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Recommended Citation

James, W. Robert; Bowles, David S.; and Kottegoda, Nath T., "A User's Manual for Computer Programs Used in: Model Choice: An Operational Comparison of Stochastic Streamflow Models for Droughts" (1981). *Reports*. Paper 320.

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A USER'S MANUAL FOR COMPUTER PROGRAMS USED IN:
MODEL CHOICE: AN OPERATIONAL COMPARISON
OF STOCHASTIC STREAMFLOW MODELS FOR DROUGHTS

by

W. Robert James
David S. Bowles
Nath T. Kottegoda

The work upon which this publication is based was supported in part by funds provided by the Office of Water Research and Technology (Agreement No. 14-34-001-9047), U.S. Department of the Interior, Washington, D.C., as authorized by the Water Research and Development Act of 1978.

WATER RESOURCES PLANNING SERIES
UWRL/P-81-03

Utah Water Research Laboratory
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June 1981

APPENDIX A

User Manual for Streamflow Generation Comparative
Analysis of Results Program

Table A.1. Description of input formats.

Data Segment	Card No. in Data Segment	Format	Symbol	Description
PROGRAM				
MAUT				
Annual and seasonal generation models	1	Format Free	NR	Number of data values in the time series to be generated
	1	Format Free	MAN	Number of synthetic traces NR in length to be generated (MAXIMUM 50)
	1	Format Free	LL	Output option for writing statements = 0: write out various program results = 1: do not write program results except for summary results
	1	Format Free	NJ	Model number for stochastic generation technique = 1: AR2 model (autoregressive 2nd order) = 2: AMAK model (ARMA-Markov) = 3: BKL model (Broken Line) = 4: FFGN model (Fast fractional Gaussian noise) = 5: ARMA model (ARMA(1,1))
	1	Format Free	IHIS	Program option for disaggregation analysis = 0: compare synthetic generated time series = 1: compare historic time series after disaggregation

Table A.1. Continued.

Data Segment	Card No. in Data Segment	Format	Symbol	Description
	1	Format Free	LN	Number of lines to print out in disaggregation model
	2	Format Free	TITLE	Title of the watershed and generation technique used
	3	Format Free	MODEL PARAMETERS	Depending on which model, NJ, chosen, parameters are input respectively
PROGRAM MAUT				
AR2 model	3	Format Free	R1	lag-one autocorrelation coefficient
	3	Format Free	R2	lag-two autocorrelation coefficient
AMAK model	3	Format Free	C1	model weighting parameter
	3	Format Free	C2	model weighting parameter
	3	Format Free	AM	Markov model lag-one autocorrelation coefficient
	3	Format Free	PH	ARMA autoregressive parameter,
	3	Format Free	TH	ARMA moving average parameter,
BKL model	3	Format Free	B	quality parameter, use 3

Table A.1. Continued.

Data Segment	Card No. in Data Segment	Format	Symbol	Description
	3	Format Free	H	model parameter, Hurst coefficient, use K estimate
	3	Format Free	A	model parameter, a_1 , calibrated to $\rho(1)$, K, N
BKL model	3	Format Free	MR1	Sets $A_0 = A_1$ if $\rho(1)$ is > than maximum of Eq. 4.50
FFGN model	3	Format Free	CZ	Model parameter, lag-one autocorrelation, $\rho(1)$
	3	Format Free	H	model parameter, Hurst coefficient, use K estimate
	3	Format Free	B	quality parameter, use 2
	3	Format Free	N	model parameter, number of summations, use 10 or 20
ARMA model	3	Format Free	PH	model parameter, autoregressive term, ϕ
	3	Format Free	TH	model parameter, moving average term, θ

Table A.2. Sample input.

