RSSM	0315	0386	0386	0579					
RTAV	0573	0638							
RTSM	0309	0380	0380	0573					
RWTA	0365	0369	0638	0646					
RWTM	0369	0646							
RWTS	0009	0109	0133	0150	0374	0393	0404		
R1PC	0543	0565							
R2PC	0544	0565							
R3PC	0545	0565							
R4PC	0546	0565							
R5PC	0547	0565							
R95M	0623	0646							
SEFR	0619	0646							
SEF1	0580	0640							
SEF2	0581	0640							
SEF3	0582	0640							
SEF4	0583	0640							
SEF5	0584	0640							

*****F O R T R A N C R O S S R E F E R E N C E L I S T I N G*****

SYMBOL	INTERNAL STATEMENT NUMBERS																		
SER1	0298	0533	0533	0538															
SER2	0299	0534	0534	0539															
SER3	0300	0535	0535	0540															
SER4	0301	0536	0536	0541															
SER5	0302	0537	0537	0542															
SET1	0095																		
SET2	0096																		
SET3	0097																		
SME1	0140	0151	0151	0153	0405	0405	0407												
SME2	0141	0152	0152	0153	0406	0406	0407												
SME3	0142																		
SME4	0143																		
SMPS	0088	0126	0126	0376	0376	0377													
SMPT	0081	0119	0119	0348	0348	0362													
SMPW	0080	0118	0118	0347	0347	0361													
SMRS	0079	0127	0127	0375	0375	0378													
SMRT	0082	0120	0120	0349	0349	0364													
SMTW	0103	0117	0117	0346	0346	0370													
SQRT	0528	0529	0530	0531	0532	0538	0539	0540	0541	0542	0560								
SRX1	0318	0520	0520	0528															
SRX2	0319	0521	0521	0529															
SRX3	0320	0522	0522	0530															
SRX4	0321	0523	0523	0531															
SRX5	0322	0524	0524	0532															
TFMN	0047	0052	0052	0054	0416	0648													
TFMX	0047	0055	0055	0057	0414	0648													
TSBA	0387	0638																	
TSDX	0040	0061	0063																
TTBA	0366	0638																	
TTSI	0004	0019	0646	0654															
TWAV	0570	0638																	
TWSM	0306	0356	0356	0570															
YHAT	0003	0164	0178	0180	0219	0422	0433	0435	0465										
YNNS	0011	0129	0178	0180	0189	0191	0219	0226	0334	0382	0416	0433	0435	0442	0444	0465	0469	0490	0492
	0500																		
YXXS	0011	0128	0178	0180	0189	0191	0219	0226	0336	0381	0414	0433	0435	0442	0444	0465	0469	0490	0492
	0500																		
ALPHA	0091																		
AMAX1	0595																		
CPMAX	0595	0654																	
DATES	0246																		
DTSAV	0577	0638																	
DTSSM	0313	0384	0384	0577															
DTTAV	0575	0638																	
DTTSM	0311	0360	0360	0575															
ITTSX	0067	0069																	
JYEAR	0106	0473	0473	0561	0563	0565													
RCPC1	0502	0650																	
RCPC2	0503	0650																	

*****F O R T R A N C R O S S R E F E R E N C E L I S T I N G*****

SYMBOL	INTERNAL STATEMENT NUMBERS												
RCPC3	0504	0650											
RCPC4	0505	0650											
RCPC5	0506	0650											
RESID	0003	0164	0178	0180	0219	0422	0433	0435	0465				
RMSE1	0538	0548	0580	0590	0597	0597	0599	0601	0606	0640	0652		
RMSE2	0539	0548	0549	0552	0581	0591	0597	0599	0599	0601	0611	0640	0652
RMSE3	0540	0549	0554	0582	0592	0597	0599	0601	0601	0616	0640	0652	
RMSE4	0541	0552	0554	0555	0583	0593	0624	0626	0640	0652			
RMSE5	0542	0555	0584	0594	0624	0626	0640	0652					
RPJPC	0636	0648											
RWTAV	0572	0638											
RWTSM	0308	0358	0358	0572									
R6MMD	0454	0456											
R95PC	0620	0621	0621	0623	0646								
SDTOT	0002												
SEFOR	0606	0611	0616	0619	0620	0646							
SMDTS	0087	0125	0125	0354	0354	0388							
SMDTT	0085	0123	0123	0352	0352	0367							
SMRS2	0304	0556	0556	0557									
SMRWT	0083	0121	0121	0350	0350	0365							
SMTSB	0086	0124	0124	0353	0353	0387							
SMTTB	0084	0122	0122	0351	0351	0366							
SUMES	0098												
SUME1	0099												
SUME2	0100												
SUME3	0101												
SUME4	0102												
TFMNN	0045	0052	0054										
TFMXX	0046	0055	0057										
TSBAV	0576	0638											
TSBSM	0312	0383	0383	0576									
TTBAV	0574	0638											
TTBSM	0310	0359	0359	0574									
YNNSA	0390	0416	0648										
YRCOE	0012	0031											
YRERR	0012												
YRPRE	0012	0020	0029	0031	0106	0255	0646						
YXXSA	0389	0414	0648										
READAY	0022	0023	0024	0025									
RGRTWO	0164	0178	0180	0219	0422	0433	0435	0465					
SMYNNS	0090	0129	0129	0382	0382	0390							
SMYXXS	0089	0128	0128	0381	0381	0389							
SUM123	0108	0145	0159	0170	0186	0198	0211	0225	0338				

*****F O R T R A N C R O S S R E F E R E N C E L I S T I N G*****

LABEL	DEFINED	REFERENCES
11	0018	0016
16	0047	0672

*****F O R T R A N C R O S S R E F E R E N C E L I S T I N G*****

LABEL	DEFINED	REFERENCES
41	0203	0174
42	0229	0202
52	0452	0429
53	0472	0451
63	0495	0486
65	0499	0495
66	0500	0498
67	0501	0494
90	0285	0249 0251 0253
91	0255	0247
95	0261	0256 0258
100	0130	0107
111	0603	0597
200	0154	0144
222	0608	0599
300	0163	0158
333	0613	0601
400	0173	0169
401	0180	0176
402	0181	0179
403	0207	0203
404	0208	0206
405	0218	0210
406	0216	0212
407	0217	0215
408	0228	0224
420	0191	0187
421	0192	0190
425	0193	0185
444	0617	0607 0612
450	0201	0197
451	0435	0431
452	0436	0434
455	0414	0372
457	0444	0440
458	0445	0443
460	0473	0420
461	0492	0488
462	0493	0491
463	0554	0550
464	0555	0553
465	0561	0514
485	0533	0518
500	0567	0323
503	0456	0452
504	0457	0455
505	0463	0459
506	0464	0462
533	0628	0624