65, 50, 1, 3, 0, 0

BLACKSMITH FORK

3, .76, 5, 1.151, 1

Table A.3. Sample output.

```

NPROB5, NANN54, LL=1, NJ=3, INIS=0, LNE=0,
S2=3.0, M=10.76, K=5, AA=1.157,
MEAN = 92649.97 STD DEV = 11380.74

TYPE B RESSEMBLANCE STATISTICS FOR 50 SEQUENCES

BRUEN LINE MODEL
BLAC=SMITH FINAL
NY=# OF MONTHS,
NZ=# OF PREVIOUS SEASONS,
NY=# OF YEARS,
IZ= COUNTER # FOR STARTING PREVIOUS SEASON,
NOT=1 IF NO TRANSFORM, NOT=0 IF TRANSFORM,
IMTS=1 THEN READ HISTORIC TIME SERIES,
IVS=1, THEN VALENCIA-SCHAAKE DISAG,
LN= LINE # TO PRINT OUT GEN. YRS IN MONTH S/R,
NY=12, NZ=1, NPROB5, IZ=12, NOT=0, INIS=0, NTRACE=50, INR=1, IVS=1, LN=0, AL=0.333, NCL=0, ISTART=1979,
INITIAL VALUES OF PREVIOUS YEARS MONTHS =/O MEAN SUB,
.2980E+04
AL=0.333, DSEED=308151841.0,
TRANSFORMED ANNUAL AND MONTHLY MEANS,
130.616624922, 15.4982964379, 49.9057706532, 48.4082006473, 47.4865023643, 47.2004964076, 45.8327677541, 50.9549616936,
65.384478623, 73.353836256, 60.240578556, 54.0138180896, 52.1946868134, 50.0113527409, 5.27908622538, 4.5319605347, 4.35426213311,
4.20495223895, 3.83225119577, 6.1117360296, 12.0951981324, 15.196224514, 9.9137717541, 7.312025057, 6.5801925265, 5.6610584966,
A MATRIX,
C MATRIX,
NPROB5, NY=12, NTRACE=50, INR=1, ISTART=1979, NCL=0,
ODOWN CROSSINGS TOTAL DEFICIT RUN LENGTHS AND SUMS
CROSSINGS 41
TOTAL RUN LENGTH 79
TOTAL RUN SUM 32069.81
DEFICIT RUN LENGTHS AT CROSSING LEVEL ARE 1 1 2 1 3 2 2 2 2 2 2 2 2 1 1 4 3 2 2 2
2 1 2 2 2 2 3 2 2 1 2 1 2 2 2 2 2 2 2 2
DEFICIT RUN SUMS AT CROSSING LEVEL ARE 32.26 581.02 1785.53 1361.10 634.17
4.22 70.50 511.35 66.23 1057.34 1567.26 521.65 1600.93 993.00 1005.69
1357.82 689.57 1588.86 151.05 156.45 2901.26 1980.19 704.18 786.08 694.64
654.25 145.29 770.55 724.86 479.78 282.63 1795.92 657.62 1034.05 149.40
294.73 35.87 317.51 1299.13 400.31 484.95 532.90 575.27 1364.50 1069.42
692.57
MEAN ST. DEV. MAX MIN R/MAX
RUN LENGTH 1.93 0.61 4.00 1.00 4.00
RUN SUM .7822E+03 .6188E+03 .2961E+04 .4218E+01 .2961E+04
GEN. ANNUAL STATISTICS,
A=92612.038007, DS=31327.6232022, SK=0.161279246166, H=0.61462743711,
MXX,
.5002E+00 .5419E+00 .6157E+00 .6913E+00 .7034E+00 .7160E+00 .7686E+00 .9150E+00 .9113E+00 .9797E+00 .9427E+00 .4775E+00
BY GENERATED,
LAG 1 SERIAL CORR.,
MBC=0.493734376527,
LAG 1 SERIAL CORR. GENERATED,
EXP=0.1320381908,
COMPARISON MONTHLY MEANS
*****
OCTOBER NOVEMBER DECEMBER JANUARY FEBRUARY MARCH APRIL MAY JUNE JULY AUGUST SEPTEMBER
*****

```


Table A.3. Continued.

HISTORIC STATISTIC												
AVERAGE GENERATED STATISTIC	5672.31	5176.02	5043.23	4810.15	4416.00	6041.23	13059.45	14538.31	10117.08	7463.69	6526.92	5744.54
STAN. DEV. OF AVER. GEN. STAT.												
	202.03	161.74	147.40	124.29	106.67	140.17	451.96	615.88	220.07	62.10	46.69	43.48
MAXIMUM GEN. STATISTIC												
MINIMUM GEN. STATISTIC	6143.83	5547.31	5468.43	5170.25	4652.86	6540.66	14514.94	19717.23	10630.22	7620.70	6654.53	5835.70
MEAN DEVIATION STATISTIC												
ST. DEV. OF DEV. STATISTIC	0.01	0.01	0.00	0.09	0.00	0.00	-0.01	0.00	-0.00	-0.00	-0.00	-0.00
COMPARISON OF MONTHLY STAN. DEV.												
	OCTOBER	NOVEMBER	DECEMBER	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER
HISTORIC STATISTIC												
AVERAGE GENERATED STATISTIC	1456.57	1337.47	1263.83	1200.25	1030.84	2270.69	6844.98	10310.07	4716.27	2739.80	2260.21	1854.68
STAN. DEV. OF AVER. GEN. STAT.												
	156.60	123.30	120.71	101.09	85.29	159.72	513.00	731.17	266.07	72.23	56.41	47.69
MAXIMUM GEN. STATISTIC												
MINIMUM GEN. STATISTIC	2093.81	1665.96	1530.56	1445.51	1257.82	2504.43	8036.76	11927.60	5123.27	2918.24	2403.41	1962.19
MEAN DEVIATION STATISTIC												
ST. DEV. OF DEV. STATISTIC	-0.03	-0.03	-0.03	-0.02	-0.01	0.10	0.04	0.02	0.05	0.00	-0.00	-0.01
COMPARISON OF MONTHLY SKEWS												
	OCTOBER	NOVEMBER	DECEMBER	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER
HISTORIC STATISTIC												
AVERAGE GENERATED STATISTIC	0.37	0.24	0.24	0.43	0.40	2.28	0.99	0.72	1.08	0.52	0.48	0.45
STAN. DEV. OF AVER. GEN. STAT.												
	0.36	0.34	0.39	0.37	0.36	0.36	0.46	0.42	0.40	0.37	0.37	0.37
MAXIMUM GEN. STATISTIC												
MINIMUM GEN. STATISTIC	1.34	1.12	1.33	1.32	1.03	1.43	1.74	1.67	1.48	1.07	0.97	1.02
MEAN DEVIATION STATISTIC												
ST. DEV. OF DEV. STATISTIC	-0.17	-0.24	-0.39	-0.58	-0.65	-0.32	-0.11	-0.01	-0.40	-0.56	-0.60	-0.69
MONTHLY CROSSING PROPERTIES												
CROSSING PROPERTIES												
	HIST	MEAN	ST. DEV.	MAXIMUM	MINIMUM	MEAN DEV	ST. DEV.					
MEAN CROSSINGS PER 65 YEARS		46.00	42.20	2.64	47.00	38.00						
MEAN RUN LENGTH		2.02	1.99	0.08	2.17	1.83	0.01	0.04				
STL DEV OF THE RUN LENGTHS		0.65	0.77	0.16	1.50	0.56						
MEAN RUN SUM		470.1	921.4	81.9	1050.8	753.3	-0.1	0.1				

Table A.3. Continued.

STDEV OF THE RUN SUMS	674.1	785.9	123.4	1235.4	580.4		
*****	*****	*****	*****	*****	*****	*****	*****
LOOP LOSS FUNCTION	HIST	MEAN	ST. DEV.	MAXIMUM	MINIMUM	MEAN DEV	ST. DEV.
TOTAL YIELD	.1846E+08	.1874E+08	.2578E+06	.1932E+08	.1796E+08	-0.0059	0.0138
TOTAL BENEFIT	.4540E+08	.4591E+08	.6310E+06	.4732E+08	.4400E+08	-0.0050	0.0138
ANNUAL AVERAGE YIELD	.2868E+06	.2883E+06	.3960E+04	.2972E+06	.2763E+06	-0.0050	0.0138
ANNUAL ST DEV YIELD	.1471E+06	.1435E+06	.4621E+04			0.0243	0.0314
ANNUAL AVFRAGE BENEFIT	.7028E+06	.7063E+06	.9717E+04	.7260E+06	.6769E+06	-0.0050	0.0138
ANNUAL ST DEV BENEFIT	.3604E+06	.3517E+06	.1132E+05			0.0243	0.0314
RFSFRVOIP SIZF	3641.95	5268.23	1623.46	8924.65	2261.48	-0.45	0.45
PKUR LESS THAN RESEPOVIR SIZE	ANN CROP YIELD	ANN CROP BENEF	MAX RUN LENGTH	RUN/MAX SUM	MAX RUN SUM	SUM/MAX RUN	
HISTORIC	.364195114E+04	.286843707E+06	.702707082E+06	.40000000E+01	.40000000E+01	.235554657E+04	.235554657E+04
.190678431E-01	.226148022E+04	.276301029E+06	.676937499E+06	.40000000E+01	.30000000E+01	.215091780E+04	.192704954E+04
.392156863E-01	.251566883E+04	.281218434E+06	.688985104E+06	.40000000E+01	.30000000E+01	.226148023E+04	.210986560E+04
.588235294E-01	.297679126E+04	.282470434E+06	.692052564E+06	.40000000E+01	.40000000E+01	.237467063E+04	.215091780E+04
.784313725E-01	.341371901E+04	.283540304E+06	.694673745E+06	.40000000E+01	.40000000E+01	.247590899E+04	.237467063E+04
.966392157E-01	.349907086E+04	.283712520E+06	.695095675E+06	.40000000E+01	.40000000E+01	.251566884E+04	.238714698E+04
.117647059E+00	.362325454E+04	.284012344E+06	.695830247E+06	.40000000E+01	.40000000E+01	.256676157E+04	.239436238E+04
.137254992E+00	.377579986E+04	.284511429E+06	.697053001E+06	.40000000E+01	.40000000E+01	.273582607E+04	.240422426E+04
.156862745E+00	.382764637E+04	.284524990E+06	.697086225E+06	.40000000E+01	.40000000E+01	.273878977E+04	.244950629E+04
.176470588E+00	.388654307E+04	.284561172E+06	.697174871E+06	.40000000E+01	.40000000E+01	.278635352E+04	.246868738E+04
.196678431E+00	.389934983E+04	.284717862E+06	.697558763E+06	.40000000E+01	.40000000E+01	.280470041E+04	.247590899E+04
.215686275E+00	.406951189E+04	.285230793E+06	.698815444E+06	.40000000E+01	.40000000E+01	.294537849E+04	.2481173129E+04
.235294118E+00	.418049361E+04	.285785567E+06	.700174639E+06	.40000000E+01	.40000000E+01	.295620137E+04	.254255040E+04
.254961961E+00	.423800948E+04	.285805647E+06	.700223835E+06	.40000000E+01	.40000000E+01	.296125531E+04	.256876157E+04
.274569804E+00	.429032049E+04	.286318061E+06	.701479250E+06	.40000000E+01	.40000000E+01	.297929057E+04	.264368801E+04
.294117647E+00	.434408597E+04	.286557106E+06	.702064911E+06	.40000000E+01	.40000000E+01	.303112392E+04	.266854750E+04
.313725490E+00	.436201546E+04	.286701940E+06	.702419752E+06	.40000000E+01	.40000000E+01	.303551426E+04	.268633084E+04
.333333333E+00	.450903644E+04	.286945043E+06	.703015350E+06	.40000000E+01	.40000000E+01	.303965143E+04	.270882865E+04
.352941176E+00	.452615963E+04	.287130594E+06	.703469954E+06	.40000000E+01	.40000000E+01	.304989863E+04	.272524445E+04
.372549020E+00	.454805206E+04	.287384619E+06	.704002316E+06	.40000000E+01	.40000000E+01	.309167970E+04	.273582607E+04
.392156863E+00	.465704704E+04	.287416625E+06	.704170732E+06	.40000000E+01	.40000000E+01	.309851850E+04	.273878977E+04
.411764706E+00	.466050492E+04	.287588430E+06	.704591653E+06	.40000000E+01	.40000000E+01	.313905692E+04	.274299768E+04