*****FORTRAN CROSS REFERENCE LISTING*****

LABEL	DEFINED	REFERENCES
544	0632	0626
548	0635	0631
600	0671	0658
1000	0673	
1001	0048	0047
1100	0674	0650
1111	0675	0646
1112	0676	0669
1200	0677	0279
1211	0678	0648
1300	0679	0281
1400	0680	0294
1500	0681	0296
1600	0682	0656
1700	0683	0561
1716	0298	0230 0286
1811	0684	0660
1812	0685	0662
1821	0686	0664
1822	0687	0666
2200	0688	0638
2600	0689	0290
2610	0690	0292
2700	0691	0283
3000	0692	0255
3100	0693	0288
3500	0694	0260
4000	0695	0563
4010	0696	0261
4015	0697	0263
4020	0698	0265
4030	0699	0267
4040	0700	0269
4050	0701	0271
4052	0702	0273
4060	0703	0275
4070	0704	0277
5000	0705	0565
5500	0706	0640
6000	0707	0652
7000	0708	0020
7500	0709	0642
8000	0710	0654
9000	0711	

```
REQUESTED OPTIONS: XREF

OPTIONS IN EFFECT: NAME(MAIN) OPTIMIZE(1) LINECOUNT(54) SIZE(MAX) AUTODBL(NONE)
                   SOURCE EBCDIC NOLIST NODECK OBJECT MAP NOFORMAT GOSTMT XREF NOALC NOANSF NOTERM IBM FLAG(I)

   ISN 0002            SUBROUTINE ALPHA(M1A,MTA,M2A,M3A,M4A,NI,JI,IX,JX)
   ISN 0003            COMMON/DATE/ M1,M1D,MT,MTD,M2,M2D,M3,M3D,M4,M4D
   ISN 0004            COMMON/DATEX/M1X,M1DX,M2X,M2DX,M3X,M3DX,M4X,M4DX
   ISN 0005            COMMON /MONTH/ MTH(13),NDAY(13)
   ISN 0006            DATA L/3H   /
                     C
   ISN 0007            IF(IX.EQ.0) IX=JX
   ISN 0009            JX=IX
   ISN 0010            IF(NI.EQ.0) NI=JI
   ISN 0012            JI=NI
                     C
   ISN 0013            IF(M1D.EQ.0) GOT O 21
   ISN 0015            M1DX=M1D
   ISN 0016         21 M1D=M1DX
   ISN 0017            IF(M2D.EQ.0) GOT O 31
   ISN 0019            M2DX=M2D
   ISN 0020         31 M2D=M2DX
   ISN 0021            IF(M3D.EQ.0) GO TO 41
   ISN 0023            M3DX=M3D
   ISN 0024         41 M3D=M3DX
   ISN 0025            IF(M4D.EQ.0) GO TO 51
   ISN 0027            M4DX=M4D
   ISN 0028         51 M4D=M4DX
                     C
   ISN 0029            DO 110 I=1,13
   ISN 0030            IF(M1A.EQ.L) GO TO 20
   ISN 0032            IF(M1A.EQ.MTH(I)) GOT O111
   ISN 0034        110 CONTINUE
   ISN 0035        111 M1=I
   ISN 0036             M1X=M1A
   ISN 0037         20 M1A=M1X
                     C
   ISN 0038            DO 120 J=I,13
   ISN 0039            IF(M2A.EQ.L) GOTO 30
   ISN 0041            IF(M2A.EQ.MTH(J)) GOT O 121
   ISN 0043        120 CONTINUE
   ISN 0044        121  M2=J
   ISN 0045            M2X=M2A
   ISN 0046         30 M2A=M2X
                     C
   ISN 0047            MT=M2
   ISN 0048            MTD=M2D-NI
   ISN 0049            IF(MTD.GT.0) GO  TO 10
   ISN 0051            MT=M2-1
   ISN 0052            MTD=MTD+NDAY(MT)
   ISN 0053         10 CONTINUE
   ISN 0054            MTA=MTH(MT)
```

```
                C
   ISN 0055             DO 130 I=J,13
   ISN 0056              IF(M3A.EQ.L) GOTO 40
   ISN 0058             IF(M3A.EQ.MTH(I)) GO TO 131
   ISN 0060           130 CONTINUE
   ISN 0061           131 M3=I
   ISN 0062               M3X=M3A
   ISN 0063            40 M3A=M3X
                C
   ISN 0064             DO 140 J=I,13
   ISN 0065             IF(M4A.EQ.L) GOT 050
   ISN 0067             IF(M4A.EQ.MTH(J)) GO TO 141
   ISN 0069           140 CONTINUE
   ISN 0070           141 M4=J
   ISN 0071               M4X=M4A
   ISN 0072            50 M4A=M4X
                C
   ISN 0073              RETURN
   ISN 0074             END
```

```
                    *****F O R T R A N    C R O S S    R E F E R E N C E    L I S T I N G*****
SYMBOL  INTERNAL STATEMENT NUMBERS
I       0029  0032  0035  0038  0055  0058  0061  0064
J       0038  0041  0044  0055  0064  0067  0070
L       0006  0030  0039  0056  0065
IX      0002  0007  0007  0009
JI      0002  0010  0012
JX      0002  0007  0009
MT      0003  0047  0051  0052  0054
M1      0003  0035
M2      0003  0044  0047  0051
M3      0003  0061
M4      0003  0070
NI      0002  0010  0010  0012  0048
MTA     0002  0054
MTD     0003  0048  0049  0052  0052
MTH     0005  0032  0041  0054  0058  0067
M1A     0002  0030  0032  0036  0037
M1D     0003  0013  0015  0016
M1X     0004  0036  0037
M2A     0002  0039  0041  0045  0046
M2D     0003  0017  0019  0020  0048
M2X     0004  0045  0046
M3A     0002  0056  0058  0062  0063
M3D     0003  0021  0023  0024
M3X     0004  0062  0063
M4A     0002  0065  0067  0071  0072
M4D     0003  0025  0027  0028
M4X     0004  0071  0072
M1DX    0004  0015  0016
M2DX    0004  0019  0020
```

```
REQUESTED OPTIONS: XREF

OPTIONS IN EFFECT: NAME(MAIN) OPTIMIZE(1) LINECOUNT(54) SIZE(MAX) AUTODBL(NONE)
                   SOURCE EBCDIC NOLIST NODECK OBJECT MAP NOFORMAT GOSTMT XREF NOALC NOANSF NOTERM IBM FLAG(I)

   ISN 0002            SUBROUTINE AVAR(N,X,AVE,VAR,MD)                                    D  10
   ISN 0003            DIMENSION X(MD)                                                    D  20
                  C                                  SUMS X AND Y SQUARED FOR LINEAR      D  30
                  C                                  REGRESSION,FINDS AVERAGES AND        D  40
                  C                                  VARIANCE                             D  50
   ISN 0004            SX=0.                                                              D  60
   ISN 0005            SX2=0.                                                             D  70
   ISN 0006            T=N                                                                D  80
   ISN 0007            DO 10 I=1,N                                                        D  90
   ISN 0008            SX=SX+X(I)                                                         D 100
   ISN 0009         10 SX2=SX2+X(I)**2                                                    D 110
   ISN 0010            AVE=SX/T                                                           D 120
   ISN 0011            VAR=SX2/T-AVE**2                                                   D 130
   ISN 0012            RETURN                                                             D 140
   ISN 0013            END                                                                D 150-


                        *****F O R T R A N    C R O S S    R E F E R E N C E    L I S T I N G*****
SYMBOL  INTERNAL STATEMENT NUMBERS
I       0007  0008  0009
N       0002  0006  0007
T       0006  0010  0011
X       0002  0003  0008  0009
MD      0002  0003
SX      0004  0008  0008  0010
AVE     0002  0010  0011
SX2     0005  0009  0009  0011
VAR     0002  0011
AVAR    0002


                        *****F O R T R A N    C R O S S    R E F E R E N C E    L I S T I N G*****
 LABEL   DEFINED   REFERENCES
   10    0009      0007


                                                        /    AVAR /     SIZE OF PROGRAM 0001C6 HEXADECIMAL BYTES

      NAME     TAG   TYPE  ADD.        NAME     TAG   TYPE  ADD.        NAME     TAG   TYPE  ADD.        NAME     TAG   TYPE  ADD.
         I  SF        I*4   00009C        N  F        I*4   0000A0        T  SF        R*4   0000A4        X  F  XR   R*4   000000
        MD            I*4   0000A8       SX  SF       R*4   0000AC      AVE  SF       R*4   0000B0      SX2  SF        R*4   0000B4
       VAR  S         R*4   0000B8     AVAR           R*4   0000BC


  SOURCE STATEMENT LABELS

    LABEL  ISN   ADDR          LABEL  ISN   ADDR          LABEL  ISN   ADDR          LABEL  ISN   ADDR
```

```
REQUESTED OPTIONS: XREF

OPTIONS IN EFFECT: NAME(MAIN) OPTIMIZE(1) LINECOUNT(54) SIZE(MAX) AUTODBL(NONE)
                   SOURCE EBCDIC NOLIST NODECK OBJECT MAP NOFORMAT GOSTMT XREF NOALC NOANSF NOTERM IBM FLAG(I)

   ISN 0002              SUBROUTINE DATES(NT,NTD,N2,N2D)
                C
                C        DAYTEM
                C
   ISN 0003              COMMON /MONTH/ MTH(13),NDAY(13)
   ISN 0004              COMMON /DATE/ M1,M1D,MT,MTD,M2,M2D,M3,M3D,M4,M4D
                C
   ISN 0005              NT=MT
   ISN 0006              NTD=MTD-1
   ISN 0007              IF(NTD.GT.0) GO TO 10
   ISN 0009              NT=MT-1
   ISN 0010              NTD=NDAY(NT)
                C
   ISN 0011           10 N2=M2
   ISN 0012              N2D=M2D-1
   ISN 0013              IF(N2D.GT.0) GO TO 20
   ISN 0015              N2=M2-1
   ISN 0016              N2D=NDAY(N2)
   ISN 0017           20 CONTINUE
                C
   ISN 0018              RETURN
   ISN 0019              END


                         *****F O R T R A N    C R O S S    R E F E R E N C E    L I S T I N G*****
SYMBOL  INTERNAL STATEMENT NUMBERS
MT      0004  0005  0009
M1      0004
M2      0004  0011  0015
M3      0004
M4      0004
NT      0002  0005  0009  0010
N2      0002  0011  0015  0016
MTD     0004  0006
MTH     0003
M1D     0004
M2D     0004  0012
M3D     0004
M4D     0004
NTD     0002  0006  0007  0010
N2D     0002  0012  0013  0016
NDAY    0003  0010  0016
DATES   0002


                         *****F O R T R A N    C R O S S    R E F E R E N C E    L I S T I N G*****
 LABEL   DEFINED   REFERENCES
```

```
REQUESTED OPTIONS: XREF

OPTIONS IN EFFECT: NAME(MAIN) OPTIMIZE(1) LINECOUNT(54) SIZE(MAX) AUTODBL(NONE)
                   SOURCE EBCDIC NOLIST NODECK OBJECT MAP NOFORMAT GOSTMT XREF NOALC NOANSF NOTERM IBM FLAG(I)

   ISN 0002            SUBROUTINE FEB(NYR,IR1)                                                    F  20
   ISN 0003            COMMON/RAW/P(13,36,30),R(13,36,30),TX(13,36,30),TN(13,36,30) ,NI
               C                                  COMBINES 28TH AND 29TH
               C                                  FEBRUARY DATA EACH LEAP YEAR
   ISN 0004            DO 10 IYR=1,NYR                                                            F  40
   ISN 0005            I=IR1+IYR                                                                  F  50
   ISN 0006            IF (MOD(I,4).NE.0) GO TO 10
   ISN 0008            P   (6,28,IYR)=P   (6,28,IYR)+P   (6,29,IYR)
   ISN 0009            R   (6,28,IYR)=R   (6,28,IYR)+R   (6,29,IYR)
   ISN 0010          10 CONTINUE                                                                  F 110
   ISN 0011            RETURN                                                                     F 120
   ISN 0012            END                                                                        F 130-


                        *****F O R T R A N   C R O S S   R E F E R E N C E   L I S T I N G*****
SYMBOL  INTERNAL STATEMENT NUMBERS
I       0005  0006
P       0003  0008  0008  0008
R       0003  0009  0009  0009
NI      0003
TN      0003
TX      0003
FEB     0002
IR1     0002  0005
IYR     0004  0005  0008  0008  0008  0009  0009  0009
MOD     0006
NYR     0002  0004


                        *****F O R T R A N   C R O S S   R E F E R E N C E   L I S T I N G*****
 LABEL   DEFINED   REFERENCES
   10    0010      0004  0006

                                                 /     FEB /     SIZE OF PROGRAM 000170 HEXADECIMAL BYTES

      NAME     TAG   TYPE  ADD.        NAME     TAG   TYPE  ADD.        NAME     TAG   TYPE  ADD.        NAME     TAG   TYPE  ADD.
         I S A      I*4   0000A0          P SF   C   R*4   000000          R SF   C   R*4   00D860         NI       C   I*4     NR
        TN       C  R*4     NR           TX       C   R*4     NR         FEB          R*4   0000A4        IR1   F      I*4   0000A8
       IYR SF       I*4   0000AC        NYR   F      I*4   0000B0

                                        *****  COMMON INFORMATION   *****

        NAME OF COMMON BLOCK  *   RAW*   SIZE OF BLOCK     036D84 HEXADECIMAL BYTES

      VAR. NAME  TYPE  REL. ADDR.   VAR. NAME  TYPE  REL. ADDR.   VAR. NAME  TYPE  REL. ADDR.   VAR. NAME  TYPE  REL. ADDR.
```

```
REQUESTED OPTIONS: XREF

OPTIONS IN EFFECT: NAME(MAIN) OPTIMIZE(1) LINECOUNT(54) SIZE(MAX) AUTODBL(NONE)
                   SOURCE EBCDIC NOLIST NODECK OBJECT MAP NOFORMAT GOSTMT XREF NOALC NOANSF NOTERM IBM FLAG(I)

   ISN 0002            SUBROUTINE LIN(N,X,YL,A,B,XBAR,YBAR,FE,R,MD)
   ISN 0003            DIMENSION X(MD), YL(MD)
   ISN 0004            COMMON /SEASN/ PWT(30),PW(30),RWT(30),RWTS(30),PS(30),T(30),
                      1 RTS(30),TS(30) ,RW(30)  ,TW(30)
                C                                   REGRESSES RUNOFF AND PRECIP,TEST      I  40
                C                                   SEASON AND PREDICTION SEASON ERRORS   I  50
                C                                   FOR LINEAR METHOD,GIVES               I  60
                C                                   COEFFIENTS,MEANS,VARIANCE,            I  70
                C                                   AND COEFFIENT OF DETERMINATION.       I  80
   ISN 0005            CALL AVAR(N,X,XBAR,VX,MD)                                         I  90
   ISN 0006            CALL AVAR(N,YL,YBAR,VY,MD)
   ISN 0007            IF (VX) 20,20,10                                                  I 110
   ISN 0008         10 IF (VY) 20,20,30                                                  I 120
   ISN 0009         20 A=0.                                                              I 130
   ISN 0010            B=YBAR                                                            I 140
   ISN 0011            R=0.                                                              I 150
   ISN 0012            FE=0.                                                             I 160
   ISN 0013            VU=VY                                                             I 170
   ISN 0014            GO TO 50                                                          I 180
   ISN 0015         30 D=N
   ISN 0016            SXY=0.                                                            I 200
   ISN 0017            DO 40 I=1,N                                                       I 210
   ISN 0018         40 SXY=SXY+X(I)*YL(I)
   ISN 0019            VXY=SXY/D-XBAR*YBAR
   ISN 0020            A=VXY/VX                                                          I 240
   ISN 0021            B=YBAR-A*XBAR                                                     I 250
   ISN 0022            R=A*SQRT(VX/VY)                                                   I 260
   ISN 0023            FE=R**2                                                           I 270
   ISN 0024            VU=VY*(1.-FE)                                                     I 280
   ISN 0025         50 RETURN                                                            I 290
   ISN 0026             END

                        *****F O R T R A N   C R O S S   R E F E R E N C E   L I S T I N G*****
SYMBOL  INTERNAL STATEMENT NUMBERS
A       0002  0009  0020  0021  0022
B       0002  0010  0021
D       0015  0019
I       0017  0018  0018
N       0002  0005  0006  0015  0017
R       0002  0011  0022  0023
T       0004
X       0002  0003  0005  0018
FE      0002  0012  0023  0024
MD      0002  0003  0003  0005  0006
PS      0004
PW      0004
```