.431372549E+00	.469576258E+04	.287690206E+06	.704841004E+06	.40000000E+01	.40000000E+01	.316938963E+04	.275619062E+04
.450980392E+00	.470178249E+04	.287738548E+06	.704959442E+06	.40000000E+01	.40000000E+01	.317512412E+04	.278876631E+04
.470588235E+00	.472364755E+04	.287743151E+06	.704979119E+06	.40000000E+01	.40000000E+01	.319054052E+04	.281090359E+04
.490196078E+00	.487628796E+04	.287942616E+06	.705459409E+06	.40000000E+01	.40000000E+01	.319645895E+04	.281192746E+04
.509803922E+00	.488598056E+04	.288031478E+06	.705677121E+06	.40000000E+01	.40000000E+01	.320361953E+04	.281271654E+04
.529411765E+00	.493851673E+04	.288112245E+06	.705875000E+06	.40000000E+01	.40000000E+01	.324526744E+04	.285574454E+04
.549619608E+00	.496321112E+04	.288216712E+06	.706136943E+06	.40000000E+01	.40000000E+01	.326242509E+04	.294787748E+04
.568627451E+00	.497855328E+04	.288293224E+06	.706318400E+06	.40000000E+01	.40000000E+01	.330912664E+04	.296125531E+04
.588235294E+00	.498210870E+04	.288340100E+06	.706555744E+06	.40000000E+01	.40000000E+01	.332418865E+04	.303259152E+04
.607843137E+00	.500847081E+04	.289131364E+06	.708371042E+06	.40000000E+01	.40000000E+01	.332798184E+04	.303965143E+04
.627450980E+00	.522461854E+04	.289138320E+06	.708388883E+06	.40000000E+01	.40000000E+01	.333765016E+04	.304989863E+04
.647058824E+00	.533665544E+04	.289143272E+06	.708401107E+06	.40000000E+01	.40000000E+01	.336199462E+04	.309851850E+04
.666666667E+00	.542832866E+04	.289227266E+06	.708595679E+06	.40000000E+01	.40000000E+01	.339096151E+04	.313407781E+04
.686274510E+00	.551469086E+04	.289293527E+06	.708769140E+06	.40000000E+01	.40000000E+01	.340492009E+04	.316179941E+04
.705882353E+00	.610809187E+04	.289736415E+06	.709854216E+06	.40000000E+01	.40000000E+01	.345175069E+04	.316938963E+04
.725490196E+00	.649437490E+04	.290156001E+06	.710882202E+06	.40000000E+01	.40000000E+01	.349907086E+04	.317512412E+04
.745098039E+00	.654377820E+04	.290208675E+06	.711101254E+06	.40000000E+01	.40000000E+01	.351879828E+04	.319645895E+04
.764758824E+00	.670438289E+04	.290608584E+06	.711199193E+06	.40000000E+01	.40000000E+01	.360936564E+04	.322892391E+04
.784313725E+00	.677553239E+04	.291407208E+06	.713947659E+06	.40000000E+01	.40000000E+01	.363850195E+04	.324526744E+04
.803921569E+00	.684467854E+04	.291756066E+06	.714802215E+06	.40000000E+01	.40000000E+01	.364948983E+04	.326242509E+04
.823529412E+00	.726246688E+04	.292323126E+06	.716191659E+06	.40000000E+01	.40000000E+01	.365202662E+04	.330912664E+04
.843137255E+00	.726354760E+04	.292817859E+06	.717403755E+06	.40000000E+01	.40000000E+01	.368959475E+04	.332418865E+04
.862745098E+00	.732246395E+04	.292848014E+06	.717575633E+06	.40000000E+01	.40000000E+01	.372154737E+04	.340492009E+04
.882352941E+00	.751277682E+04	.293903629E+06	.720064362E+06	.40000000E+01	.40000000E+01	.373371121E+04	.345175069E+04
.901960784E+00	.777001648E+04	.294514164E+06	.721559702E+06	.40000000E+01	.40000000E+01	.379744534E+04	.351879828E+04
.921568627E+00	.812969355E+04	.294573042E+06	.721581454E+06	.40000000E+01	.40000000E+01	.380677332E+04	.360936564E+04
.941176471E+00	.856797763E+04	.294600399E+06	.721991478E+06	.40000000E+01	.40000000E+01	.402109674E+04	.373371121E+04
.960784314E+00	.886406499E+04	.296135301E+06	.725531488E+06	.80000000E+01	.80000000E+01	.564001146E+04	.564001146E+04