*****F O R T R A N C R O S S R E F E R E N C E L I S T I N G*****

SYMBOL	INTERNAL STATEMENT NUMBERS				
RW	0004				
TS	0004				
TW	0004				
VU	0013	0024			
VX	0005	0007	0020	0022	
VY	0006	0008	0013	0022	0024
YL	0002	0003	0006	0018	
LIN	0002				
PWT	0004				
RTS	0004				
RWT	0004				
SXY	0016	0018	0018	0019	
VXY	0019	0020			
AVAR	0005	0006			
RWTS	0004				
SQRT	0022				
XBAR	0002	0005	0019	0021	
YBAR	0002	0006	0010	0019	0021

*****F O R T R A N C R O S S R E F E R E N C E L I S T I N G*****

LABEL	DEFINED	REFERENCES			
10	0008	0007			
20	0009	0007	0007	0008	0008
30	0015	0008			
40	0018	0017			
50	0025	0014			

/ LIN / SIZE OF PROGRAM 000340 HEXADECIMAL BYTES

NAME	TAG	TYPE	ADD.	NAME	TAG	TYPE	ADD.	NAME	TAG	TYPE	ADD.	NAME	TAG	TYPE	ADD.
A	SF	R*4	0000C8	B	S	R*4	0000CC	D	SF	R*4	0000D0	I	SF	I*4	0000D4
N	SFA	I*4	0000D8	R	SF	R*4	0000DC	T	C	R*4	NR	X	SFA XR	R*4	000000
FE	SF	R*4	0000E0	MD	SFA	I*4	0000E4	PS	C	R*4	NR	PW	C	R*4	NR
RW	C	R*4	NR	TS	C	R*4	NR	TW	C	R*4	NR	VU	S	R*4	0000E8
VX	SFA	R*4	0000EC	VY	SFA	R*4	0000F0	YL	SFA XR	R*4	000000	LIN		I*4	0000F4
PWT	C	R*4	NR	RTS	C	R*4	NR	RWT	C	R*4	NR	SXY	SF	R*4	0000F8
VXY	SF	R*4	0000FC	AVAR	SF XF		000000	RWTS	C	R*4	NR	SQRT	F XF	R*4	000000
XBAR	SFA	R*4	000100	YBAR	SFA	R*4	000104								

***** COMMON INFORMATION *****

NAME OF COMMON BLOCK * SEASN* SIZE OF BLOCK 0004B0 HEXADECIMAL BYTES

VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.
PWT	R*4	000000 NR	PW	R*4	000078 NR	RWT	R*4	0000F0 NR	RWTS	R*4	000168 NR
PS	R*4	0001E0 NR	T	R*4	000258 NR	RTS	R*4	0002D0 NR	TS	R*4	000348 NR

```
REQUESTED OPTIONS: XREF

OPTIONS IN EFFECT: NAME(MAIN) OPTIMIZE(1) LINECOUNT(54) SIZE(MAX) AUTODBL(NONE)
                   SOURCE EBCDIC NOLIST NODECK OBJECT MAP NOFORMAT GOSTMT XREF NOALC NOANSF NOTERM IBM FLAG(I)

   ISN 0002             SUBROUTINE READAY(X,N,ID,IY1,L)
                     C
                     C READ DAILY VALUES
                     C
   ISN 0003             DIMENSION X(13,36,30),T(36)    ,NDAY(12)
   ISN 0004             COMMON /MONTH/ MZ (13),NX  (13)
                     C
   ISN 0005             DO 21 I=1,12
   ISN 0006          21 NDAY(I)= NX(I+1)
   ISN 0007              DO 11 I=1,30
   ISN 0008              DO 11 J=1,13
   ISN 0009             DO 11 K=1,36
   ISN 0010          11 X(J,K,I)=0.
   ISN 0011             NM1=N-1
   ISN 0012             I1=IY1-1
                     C
   ISN 0013          70 READ(L,400,END=60) IYR,MT,ID
   ISN 0014             IF(MT.NE.11.OR.IYR.NE.I1) GO TO70
   ISN 0016             READ(L,300,END=60) (T(K),K=1,36)
   ISN 0017             DO 80 K=1,31
   ISN 0018          80 X(1,K,1)= T(K)
                     C
   ISN 0019             DO 10 IYR=1,NM1
   ISN 0020             DO 10 MTH=2,13
   ISN 0021             M=MTH-1
   ISN 0022             READ(L,100,END=60) (T(K),K=1,12),MT,(T(K),K=13,36)
   ISN 0023             IF(MT.NE.M) GO TO 40
   ISN 0025          30 ND=NDAY(MT)
   ISN 0026             DO 20 K=1,ND
   ISN 0027             X(MTH,K,IYR)=T(K)
   ISN 0028          20 CONTINUE
   ISN 0029             IF(MTH.NE.13) GO TO10
   ISN 0031             DO 90 K=1,ND
   ISN 0032          90 X(1,K,IYR+1)=T(K)
   ISN 0033          10 CONTINUE
                     C
   ISN 0034             DO 50 J=2,13
   ISN 0035             READ(L,500,END=60) (T(K),K=1,12),MT
   ISN 0036             IF(MT.EQ.0) GO TO 60
   ISN 0038             READ(L,300,END=60) (T(K),K=13,36)
   ISN 0039             ND=NDAY(MT)
   ISN 0040             DO 50 K=1,ND
   ISN 0041             X(J,K,N)=T(K)
   ISN 0042          50 CONTINUE
   ISN 0043             READ(L,100,END=60)
   ISN 0044             GO TO 60
                     C
```

```
ISN 0045         40 WRITE(6,200) L
ISN 0046        100 FORMAT(12F5.0,13X,I2       / (12F5.0 )      )
ISN 0047        200 FORMAT(1H ,'NOT ENOUGH DATA OR DATA OUT ORDER ON UNIT ',I2)
                   1')
ISN 0048        300 FORMAT( (12F5.0 ))
ISN 0049        400 FORMAT(70X,I2,1X,I2,1X,I4//)
ISN 0050        500 FORMAT(12F5.0,13X,I2)
ISN 0051            STOP
                C
ISN 0052         60 REWIND L
ISN 0053            RETURN
ISN 0054            END
```