Table A.3. Continued.

.980392157E+00	.892464525E+04	.297162194E+06	.728047375E+06	.800000000E+01	.800000000E+01	.654377820E+04 .654377820E+04

TOTAL MONTHLY DEVIATIONS,	MEAN	0.030	ST. DEV.	0.335	SKEW	6.410
TOTAL ALL						6.847

ANNUAL STATISTICS AVERAGED OVER NTRACF GEN.,						

ANNUAL STATS	MEAN	ST. DEV	SKEW	LAG ONE	MURST	

HISTORIC STATISTIC						
AVERAGE GENERATED STATISTIC	92640.92	31380.74	0.500	0.494	0.764	
STAN. DEV. OF AVER. GEN. STAT.	92612.18	31130.87	0.137	0.294	0.724	
MAXIMUM GEN. STATISTIC	347.70	493.77	0.367	0.146	0.076	
MINIMUM GEN. STATISTIC	93243.30	32491.86	1.241	0.543	0.853	
MEAN DEVIATION STATISTIC	91768.95	30107.92	-0.531	-0.029	0.459	

ST. DEV. OF DEV. STATISTIC	0.00	0.01	0.726	0.405	0.052	
TOTAL ANNUAL DEV.	0.00	0.02	0.734	0.296	0.100	

TOTAL ANNUAL DEV.	1.191			TOTAL FOR MODEL	8.038	

BROKEN LINE MODEL
BLACKSMITH FINAL

Table A.4. Program listing.

```

1 RESET FILE
2 SET AUTOBIND
3 BIND GGUBS FROM INSL/0
4 BIND USMNMK FROM INSL/0
5 BIND NDNMIS FROM INSL/0
6 BIND GGNML FROM INSL/0
7 BIND USPLM FROM INSL/0
8 BIND GGUBS FROM INSL/0
9 BIND MERFI FROM INSL/0
E BIND UGETIO FROM INSL/0
I BIND UERTST FROM INSL/0
FILE 8(KIND#RE#DTE,MAXRECSIZE#22)
FILE 19(TITLE# "CROP",KIND#DISK,MAXRECSIZE#20,BLOCKSIZE#600,AREASIZE#
#450,SAVEFACTOR#999,SECURITYTYPE#CLASSB,SECURITYUSE#10,AREAS#1000)
FILE 16(TITLE# "YGMUN",KIND#DISK,MAXRECSIZE#20,BLOCKSIZE#600,AREASIZE#
#450,SAVEFACTOR#999,SECURITYTYPE#CLASSB,SECURITYUSE#10,AREAS#1000)
FILE 17(TITLE# "YNGRT",KIND#DISK,MAXRECSIZE#20,BLOCKSIZE#600,AREASIZE#
#450,SAVEFACTOR#999,SECURITYTYPE#CLASSB,SECURITYUSE#10,AREAS#1000)
FILE 10(TITLE# "YGMNH",KIND#DISK,MAXRECSIZE#20,BLOCKSIZE#600,AREASIZE#
#450,SAVEFACTOR#999,SECURITYTYPE#CLASSB,SECURITYUSE#10,AREAS#1000)
FILE 12(TITLE# "TALTA",KIND#DISK,MAXRECSIZE#20,BLOCKSIZE#600,AREASIZE#
#450,SAVEFACTOR#999,SECURITYTYPE#CLASSB,SECURITYUSE#10,AREAS#1000)
FILE 18(TITLE# "WANNL",KIND#DISK,MAXRECSIZE#20,BLOCKSIZE#600,AREASIZE#
#450,SAVEFACTOR#999,SECURITYTYPE#CLASSB,SECURITYUSE#10,AREAS#1000)
FILE 11(TITLE# "TANUN",KIND#DISK,MAXRECSIZE#20,BLOCKSIZE#600,AREASIZE#
#450,SAVEFACTOR#999,SECURITYTYPE#CLASSB,SECURITYUSE#10,AREAS#1000)
FILE 13(TITLE# "A",KIND#DISK,MAXRECSIZE#20,BLOCKSIZE#600,AREASIZE#
#450,SAVEFACTOR#999,SECURITYTYPE#CLASSB,SECURITYUSE#10,AREAS#1000)
FILE 14(TITLE# "B",KIND#DISK,MAXRECSIZE#20,BLOCKSIZE#600,AREASIZE#
#450,SAVEFACTOR#999,SECURITYTYPE#CLASSB,SECURITYUSE#10,AREAS#1000)
FILE 15(TITLE# "C",KIND#DISK,MAXRECSIZE#20,BLOCKSIZE#600,AREASIZE#
#450,SAVEFACTOR#999,SECURITYTYPE#CLASSB,SECURITYUSE#10,AREAS#1000)
C SEASONAL STOCHASTIC HYDROLOGY GENERATION MODEL
C COMPARISON WITH HISTORIC AT CROSSING LEVELS AND RESERVOIR SIZE
C DISAGGREGATION OF ANNUAL TO MONTHLY AND A CROP PRODUCTION MODEL
C AR1=AUTOREGRESSIVE 1ST ORDER MODEL
C BK1=ARMA1 LINE MODEL
C FRAC=FAST FRACTIONAL GAUSSIAN NOISE MODEL
C FFG=FLDIN FROM FROM S/R
C FFG=HFF, HIGH FREQ MODEL S/R
C AMAR=AR1(MARKOV) MODEL
C CORP=SERIAL CORRELATION S/R
C HUNST=HUNST STATISTIC S/R
C CROSS=CROSSING PROPERTIES S/R
C DEFCIT=MAX NEGATIVE RUNS S/R
C STNS=MEAN, STD, DEV, S/R
C AR1 PARAMETERS P1
C BK1 PARAMETERS P2,PH,N2,AL,PR1
C FRAC PARAMETERS C2,M,P,NZ
C AMAR PARAMETERS C1,C2,AM,RAN,PH,IN
C NRM# OF YEARS GENERATED
L NAME OF FILES
L NAME OF SERIAL CORRELATIONS
C (L) IF * (F) IF NO WRITE
C (H) IF * (F) HISTORIC ANNUAL SERIES
C (R) IF * (F) SERIAL MEAN
C (S) IF * (F) STD, DEV
C (J) IF * (F) PARAMETERS SHOULD BE SPECIFIED MODELS