*****F O R T R A N C R O S S R E F E R E N C E L I S T I N G*****

SYMBOL	INTERNAL STATEMENT NUMBERS																		
I	0005	0006	0006	0007	0010														
J	0008	0010	0034	0041															
K	0009	0010	0016	0016	0016	0017	0018	0018	0022	0022	0022	0022	0022	0022	0026	0027	0027	0031	0032
	0032	0035	0035	0035	0038	0038	0038	0040	0041	0041									
L	0002	0013	0016	0022	0035	0038	0043	0045	0052										
M	0021	0023																	
N	0002	0011	0041																
T	0003	0016	0018	0022	0022	0027	0032	0035	0038	0041									
X	0002	0003	0010	0018	0027	0032	0041												
ID	0002	0013																	
I1	0012	0014																	
MT	0013	0014	0022	0023	0025	0035	0036	0039											
MZ	0004																		
ND	0025	0026	0031	0039	0040														
NX	0004	0006																	
IYR	0013	0014	0019	0027	0032														
IY1	0002	0012																	
MTH	0020	0021	0027	0029															
NM1	0011	0019																	
NDAY	0003	0006	0025	0039															
NEADAY	0002																		

*****F O R T R A N C R O S S R E F E R E N C E L I S T I N G*****

LABEL	DEFINED	REFERENCES							
10	0033	0019	0020	0029					
11	0010	0007	0008	0009					
20	0028	0026							
21	0006	0005							
30	0025								
40	0045	0023							
50	0042	0034	0040						
60	0052	0013	0016	0022	0035	0036	0038	0043	0044
70	0013	0014							
80	0018	0017							
90	0032	0031							

```
REQUESTED OPTIONS: XREF

OPTIONS IN EFFECT: NAME(MAIN) OPTIMIZE(1) LINECOUNT(54) SIZE(MAX) AUTODBL(NONE)
                   SOURCE EBCDIC NOLIST NODECK OBJECT MAP NOFORMAT GOSTMT XREF NOALC NOANSF NOTERM IBM FLAG(I)

   ISN 0002            SUBROUTINE SUM (SUMY,Y,I,ID,K,KD,N)
   ISN 0003            DIMENSION Y(13,36,30),MDAY(13),ND  (13)
   ISN 0004            COMMON /MONTH/ MTH(13),NDAY(13)
   ISN 0005            DO 20 L=1,13
   ISN 0006             MDAY(L)=1
   ISN 0007         20 ND(L)= NDAY(L)
   ISN 0008            SUMY=0
                  C
   ISN 0009            J=K
   ISN 0010            JD=KD
   ISN 0011            IF(KD.GT.0) GO TO 5
   ISN 0013            J=J-1
   ISN 0014            JD=ND  (J)
                  C
   ISN 0015          5 MDAY(I)=ID
   ISN 0016            ND  (J)=JD
                  C
   ISN 0017            DO 10 II=I,J
   ISN 0018               NDY=ND(II)
   ISN 0019            MD=MDAY(II)
   ISN 0020            DO 10 JJ=MD,NDY
   ISN 0021         10 SUMY=SUMY+Y(II,JJ,N)
                  C
   ISN 0022            RETURN
   ISN 0023            END


                        *****F O R T R A N    C R O S S    R E F E R E N C E    L I S T I N G*****
SYMBOL  INTERNAL STATEMENT NUMBERS
I       0002  0015  0017
J       0009  0013  0013  0014  0016  0017
K       0002  0009
L       0005  0006  0007  0007
N       0002  0021
Y       0002  0003  0021
ID      0002  0015
II      0017  0018  0019  0021
JD      0010  0014  0016
JJ      0020  0021
KD      0002  0010  0011
MD      0019  0020
ND      0003  0007  0014  0016  0018
MTH     0004
NDY     0018  0020
SUM     0002
MDAY    0003  0006  0015  0019
NDAY    0004  0007
```

```
                    *****F O R T R A N    C R O S S    R E F E R E N C E    L I S T I N G*****
SYMBOL  INTERNAL STATEMENT NUMBERS
SUMY    0002  0008  0021  0021


                    *****F O R T R A N    C R O S S    R E F E R E N C E    L I S T I N G*****
 LABEL   DEFINED   REFERENCES
    5    0015      0011
   10    0021      0017  0020
   20    0007      0005

                                                    /      SUM /     SIZE OF PROGRAM 0002CA HEXADECIMAL BYTES

      NAME     TAG   TYPE  ADD.        NAME     TAG   TYPE  ADD.        NAME     TAG   TYPE  ADD.        NAME     TAG   TYPE  ADD.
         I   F        I*4   000098         J  SF        I*4   00009C         K   F        I*4   0000A0         L  SF        I*4   0000A4
         N   F        I*4   0000A8         Y   F  XR     R*4   000000        ID   F        I*4   0000AC        II  SF        I*4   0000B0
        JD  SF        I*4   0000B4        JJ  SF        I*4   0000B8        KD   F        I*4   0000BC        MD  SF        I*4   0000C0
        ND  SF        I*4   0000D0       MTH        C   I*4    NR          NDY  SF        I*4   0000C4       SUM            R*4   0000C8
      MDAY  SF        I*4   000104      NDAY   F   C   I*4   000034       SUMY  SF        R*4   0000CC

                                        *****  COMMON INFORMATION   *****

        NAME OF COMMON BLOCK  * MONTH*   SIZE OF BLOCK     000068 HEXADECIMAL BYTES

      VAR. NAME  TYPE  REL. ADDR.    VAR. NAME  TYPE  REL. ADDR.    VAR. NAME  TYPE  REL. ADDR.    VAR. NAME  TYPE  REL. ADDR.
           MTH   I*4    000000 NR         NDAY   I*4    000034


  SOURCE STATEMENT LABELS

    LABEL  ISN   ADDR            LABEL  ISN   ADDR            LABEL  ISN   ADDR            LABEL  ISN   ADDR
       20    7  00016E               5   15  000188              10   21  0001F8

  COMPILER GENERATED LABELS

    LABEL  ISN   ADDR            LABEL  ISN   ADDR            LABEL  ISN   ADDR            LABEL  ISN   ADDR
   100001    2  000144          100002    6  000160          100003    8  000192          100004   13  0001A6
   100005   18  0001DA          100006   22  000226          100007   22  000230

*OPTIONS IN EFFECT*NAME(MAIN) OPTIMIZE(1) LINECOUNT(54) SIZE(MAX) AUTODBL(NONE)

*OPTIONS IN EFFECT*SOURCE EBCDIC NOLIST NODECK OBJECT MAP NOFORMAT GOSTMT XREF NOALC NOANSF NOTERM IBM FLAG(I)

*STATISTICS*      SOURCE STATEMENTS =      22, PROGRAM SIZE =      714, SUBPROGRAM NAME =   SUM

*STATISTICS*  NO  DIAGNOSTICS GENERATED

****** END OF COMPILATION ******                                          118K BYTES OF CORE NOT USED
```

```
REQUESTED OPTIONS: XREF

OPTIONS IN EFFECT: NAME(MAIN) OPTIMIZE(1) LINECOUNT(54) SIZE(MAX) AUTODBL(NONE)
                   SOURCE EBCDIC NOLIST NODECK OBJECT MAP NOFORMAT GOSTMT XREF NOALC NOANSF NOTERM IBM FLAG(I)

   ISN 0002              SUBROUTINE SMDY (JS,JW)
                C         HMSM 01
   ISN 0003             COMMON /DATE/ M1,M1D,MT,MTD,MP,MPD,MS,MSD,M5,M5D
   ISN 0004             COMMON /MONTH/ MTH(13),NDAY(13)
   ISN 0005              NDW=0
   ISN 0006              NDM=0
   ISN 0007              IF(MS.EQ.M5) GO TO 250
   ISN 0009              DO 100 J=1,13
   ISN 0010              IF (MS.EQ.J)       NDS=NDAY(J)
   ISN 0012              ND1=NDS -MSD+1
   ISN 0013              IF (MS.EQ.J.      AND.J.NE.13) KL=J+1
   ISN 0015        100   IF(M5.EQ.J)       KM=J-1
   ISN 0017              IF(KL.GT.KM) GO TO 200
   ISN 0019              DO 150 J=KL,KM
   ISN 0020        150   NDM=NDM +NDAY(J)
   ISN 0021        200   JS=ND1 +NDM+M5D
   ISN 0022              GO TO 300
   ISN 0023        250   JS =M5D-MSD+1
   ISN 0024        300   CONTINUE
   ISN 0025              DO 275  J=1,13
   ISN 0026              IF(M1.EQ.J) NDSW=NDAY(J)
   ISN 0028              ND2=NDSW-M1D+1
   ISN 0029              IF(M1.EQ.J) KW1=J+1
   ISN 0031              IF(MT.EQ.J) KW2=J-1
   ISN 0033        275   CONTINUE
   ISN 0034              IF(M1.EQ.MT) GO TO 375
   ISN 0036              IF(KW1.GT.KW2) GO TO 350
   ISN 0038              DO 325 J=KW1,KW2
   ISN 0039        325   NDW=NDW+NDAY(J)
   ISN 0040        350   JW=ND2+NDW+MTD
   ISN 0041              GO TO 400
   ISN 0042        375   JW=MTD-M1D+1
   ISN 0043        400   RETURN
   ISN 0044              END


                         *****F O R T R A N    C R O S S    R E F E R E N C E    L I S T I N G*****
SYMBOL  INTERNAL STATEMENT NUMBERS
J       0009  0010  0010  0013  0013  0013  0015  0015  0019  0020  0025  0026  0026  0029  0029  0031  0031  0038  0039
JS      0002  0021  0023
JW      0002  0040  0042
KL      0013  0017  0019
KM      0015  0017  0019
MP      0003
MS      0003  0007  0010  0013
MT      0003  0031  0034
M1      0003  0026  0029  0034
```