```

Table A.4. Continued.

```

COMMON/AE/ZA, NR, LL
COMMON/AB/DSEED, G, H
COMMON/E5/PH1, TH1
COMMON/E1/NZ, MH, AA, N, MRI
COMMON/E2/H, NZ, B, BQ, C2
COMMON/E3/R1
COMMON/E4/C1, C2, AM, RAM, PH, TH
COMMON/F1/BH, STD
COMMON/F2/GAM, H
COMMON/F3/AV, STT
COMMON/G4/IY, RS, JL
COMMON/GT/X, MAN, IHIS, LN, NCL, ISTART
COMMON/SCF/HHM, YTD, HSTD, SK, HHH, HSC
DIMENSION X(100,50)
DIMENSION N1(7), P(80,12), TAVE(50), TSTD(50)
DIMENSION ZA(200), CQ(20), COR(20), CHR(20), COO(50), HM(50)
*, TITLE(20)
REAL R(300), G(300), S(2000)
DOUBLE PRECISION DSEED
DSEED=123457.00
10  FORMAT(10I5)
20  FORMAT(10F5,0)
30  FORMAT(4F10,0)
    WRITE(8,35)
    WRITE(A,34)
38  FORMAT(1M, '1J, 1=AZ2, 2=AMAK, 3=BKL, 4=FRAC, 5=AKIM1, /)
35  FORMAT(1M, '1NR, MAN, LL, NJ, IHIS, LN1, /)
    READ(5, /) NR, MAN, LL, NJ, IHIS, LN
    WRITE(6, /) NR, MAN, LL, NJ, IHIS, LN
    WRITE(8,36)
36  FORMAT(1M, 'INPUT=TITLE', /)
    READ(5,37) (TITLE(I), I=1,18)
37  FORMAT(20A4)
    IF (IHIS.EQ.1) GOTO 80
    GOT:140,50,60,70,76), NJ
40  WRITE(8,35)
45  FORMAT(1M, 'ANI: INPUT=R1', /)
    READ(5, /) R1
    WRITE(6, /) R1
    GOTO 80
50  WRITE(8,55)
    READ(5, /) C1, C2, AM, RAM, PH, TH
55  FORMAT(1M, 'AMAK: INPUT=C1, C2, AM, RAM, PH, TH, /)
    WRITE(6, /) C1, C2, AM, RAM, PH, TH
    GOTO 80
60  WRITE(8,65)
65  FORMAT(1M, 'BKL: INPUT=BZ, HH, N, AA, MRI', /)
    READ(5, /) BZ, MH, N, AA, MRI
    WRITE(6, /) BZ, MH, N, AA, MRI
    GOTO 80
70  WRITE(8,75)
75  FORMAT(1M, 'FRAC: INPUT=CZ, H, B, NZ', /)
    READ(5, /) CZ, H, B, NZ
    WRITE(6, /) CZ, H, B, NZ
    GOTO 80
76  WRITE(8,77)
77  FORMAT(1M, 'ARINA: INPUT=PH1, TH1', /)
    READ(5, /) PH1, TH1
    WRITE(6, /) PH1, TH1
80  READ(17, /) YTD, VTD, STD, SK, HHH, HSC
    HBM=0

```

Table A.4. Continued.

```

      MSTD=STD
      WRITE(6,120) BH,STD
      IF(IHIS,EQ,1)GOTO 250
      WRITE(6,90) MAH
100  FORMAT(//'TYPE B RESEMBLANCE STATISTICS FOR',15,10H SEQUENCES)
      1Y=1
C  GENERATE BL VARIATES (TOTAL=NR) WITH PARAMETERS M,B,N,AA
110  FORMAT(3X,10F9,4)
      RN=FLOAT(08)
120  FORMAT(2X,8H MEAN = ,F12.2,11H STD DEV = ,F12.2)
130  FORMAT(2X,10F10,0)
      IF(NJ,EQ,1) WRITE(6,150)(TITLE(I),I=1,18)
      FORMAT(//,31H AUTOREGRESSIVE 1ST ORDER MODEL,/,20A4)
150  IF(NJ,EQ,2) WRITE(6,160)(TITLE(I),I=1,18)
      FORMAT(//,16H ARMA MARKOV MODEL,/,20A4)
160  IF(NJ,EQ,3) WRITE(6,170)(TITLE(I),I=1,18)
      FORMAT(//,18H HIDDEN LINE MODEL,/,20A4)
170  FORMAT(2X,2110)
180  IF(NJ,EQ,4) WRITE(6,190)(TITLE(I),I=1,18)
      FORMAT(//,37H FAST FRACTIONAL GAUSSIAN NOISE MODEL,/,20A4)
190  FORMAT(//,14RIMA(1,1) MODEL,/,20A4)
195  DO 250 I=1,MAH
      IF(NJ,EQ,1) CALL AR1
      IF(NJ,EQ,2) CALL ARK
      IF(NJ,EQ,3) CALL BKL
      IF(NJ,EQ,4) CALL FRAC
      IF(NJ,EQ,5) CALL ARMA
      DO 240 I=1,NR
      IF(ZA(I).LT.10,0)ZA(I)=10.
      X(I,1)=ZA(I)
240  CONTINUE
250  CONTINUE
      CALL SPLIT
      CALL CF
      IF(IHIS,EQ,1)GOTO 260
      IF(NJ,EQ,1) WRITE(6,150)(TITLE(I),I=1,18)
      IF(NJ,EQ,2) WRITE(6,160)(TITLE(I),I=1,18)
      IF(NJ,EQ,3) WRITE(6,170)(TITLE(I),I=1,18)
      IF(NJ,EQ,4) WRITE(6,190)(TITLE(I),I=1,18)
      IF(NJ,EQ,5) WRITE(6,195)(TITLE(I),I=1,18)
260  CONTINUE
      CLOSE(19,DISP=CRUNCH)
      STOP
      END

SUBROUTINE AR1
COMMON/AE/ZA,NR,LL
COMMON/AB/DSEED,G,H
COMMON/ES/K1
COMMON/FI/BI,STD
COMMON/IS/AV,STT
DIMENSION ZA(200),CO(20)
REAL R(300),G(300)
DOUBLE PRECISION DSEED
HT=NR+10
CALL G05ML(DSEED,HT,G)
R(1)=G(1)
STT=SIGN(1,G=H1+1)
DO 10 N=2,HT
10  R(N)=R(N-1)+STT*G(N)
DO 20 N=1,NR
20  ZA(N)=1+51*(R(N+10))
CALL SPLIT
DO 25 N=1,NR
25  ZA(N)=(ZA(N)-AV)/STT
DO 27 N=1,NR
27  ZA(N)=ZAC(2,ASIDAN)
IF(LL.EQ,0) WRITE(6,30) (ZA(I),I=1,NR)
30  FORMAT(2X,10F10,0)
RETURN
END