*****F O R T R A N C R O S S R E F E R E N C E L I S T I N G*****

SYMBOL	INTERNAL STATEMENT NUMBERS			
M5	0003	0007	0015	
KW1	0029	0036	0038	
KW2	0031	0036	0038	
MPD	0003			
MSD	0003	0012	0023	
MTD	0003	0040	0042	
MTH	0004			
M1D	0003	0028	0042	
M5D	0003	0021	0023	
NDM	0006	0020	0020	0021
NDS	0010	0012		
NDW	0005	0039	0039	0040
ND1	0012	0021		
ND2	0028	0040		
NDAY	0004	0010	0020	0026 0039
NDSW	0026	0028		
SMDY	0002			

*****F O R T R A N C R O S S R E F E R E N C E L I S T I N G*****

LABEL	DEFINED	REFERENCES
100	0015	0009
150	0020	0019
200	0021	0017
250	0023	0007
275	0033	0025
300	0024	0022
325	0039	0038
350	0040	0036
375	0042	0034
400	0043	0041

/ SMDY / SIZE OF PROGRAM 000296 HEXADECIMAL BYTES

NAME	TAG	TYPE	ADD.	NAME	TAG	TYPE	ADD.	NAME	TAG	TYPE	ADD.	NAME	TAG	TYPE	ADD.
J	SF	I*4	00008C	JS	S	I*4	000090	JW	S	I*4	000094	KL	SF	I*4	000098
KM	SF	I*4	00009C	MP	C	I*4	NR	MS	C	I*4	000018	MT	C	I*4	000008
M1	C	I*4	000000	M5	C	I*4	000020	KW1	SF	I*4	0000A0	KW2	SF	I*4	0000A4
MPD	C	I*4	NR	MSD	F C	I*4	00001C	MTD	F C	I*4	00000C	MTH	C	I*4	NR
M1D	F C	I*4	000004	M5D	F C	I*4	000024	NDM	SF	I*4	0000A8	NDS	SF	I*4	0000AC
NDW	SF	I*4	0000B0	ND1	SF	I*4	0000B4	ND2	SF	I*4	0000B8	NDAY	F C	I*4	000034
NDSW	SF	I*4	0000BC	SMDY		R*4	0000C0								

***** COMMON INFORMATION *****

NAME OF COMMON BLOCK * DATE* SIZE OF BLOCK 00002B HEXADECIMAL BYTES

```
REQUESTED OPTIONS: XREF

OPTIONS IN EFFECT: NAME(MAIN) OPTIMIZE(1) LINECOUNT(54) SIZE(MAX) AUTODBL(NONE)
                   SOURCE EBCDIC NOLIST NODECK OBJECT MAP NOFORMAT GOSTMT XREF NOALC NOANSF NOTERM IBM FLAG(I)

   ISN 0002            SUBROUTINE SUM123(N)
   ISN 0003            COMMON/RAW/P(13,36,30),R(13,36,30),TX(13,36,30),TN(13,36,30) ,NI
   ISN 0004            COMMON/TEMP/ TTB(30),TSB(30),DTT(30),DTS(30)
   ISN 0005            COMMON /DATE/ M1,M1D,MT,MTD,MP,MPD,MS,MSD,M5,M5D
   ISN 0006            COMMON /SEASN/ PWT(30),PW(30),RWT(30),RWTS(30),PS(30) ,T(30) ,
                      1 RTS(30),TS(30)  ,RW(30) ,TW(30)
   ISN 0007            COMMON/CORR/ YXT(30),YNT(30),YXXS(30),YNNS(30)
   ISN 0008            IE=MPD-1
   ISN 0009            ID=MTD-1
   ISN 0010            IX=NI
                  C
                  C
   ISN 0011            CALL SUM(Y,P,M1,M1D,MP,IE,N)
   ISN 0012            PWT(N)=Y
                  C
   ISN 0013            CALL SUM(Y,P,M1,M1D,MT,ID,N)
   ISN 0014               PW(N)=Y
   ISN 0015             CALL SUM(Y,R,M1,M1D,MT,ID,N)
   ISN 0016             RW(N)=Y
                  C
   ISN 0017             PT=PWT(N)-PW(N)
                  C
   ISN 0018            CALL SUM(Y,R,M1,M1D,MP,IE,N)
   ISN 0019            RWT(N)=Y
                  C
   ISN 0020            CALL SUM(Y,R,MS,MSD,M5,M5D,N)
   ISN 0021            RWTS(N)= Y+RWT(N)
                  C
   ISN 0022            CALL SUM(Y,P,MS,MSD,M5,M5D,N)
   ISN 0023            PS(N)=Y
                  C
   ISN 0024             CALL SUM(YWN,TN,M1,M1D,MP,IE,N)
   ISN 0025             CALL SUM(YWX,TX,M1,M1D,MP,IE,N)
   ISN 0026               CALL SMDY (JS,JW)
   ISN 0027             YWX=YWX/JW
   ISN 0028             YWN=YWN/JW
   ISN 0029             TWB=(YWX+YWN)/2
   ISN 0030             DTW=YWX-YWN
   ISN 0031            RTS(N)=RWTS(N)-RWT(N)
   ISN 0032             CALL SUM(YX,TX,MT,MTD,MP,IE,N)
   ISN 0033            YX=YX/IX
   ISN 0034            CALL SUM(YN,TN,MT,MTD,MP,IE,N)
   ISN 0035            YN=YN/IX
   ISN 0036            CALL SUM(YXX,TX,MS,MSD,M5,M5D,N)
   ISN 0037            YXX=YXX/JS
   ISN 0038            CALL SUM (YNN,TN,MS,MSD,M5,M5D,N)
   ISN 0039             YNN=YNN/JS
```

```
ISN 0040            TTB(N)=(YX+YN)/2
ISN 0041           TSB (N)=(YNN+YXX)/2
ISN 0042            DTT(N)=YX-YN
ISN 0043            DTS(N)=YXX-YNN
ISN 0044           Tw(N)=TWB
               C ALFA REMOVED
               C       T(N)=ALFA*TTB(N)+(1.-ALFA)*DTT(N)
               C       TS(N)=ALFA*TSB(N)+(1.-ALFA)*DTS(N)
ISN 0045           YXT(N)=YX
ISN 0046           YNT(N)=YN
ISN 0047           YXXS(N)=YXX
ISN 0048           YNNS(N)=YNN
               C
ISN 0049           RETURN
ISN 0050           END
```

*****F O R T R A N C R O S S R E F E R E N C E L I S T I N G*****

SYMBOL	INTERNAL STATEMENT NUMBERS
N	0002 0011 0012 0013 0014 0015 0016 0017 0017 0018 0019 0020 0021 0021 0022 0023 0024 0025 0031 0031 0031 0032 0034 0036 0038 0040 0041 0042 0043 0044 0045 0046 0047 0048
P	0003 0011 0013 0022
R	0003 0015 0018 0020
T	0006
Y	0011 0012 0013 0014 0015 0016 0018 0019 0020 0021 0022 0023
ID	0009 0013 0015
IE	0008 0011 0018 0024 0025 0032 0034
IX	0010 0033 0035
JS	0026 0037 0039
JW	0026 0027 0028
MP	0005 0011 0018 0024 0025 0032 0034
MS	0005 0020 0022 0036 0038
MT	0005 0013 0015 0032 0034
M1	0005 0011 0013 0015 0018 0024 0025
M5	0005 0020 0022 0036 0038
NI	0003 0010
PS	0006 0023
PT	0017
PW	0006 0014 0017
RW	0006 0016
TN	0003 0024 0034 0038
TS	0006
TW	0006 0044
TX	0003 0025 0032 0036
YN	0034 0035 0035 0040 0042 0046
YX	0032 0033 0033 0040 0042 0045
DTS	0004 0043
DTT	0004 0042
DTW	0030
MPD	0005 0008
MSD	0005 0020 0022 0036 0038
MTD	0005 0009 0032 0034

*****F O R T R A N C R O S S R E F E R E N C E L I S T I N G*****

SYMBOL	INTERNAL STATEMENT NUMBERS											
M1D	0005	0011	0013	0015	0018	0024	0025					
M5D	0005	0020	0022	0036	0038							
PWT	0006	0012	0017									
RTS	0006	0031										
RWT	0006	0019	0021	0031								
SUM	0011	0013	0015	0018	0020	0022	0024	0025	0032	0034	0036	0038
TSB	0004	0041										
TTB	0004	0040										
TWB	0029	0044										
YNN	0038	0039	0039	0041	0043	0048						
YNT	0007	0046										
YWN	0024	0028	0028	0029	0030							
YWX	0025	0027	0027	0029	0030							
YXT	0007	0045										
YXX	0036	0037	0037	0041	0043	0047						
RWTS	0006	0021	0031									
SMDY	0026											
YNNS	0007	0048										
YXXS	0007	0047										
SUM123	0002											

/ SUM123 / SIZE OF PROGRAM 0005BC HEXADECIMAL BYTES

NAME	TAG	TYPE	ADD.	NAME	TAG	TYPE	ADD.	NAME	TAG	TYPE	ADD.	NAME	TAG	TYPE	ADD.
N	SFA	I*4	0001FC	P	SFA C	R*4	000000	R	SFA C	R*4	00DB60	T	C	R*4	NR
Y	SFA	R*4	000200	ID	SFA	I*4	000204	IE	SFA	I*4	000208	IX	SF	I*4	00020C
JS	SFA	I*4	000210	JW	SFA	I*4	000214	MP	SFA C	I*4	000010	MS	SFA C	I*4	000018
MT	SFA C	I*4	000008	M1	SFA C	I*4	000000	M5	SFA C	I*4	000020	NI	F C	I*4	036D80
PS	S C	R*4	0001E0	PT	S	R*4	000218	PW	SF C	R*4	000078	RW	S C	R*4	0003C0
TN	SFA C	R*4	029220	TS	C	R*4	NR	TW	S C	R*4	000438	TX	SFA C	R*4	01B6C0
YN	SFA	R*4	00021C	YX	SFA	R*4	000220	UTS	S C	R*4	000168	UTT	S C	R*4	0000F0
UTW	S	R*4	000224	MPD	F C	I*4	000014	MSD	SFA C	I*4	00001C	MTD	SFA C	I*4	00000C
M1D	SFA C	I*4	000004	M5D	SFA C	I*4	000024	PWT	SF C	R*4	000000	RTS	S C	R*4	0002D0
RWT	SF C	R*4	0000F0	SUM	SF XF		000000	TSB	S C	R*4	000078	TTB	S C	R*4	000000
TWB	SF	R*4	000228	YNN	SFA	R*4	00022C	YNT	S C	R*4	000078	YWN	SFA	R*4	000230
YWX	SFA	R*4	000234	YXT	S C	R*4	000000	YXX	SFA	R*4	000238	RWTS	SF C	R*4	000168
SMDY	SF XF		000000	YNNS	S C	R*4	000168	YXXS	S C	R*4	0000F0	SUM123		R*4	00023C

***** COMMON INFORMATION *****

NAME OF COMMON BLOCK * RAW* SIZE OF BLOCK 036D84 HEXADECIMAL BYTES

VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.
P	R*4	000000	R	R*4	00DB60	TX	R*4	01B6C0	TN	R*4	029220
NI	I*4	036D80									

```
REQUESTED OPTIONS: XREF

OPTIONS IN EFFECT: NAME(MAIN) OPTIMIZE(1) LINECOUNT(54) SIZE(MAX) AUTODBL(NONE)
                   SOURCE EBCDIC NOLIST NODECK OBJECT MAP NOFORMAT GOSTMT XREF NOALC NOANSF NOTERM IBM FLAG(I)

   ISN 0002            SUBROUTINE RGRTWO(X1,X2,N,Y,YHAT,RESID,Z)
   ISN 0003            REAL X1(30),X2(30),Y(30),YHAT(30),RESID(30),Z(10)
   ISN 0004            X1M=0.0
   ISN 0005            X2M=0.0
   ISN 0006            YM=0.0
   ISN 0007            X1S=0.0
   ISN 0008            X2S=0.0
   ISN 0009            X1Y=0.0
   ISN 0010            X2Y=0.0
   ISN 0011            YS=0.0
   ISN 0012            X1X2=0.0
   ISN 0013            DO 10 I=1,N
   ISN 0014            X1M=X1M+X1(I)/N
   ISN 0015            X2M=X2M+X2(I)/N
   ISN 0016            YM=YM+Y(I)/N
   ISN 0017         10 CONTINUE
   ISN 0018            DO 11 I=1,N
   ISN 0019            X1S=X1S+(X1(I)-X1M)**2
   ISN 0020            X2S=X2S+(X2(I)-X2M)**2
   ISN 0021            X1X2=X1X2+(X1(I)-X1M)*(X2(I)-X2M)
   ISN 0022            X1Y =X1Y +(X1(I)-X1M)*( Y(I)- YM)
   ISN 0023            X2Y =X2Y +(X2(I)-X2M)*( Y(I)- YM)
   ISN 0024            YS=YS+(Y(I)-YM)**2
   ISN 0025         11 CONTINUE
   ISN 0026            YVAR=YS/N
   ISN 0027            X1NUM=X2S*X1Y-X1X2*X2Y
   ISN 0028            X2NUM=X1S*X2Y-X1X2*X1Y
   ISN 0029            DNM=X1S*X2S-X1X2**2
   ISN 0030            BYX1=X1NUM/DNM
   ISN 0031            BYX2=X2NUM/DNM
   ISN 0032            RESMU=0.0
   ISN 0033            RESVAR=0.0
   ISN 0034            DO 30 I=1,N
   ISN 0035            YHAT(I)=YM+BYX1*(X1(I)-X1M)+BYX2*(X2(I)-X2M)
   ISN 0036            RESID(I)=Y(I)-YHAT(I)
   ISN 0037            RESMU=RESMU+RESID(I)/N
   ISN 0038            RESVAR=RESVAR+RESID(I)**2
   ISN 0039         30 CONTINUE
   ISN 0040              RVAR=(RESVAR-N*RESMU**2)/N
   ISN 0041            R123S=1.-  RVAR/YVAR
   ISN 0042            R123=SQRT(R123S)
   ISN 0043            SEST=SQRT(RVAR)
   ISN 0044            Z(1)=X1M
   ISN 0045            Z(2)=X2M
   ISN 0046            Z(3)=YM
   ISN 0047            Z(4)=BYX1
   ISN 0048            Z(5)=BYX2
```

```
ISN 0049            Z(6)=RESMU
ISN 0050            Z(7)=RVAR
ISN 0051            Z(8)=SEST
ISN 0052            Z(9)=R123S
ISN 0053            Z(10)=YM-BYX1*X1M-BYX2*X2M
ISN 0054            RETURN
ISN 0055            END
```

```
                    *****F O R T R A N   C R O S S   R E F E R E N C E   L I S T I N G*****
SYMBOL  INTERNAL STATEMENT NUMBERS
I       0013  0014  0015  0016  0018  0019  0020  0021  0021  0022  0022  0023  0023  0024  0034  0035  0035  0035  0036
        0036  0036  0037  0038
N       0002  0013  0014  0015  0016  0018  0026  0034  0037  0040  0040
Y       0002  0003  0016  0022  0023  0024  0036
Z       0002  0003  0044  0045  0046  0047  0048  0049  0050  0051  0052  0053
X1      0002  0003  0014  0019  0021  0022  0035
X2      0002  0003  0015  0020  0021  0023  0035
YM      0006  0016  0016  0022  0023  0024  0035  0046  0053
YS      0011  0024  0024  0026
DNM     0029  0030  0031
X1M     0004  0014  0014  0019  0021  0022  0035  0044  0053
X1S     0007  0019  0019  0028  0029
X1Y     0009  0022  0022  0027  0028
X2M     0005  0015  0015  0020  0021  0023  0035  0045  0053
X2S     0008  0020  0020  0027  0029
X2Y     0010  0023  0023  0027  0028
BYX1    0030  0035  0047  0053
BYX2    0031  0035  0048  0053
RVAR    0040  0041  0043  0050
R123    0042
SEST    0043  0051
SQRT    0042  0043
X1X2    0012  0021  0021  0027  0028  0029
YHAT    0002  0003  0035  0036
YVAR    0026  0041
RESID   0002  0003  0036  0037  0038
RESMU   0032  0037  0037  0040  0049
R123S   0041  0042  0052
X1NUM   0027  0030
X2NUM   0028  0031
RESVAR  0033  0038  0038  0040
RGRTWO  0002
```

```
                    *****F O R T R A N   C R O S S   R E F E R E N C E   L I S T I N G*****
 LABEL   DEFINED   REFERENCES
   10    0017      0013
   11    0025      0018
   30    0039      0034
```

```
F128-LEVEL LINKAGE EDITOR OPTIONS SPECIFIED LET,LIST,MAP
          DEFAULT OPTION(S) USED -  SIZE=(131072,20480)
```