```

Table A.4. Continued.

```

SUBROUTINE HPL
COMMON/AB/ZA,MM,LL
COMMON/AB/DSEED,S,M
COMMON/E1/KZ,MM,AA,N,NRI
COMMON/F1/KM,STD
COMMON/F3/AV,STI
DIMENSION N(20),YAT(100,20),ZA(200),CO(20)
REAL H(50),G(40)
DOUBLE PRECISION DSEED
XIFLOAT(M)
N=KZ
M=KZ
MM=KZ
MM=MM*(2,MM=1,)*(2,MM=2,)*(2,MM=3,)*(2,MM=4,)*
*(2,MM=5,)/(6,*(2,*(5,2,MM)=1,))
MM=MM*(MM=1,)+MM*(1,MM)
C N(I) ARE HEIGHTS GIVEN TO SIMPLE BLS. KAK=K(0). BH AND BD ARE CONSTAN
S=0.0
DO 10 I=1,N
XIFLOAT(I)
N(I)=(AA*(2,*(MM=1,)))*MM*(MM*(MM*(2,*(MM=1,)*X(I=1,)))/(2,*(MM=1,))
S=S+N(I)
10 N(I)=SORT(N(I))
N=NSORT(I,S)
C N(I) ARE UNIFORM(0,1) RANDOM VARIATES
NT=10
ST=1.0
DO 20 I=1,NT
R(I)=GUMPS(DSEED)
30 FORMAT(3A,10F9.4)
IF(ALL,NE,0) GO TO 40
WRITE(6,40) AA, (I(I),I=1,N)
40 FORMAT(1H,2X,10M BL HEIGHTS ARE ,10F9.4)
WRITE(6,30) BH,BD,AA
WRITE(6,50) NT
50 FORMAT(1H,2X,15,2M RANDOM 0 1 UNIFORM VARIATES)
WRITE(6,30) (N(I),I=1,NT)
60 CONTINUE
C I=INDEX FOR SIMPLE BLS (TOTAL N2MM+1) TO BE SUMMED AT TIMES T=1,2,3,
C L=INDEX FOR GAUSSIAN RANDOM DEVIATES G(L) (MAXIMUMNT) SPACED AT
C INTERVALS DA, THE FIRST IS AT T=PA=K(I)*DA.
C M=1,2,3,... IS INDEX NUMBER OF GENERATED BL VARIATES.
N2=MM+1
I=1
DO 70 M=1,N2
IF(I,LE,1) G=AV
IF(I,LE,1,AND,MM,EG,1) D=AA
IF(I,LE,2) D=AA
IF(I,GT,2) D=AA*(MM=1,2)
T=(X(I)-M)/DA+5.0/2.0
NT=2*FIX(T)
USE(D=SF,100.0)
C GUMML GENERATES NT RANDOM U(0,1) DEVIATES IN ARRAY G.
CALL GUMML(DSEED,NT,G)
IF(ALL,NE,0) GO TO 90
WRITE(6,80) NT
80 FORMAT(3A,15,2M RANDOM 0 1 NORMAL DEVIATES)
WRITE(6,30) (G(I),I=1,NT)
90 CONTINUE
L=1
F=PA*(M(I))

```

Table A.4. Continued.

```

SUBROUTINE AMAX
COMMON/AE/ZA,NR,LL
COMMON/AR/DSEED,G,R
COMMON/EA/C1,C2,AM,PH,TH
COMMON/F1/BM,STD
COMMON/F3/AV,STI
DIMENSION ZA(200),CO(20)
REAL R(300),G(300)
DOUBLE PRECISION DSEED
NT=NR+10
CALL GGNML(DSEED,NT,G)
SA=SQRT(C1*(1.0-AM+AM))
SB=SQRT(C2*(1.0-PH+PH)/(1.0+TH+TH-2.0+PH+TH))
R(1)=G(1)
DO 10 N=2,NT
10  R(N)=AM*R(N-1)+SA*G(N)
CALL GGNML(DSEED,NT,G)
ZA(1)=G(1)
DO 20 N=2,NT
20  ZA(N)=PH*ZA(N-1)+TH*SB*G(N-1)+SB*G(N)
IF(LL.EQ.0) WRITE(6,30) C1,C2,AM,PH,TH,PH
30  FORMAT(4H C1=,F5.2,3H C2=,F5.2,6H PH=,F5.2,7H PH=,F5.2,4H TH=,
*F5.2,4H PH=,F5.2)
DO 40 N=1,NR
40  ZA(N)=RM+STD*(ZA(N+10)+R(N+10))
CALL STN
DO 45 N=1,NP
45  ZA(N)=(ZA(N)-AV)/STI
DO 47 N=1,NR
47  ZA(N)=ZA(N)*STD+RM
IF(LL.EQ.0) WRITE(6,50) (ZA(I),I=1,NR)
50  FORMAT(2Y,10F10.0)
RETURN
END

100  AM=LEAST(1)
110  IF(AM,1,1) GO TO 120
FA=FA+DA
L=L+1
GO TO 110
120  YA(M,I)=(G(L-1)+(G(L)-G(L-1))*(AM-FA+DA)/DA)*STA
IF(L.E.1) YA(M,I)=YA(M,I)*NA
IF(L.GT.1) YA(M,I)=YA(M,I)*(I-1)
AM+1
IF(L.GT.NP) GO TO 130
GO TO 100
130  I=I+1
IF(I.GT.N2) GO TO 140
GO TO 70
140  DO 160 M=1,NR
S=0.0
DO 150 I=1,N2
150  S=S+YA(M,I)
160  ZA(M)=S
C YA(M,I) IS ITH SIMPLE RL VARIATE AT TIME M, ZA(M) IS BL VARIATE AT T
IF(LL.NE.0) GO TO 190
WRITE(6,170) N2
170  FORMAT(2X,15,24H SIMPLE AND/OR LINE PROCESSES)
DO 180 I=1,N2
180  WRITE(6,30) (YA(I),I=1,NR)
WRITE(6,200)
WRITE(6,50) (ZA(M),M=1,NR)
190  CONTINUE
CALL STN
DO 200 M=1,NR
200  ZA(M)=(ZA(M)-AV)/STI
DO 210 M=1,NR
210  ZA(M)=ZA(M)*STD+RM
220  FORMAT(2X,20H BROKEN LINE PROCESS)
IF(LL.EQ.0) WRITE(6,250) (ZA(I),I=1,NR)
IF(LL.EQ.0) WRITE(6,230) M,DD,AA,B,N
230  FORMAT(2X,4H M =,F5.2,5H A0 =,F5.2,5H A1 =,F5.2,4H B =,F4.1,4H N =
*12)
240  FORMAT(2X,4H MEAN =,F12.2,11H STD DEV =,F12.2)
250  FORMAT(2X,10F10.0)
RETURN
END