MODULE MAP

CONTROL SECTION

NAME	ORIGIN	LENGTH
MAIN	00	624A
ALPHA	6250	39A
AVAR	65F0	1C6
DATES	6788	190
FEB	6948	170
LIN	6A88	340
READAY	6DF8	606
SUM	7400	2CA
SMDY	7600	296
SUM123	7968	5BC
RGRTWO	7F28	580
IHOECOMH*	84A8	EB0
FIOAP# *	9358	6F4
IHOCOMH2*	9A50	9C5
IHOSSQRT*	A418	168
IHOFCVTH*	A580	A43
IHOEFNTH*	AFC8	800
IHOEFIOS*	B7C8	118C
IHOFIOS2*	C958	642
IHOUOPT *	CFA0	360
IHOFCONI*	D300	2FD
IHOFCONO*	D600	4C2
IHOERRM *	DAC8	624
IHOUATBL*	E0F0	638
IHOFTEN *	E728	198
IHOETRCH*	E8C0	2AE
RAW	EB70	36D84
MONTH	458F8	68
DATE	45960	28
DATEX	45988	20
SEASN	459A8	4B0

ENTRY

NAME	LOCATION	NAME	LOCATION	NAME	LOCATION	NAME	LOCATION
IBCOM#	84D4	IB081971	84D4	FDIOCS#	8590	INTSWTCH	9290
AP081971	97CC						
SEQDASD	9E0A						
SQRT	A418	IH$SQRT	A418				
ADCON#	A580	FCVAOUTP	A62A	FCVLOUTP	A6BA	FCVZOUTP	A816
FCVIOUTP	ABF0	FCVEOUTP	ACE2	FCVCOUTP	ACE2	INT6SWCH	AF44
ARITH#	AFC8	ADJSWTCH	B55C				
FIOCS#	B7C8	FIOCSBEP	B7CE				
FQCONI#	D300						
FQCONO#	D600						
ERRMON	DAC8	IHOERRE	DAE0				
FTEN#	E728						
IHOTRCH	E8C0	ERRTRA	E8C8				

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   NAME    ORIGIN  LENGTH                NAME   LOCATION     NAME   LOCATION     NAME   LOCATION     NAME   LOCATION

 TEMP       45E58     1E0
 CORR       46038     1E0


ENTRY ADDRESS       00
TOTAL LENGTH     46218

****MAIN      DOES NOT EXIST BUT HAS BEEN ADDED TO DATA SET


 BASIN 1935   PRECIPITATION STATION 1284   PREDICTION SEASON JAN 16-JAN 23
 WINTER STARTS NOV  1   TEST-SEAS  LENGTH  2 DAYS  FORECAST JAN 15
    FIRST YEAR 53    FORECASTS BEGIN 62    LAST YEAR 78          HMSM01
   TEMPERATURE STATION 8009     RMAX=   0.

    METHOD=  2  1 1 1      TEST-SEAS LENGTH   2 DAY(S)

STEP 4 TEST SEASON  TEMPERATURE CORRECTION OUT

PREDICTED RUNOFF BASED ON NORMAL WEATHER

   PREDICTION SEASON  JAN 16-JAN 23  1978

   RUNOFF PREDICTION  13345. CFS-DAYS,     % OF MEAN  56.
   STANDARD ERROR     11424. CFS-DAYS  FRACTION OF MEAN= 0.48

   95 % CONFIDENCE     0.  CFS-DAYS  % OF MEAN=   0.

   STANDARD DEVIATION  13960. CFS-DAYS      CV=  0.586

   1953-1977 MEAN   23680. CFS-DAYS      CP SINCE 1962  0.330

   WINTER SEASON NOV 1-JAN12
        WINTER PRECIP, % OF MEAN 111.  MEAN= 23.71 INCHES
        WINTER RUNOFF,% OF MEAN 126.    MEAN 209687. CFS-DAYS
        WINTER TEMP,DIFF FROM MEDIAN-1.83     MEDIAN= 28.23 DEGREES


PREDICTED RUNOFF BASED ON WEATHER FORECAST  AND BEST CP OF VERIFICATION PERIOD

   PROJECTED RUNOFF  18329. CFS-DAYS   % OF MEAN=  77.

   PRECIPITATION FORECAST(% OF MEAN)   36.  MEAN=  2.64 INCHES

   TEMP FORECAST(DELTA DEGREES F) MAX=   3.3  MIN=   6.4 DEGREES F

    PRED SEAS--AVE MAX=  29.3 --AVE MIN=  21.3 DEGREES F

   CP FOR PERFECT WEATHER  FORECAST   0.622

   STEP 4 PREDICTION =   18329.

   STEP 5 PREDICTION =   15237.
   TEMP REGRESSED FIRST,ONLY TEMP SIGNIFICANT
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BASIN 1935 PRECIPITATION STATION 1284 PREDICTION SEASON JAN 16-JAN 23
WINTER STARTS NOV 1 TEST-SEAS LENGTH 2 DAYS FORECAST JAN 15
FIRST YEAR 53 FORECASTS BEGIN 62 LAST YEAR 78 HMSM01
TEMPERATURE STATION 8009 RMAX= 0.

METHOD = 1 1 1

PRINT OPTION NO 2, PRECIP,TEMP AND RUNOFF DATA

YEAR	PW	TW	PT	RT	RWT	TB(T)	DT(T)	TB(S)	DT(S)	PS	RS
TS LENGTH = 2 DAYS											
1962	22.89	26.67	0.46	3775.	205264.	22.5	7.0	12.6	11.4	0.60	9084.
										26.	46.
1963	22.28	30.41	0.09	2618.	261005.	24.8	8.5	22.4	13.0	0.04	7244.
										2.	39.
1964	24.04	28.70	0.82	3341.	257077.	24.8	4.5	24.8	6.4	4.26	17809.
										186.	97.
1965	21.77	25.20	0.38	1989.	145295.	40.3	13.5	25.6	3.8	0.84	21504.
										39.	115.
1966	21.70	29.91	1.29	9989.	194463.	33.0	5.0	22.0	9.3	0.44	11906.
										21.	66.
1967	25.70	31.56	0.94	5115.	252272.	34.5	6.0	25.8	5.9	3.96	21715.
										182.	118.
1968	19.86	28.78	2.33	17998.	209606.	29.3	5.5	36.1	9.6	3.38	55556.
										150.	268.
1969	26.47	25.21	0.62	2533.	215322.	20.3	5.5	11.6	5.4	0.98	9105.
										45.	45.
1970	14.91	28.75	2.05	4574.	134721.	30.5	8.0	27.5	8.5	4.37	29526.
										190.	144.
1971	23.07	26.07	0.21	2081.	144933.	14.3	6.5	29.9	6.8	4.98	29997.
										204.	142.
1972	24.44	27.43	0.08	1896.	146344.	23.0	7.0	29.2	6.4	5.48	26093.
										211.	122.
1973	21.71	25.51	1.48	12040.	204839.	37.0	10.0	26.7	6.1	1.70	19029.
										67.	90.
1974	24.98	24.84	3.28	15104.	206780.	29.3	17.5	28.1	6.6	4.42	55333.
										168.	243.
1975	27.82	30.18	0.62	2442.	196789.	30.8	3.5	35.7	10.4	3.85	30473.
										143.	132.
1976	32.21	28.49	1.47	4140.	349217.	24.5	8.0	31.6	10.6	1.83	26719.
										69.	115.
1977	9.70	31.76	0.39	2001.	133458.	32.0	4.0	34.3	9.1	2.21	34144.
										84.	144.
1978	26.31	26.40	0.03	3918.	264506.	28.8	4.5	30.1	4.9	0.95	0.
										34.	0.
AVE	22.93	27.99	0.97	5390.	207170.	28.2	7.3	24.9	7.6	2.55	23837. OVER VERIFICATION PERIOD
MEAN	22.85	28.23	0.86	5712.	209687.	27.4	7.0	25.3	7.9	2.64	23680. OVER TOTAL PERIOD

TEMP REGRESSED FIRST,ONLY TEMP SIGNIFICANT

BASIN 1935 PRECIPITATION STATION 1284 PREDICTION SEASON JAN 16-JAN 23
WINTER STARTS NOV 1 TEST-SEAS LENGTH 2 DAYS FORECAST JAN 15
FIRST YEAR 53 FORECASTS BEGIN 62 LAST YEAR 78 HMSM01
TEMPERATURE STATION 8009 RMAX= 0.

METHOD = 1 1 1

PRINT OPTION NO 3 , PREDICTIONS AND ERRORS / % OF OBSERVED

YEAR	ET	RS(1)	ES(1)	RS(2)	ES(2)	RS(3)	ES(3)	RS(4)	ES(4)	RS(5)	ES(5)
TS LENGTH = 2 DAYS											
1962	10668.	29915.	20831.	20898.	11814.	14746.	5662.	13116.	4032.	12466.	3382.
		329.	230.		162.		144.		137.		
1963	-50946.	-34929.	-42173.	8793.	1549.	973.	-6271.	19455.	12211.	18276.	11032.
		-482.	121.		13.		269.		252.		
1964	-28662.	-9618.	-27427.	14776.	-3033.	17169.	-640.	14296.	-3513.	15352.	-2457.
		-54.	83.		96.		80.		86.		
1965	67679.	85289.	63785.	27243.	5739.	29201.	7697.	24779.	3275.	21590.	86.
		397.	127.		136.		115.		100.		
1966	12431.	37134.	25228.	26197.	14291.	37885.	25979.	25978.	14072.	22504.	10598.
		312.	220.		318.		218.		189.		
1967	-13036.	5060.	-16656.	16664.	-5051.	22046.	331.	16220.	-5495.	17698.	-4017.
		23.	77.		102.		75.		82.		
1968	-18614.	14948.	-40608.	31583.	-23973.	33490.	-22066.	50599.	-4957.	51332.	-4224.
		27.	57.		60.		91.		92.		
1969	32092.	49078.	39973.	19584.	10479.	15527.	6422.	-1965.	-11070.	-6079.	-15184.
		539.	215.		171.		-22.		-67.		
1970	19202.	54602.	25076.	36629.	7103.	35879.	6353.	42646.	13120.	46050.	16524.
		185.	124.		122.		144.		156.		
1971	71657.	87138.	57141.	19638.	-10359.	6828.	-23169.	26069.	-3928.	28017.	-1980.
		290.	65.		23.		87.		93.		
1972	77508.	92069.	65976.	21529.	-4564.	18009.	-8084.	26812.	719.	28914.	2821.
		353.	83.		69.		103.		111.		
1973	-6605.	20285.	1256.	26225.	7196.	24828.	5799.	28133.	9104.	26274.	7245.
		107.	138.		130.		148.		138.		
1974	16689.	55113.	-220.	40131.	-15202.	18415.	-36918.	43792.	-11541.	44597.	-10736.
		100.	73.		33.		79.		81.		
1975	46893.	66438.	35965.	24740.	-5733.	26853.	-3620.	42525.	12052.	43367.	12894.
		218.	81.		88.		140.		142.		
1976	-81226.	-54539.	-81258.	17111.	-9608.	16451.	-10268.	27222.	503.	25031.	-1688.
		-204.	64.		62.		102.		94.		
1977	-38636.	-20444.	-54588.	14067.	-20077.	16800.	-17344.	26002.	-8142.	24101.	-10043.
		-60.	41.		49.		76.		71.		
1978	-29361.	-13184.	-13184.	13345.	13345.	16017.	16017.	18329.	18329.	15237.	15237.
		-60.	41.		49.		76.		71.		
RMSE			43531.		11424.		15396.		8587.		8799.
SEF			1.826		0.479		0.646		0.360		0.369
SEFX =			1.719		0.451		0.608		0.339		0.347
CV = 0.586	CP=	-8.723			0.330		-0.216		0.622		0.603

TEMP REGRESSED FIRST,ONLY TEMP SIGNIFICANT

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 BASIN 1935   PRECIPITATION STATION 1284   PREDICTION SEASON JAN 16-JAN 23
 WINTER STARTS NOV  1   TEST-SEAS  LENGTH  2 DAYS  FORECAST JAN 15
    FIRST YEAR 53    FORECASTS BEGIN 62    LAST YEAR 78          HMSM01
   TEMPERATURE STATION 8009     RMAX=   0.

   PRINT OPTION NO 4 ,  ROOT MEAN SQUARE ERRORS

PRED SEAS      WINTER      TL            RMSE1  RMSE2  RMSE3  RMSE4  RMSE5
                  SEASON   METH

JAN16-JAN23  NOV 1-JAN12    2          43531. 11424. 15396.  8587.  8799. 1 1 1
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 BASIN 1935   PRECIPITATION STATION 1284   PREDICTION SEASON JAN 16-JAN 23
 WINTER STARTS NOV  1   TEST-SEAS  LENGTH  2 DAYS  FORECAST JAN 15
    FIRST YEAR 53    FORECASTS BEGIN 62    LAST YEAR 78          HMSM01
   TEMPERATURE STATION 8009     RMAX=   0.

    PRINT OPTION NO 5 ,  ACCURACY IMPROVEMENT AND CP

PRED SEAS      WINTER       TL    IMPROVEMENT IN ACCURACY/ COEFF OF PRED
                SEASON              STEP 1  STEP 2  STEP 3  STEP 4  STEP 5
                                     CP1     CP2     CP3     CP4     CP5  METH STEP 3

JAN16-JAN23  NOV 1-JAN12   2                  73.8   -34.8    24.8    -2.5
                                    -8.723   0.330  -0.216   0.622   0.603 1 1 1  OUT          0.622

PRED SEAS      WINTER       TL       PW     PWT    PWT     AT      TS      PS      ET
                                      RWT    RWT   RWTS    ES2     ES3     ES4     ES METH

JAN16-JAN23  NOV 1-JAN12   2      0.495  0.503  0.507  0.042   0.642   0.081   0.922 1 1 1

1962    7876. 34573.   7675. 34307.   7162. 65856.       0.      0.*******       0. -433.    1196. 0.858
          0.614          0.608          0.610           0.744           0.926           0.057  0.842
1963    7775. 41497.   7442. 44722.   6984. 73840.       0.      0.*******       0. -948.    2981. 0.851
          0.544          0.522          0.547           0.706           0.851           0.204  0.869
1964    7951. 39880.   7629. 42616.   7172. 71726.       0.      0.*******       0.-1416.    4379. 0.858
          0.540          0.522          0.544           0.713           0.842           0.284  0.879
1965    8264. 27563.   7984. 29244.   7513. 58865.       0.      0.*******       0.-1388.    4084. 0.880
          0.479          0.470          0.484           0.707           0.839           0.280  0.913
1966    8321. 25386.   8009. 27362.   7547. 56279.       0.      0.*******       0.-1819.    5723. 0.890
          0.482          0.467          0.475           0.359           0.732           0.357  0.910
1967    8495. 22284.   8169. 24360.   7779. 51948.       0.      0.*******       0.-2040.    6164. 0.894
          0.500          0.487          0.498           0.358           0.709           0.391  0.908
1968    8261. 28757.   8148. 25111.   7559. 59635.       0.      0.*******       0.-2121.    6192. 0.919
          0.490          0.487          0.459           0.345           0.787           0.410  0.882
1969    7773. 38028.   7708. 33704.   6983. 70891.       0.      0.*******       0.-1841.    4644. 0.936
          0.461          0.461          0.412           0.352           0.741           0.252  0.885
1970    8261. 26004.   8373. 16592.   7544. 56452.       0.      0.*******       0.-1145.    3752. 0.942
          0.544          0.532          0.482           0.348           0.691           0.085  0.886
1971    8117. 25471.   8370. 13164.   7541. 53510.       0.      0.*******       0.-1049.    3648. 0.910
          0.472          0.478          0.441           0.225           0.696           0.077  0.896
1972    7635. 32487.   8067. 16627.   7264. 56681.       0.      0.*******       0. -958.    3488. 0.899
          0.389          0.410          0.380           0.191           0.696           0.072  0.909
1973    7617. 33209.   8066. 16696.   7264. 56611.       0.      0.*******       0.-1113.    4112. 0.898
          0.388          0.410          0.380           0.191           0.673           0.093  0.909
1974    7489. 35330.   7484. 28680.   7268. 56539.       0.      0.*******       0.-1360.    4396. 0.889
          0.383          0.382          0.399           0.029           0.657           0.127  0.901
1975    6790. 49275.   6849. 41826.   6757. 67110.       0.      0.*******       0.-1219.    4421. 0.882
          0.340          0.343          0.370           0.032           0.601           0.092  0.901
1976    8539. 11994.   8569.  3443.   8579. 26453.       0.      0.*******       0.-1216.    4588. 0.893
          0.466          0.478          0.506           0.029           0.606           0.089  0.916
1977    7690. 32821.   7611. 27809.   7378. 56995.       0.      0.*******       0.-1157.    4190. 0.904
          0.495          0.503          0.507           0.042           0.642           0.081  0.922
1978    7690. 32821.   7611. 27809.   7378. 56995.       0.      0.*******       0.-1157.    4190.-0.000
          0.495          0.503          0.507           0.042           0.642           0.081  0.922

RSQ       0.495          0.503          0.507           0.042           0.642           0.081      0.922
 CP                     -8.723          0.330          -0.216           0.622           0.603
    TEMP REGRESSED FIRST,ONLY TEMP SIGNIFICANT
 JAN16-JAN23  NOV 1-JAN12   2       36.***** -13184.  13345.  16017.  18329.  15237.
        OBSERVED=          0.     0. %    CP=   -8.723   0.330  -0.216   0.622   0.603
                      PREDICTED,% OF MEAN=      -56.     56.     68.     77.     64. 1 1 1
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