```


Table A.4. Continued.

```

SUBROUTINE STFN
COMMON /A1/Z,NR,LL
COMMON /A2/AV,STI
DIMENSION ZA(200)
S=0.0
V=0.0
RN=FLOAT(NR)
DO 10 NA=1,NR
ZZ=ZA(N)
S=S+ZZ
V=V+ZZ*ZZ
AV=S/RN
STI=SQRT(V/RN-AV*AV)
STI=STI*SQRT(RN/(RN-1.0))
RETURN
END

SUBROUTINE FFGN(SR, NR, NZ, H, B, GAM, W, LL)
DIMENSION SU(200),RU(20,200),C(20),CC(20),W(20)
C
C SUBROUTINE GENERATES NR FAST FRACTIONAL GAUSSIAN NOISE NUMBERS WITH
C PARAMETERS H, B AND NZ=N(1). REQUIRES NZ<NZ INDEPENDENT STANDARD
C NORMAL VARIATES. GAM= COMPLETE GAMMA FUNCTION OF (3-2H).
C HIGH FREQUENCY COMPONENT NEEDS TO BE ADDED.
C
A=NR*(2.0-NA+1.0)*B*(B*(1.0+NA)-B*(NA-1.0))/GAM
B=NR*(2.0-NA+1.0)*H
DO 10 NA=1,NZ
C(N)=1.0/EXP((1.0/B)*FLGAT(N))
CC(N)=SQRT(1.0-C(N)*C(N))
W(N)=SQRT(A*N*B*B*(B*N*FLGAT(N)))
JJ=0
20 FORMAT(2X,10F9.4)
IF(LL.NE.0) GO TO 40
WRITE(6,30)
30 FORMAT(2X,31H MEANS & N FOR FFGN PROCESS)
WRITE(6,20) (W(N),NA,1,NZ)
40 CONTINUE
DO 60 NA=1,NZ
DO 60 NB=1,NR
JJ=JJ+1
RD(NA,NB)=SG(JJ)
IF(NB=1) SG(60,60)
50 NC=NR-1
RD(NA,NB)=RD(NA,NC)*RD(NA,NB)+RD(NA,NB)*CC(NA)
60 CONTINUE
DO 60 NA=1,NR
DO 70 NA=1,NZ
SU(NB)=SU(NB)+RD(NA,NB)*W(N)
70 CONTINUE
80 SG(NB)=SU(NB)
RETURN
END

SUBROUTINE FFGNH(G, R, NR, NZ, H, B, GAM, W, CZ, LL)
DIMENSION R(300),G(300),W(20)
C
C SUBROUTINE GENERATES NR HIGH FREQUENCY NUMBERS OF FAST FRACTIONAL
C GAUSSIAN NOISE WITH THEORETICAL VALUES OF LAG1 SERIAL CORRELATION
C COEFFICIENT=C AND STANDARD DEVIATION=STD.
SS=(B*(NR-1.0))*(2.0-NA+1.0)/GAM
STA=SQRT(1.0-SS)
C=CZ
CAT=SQRT(1.0-C*C)
G(1)=R(1)
DO 10 J=2,NR
G(J)=G(J-1)+R(J)*CAT
10 G(J)=G(J)+STA
STA=STA*STA
IF(LL.NE.0) GO TO 40
WRITE(6,20) STA,C
20 FORMAT(2X,34H VARIANCE OF FFGN HIGH FREQ NOS = ,F20.4,
*12H LAG1 SCC = ,F20.4)
WRITE(6,30) NR,NZ,H,B,GAM
30 FORMAT(2I10,1F20.5)
40 RETURN
END

```

Table A.4. Continued.

```

SUBROUTINE FRAC
COMMON/AF/ZA,NR,LL
COMMON/AB/DSEED,G,M
COMMON/AC/HZ,MZ,B,SU,CZ
COMMON/AF1/HR,STD
COMMON/AF2/GAM,M
COMMON/AF3/AV,STT
DIMENSION H(20),ZA(200),CO(20)
REAL X,GAMMA,Y
REAL R(300),G(300),S(200)
DOUBLE PRECISION DSEED
10  FORMAT(2X,4H MEAN = ,F12.2,11H STD DEV = ,F12.2)
20  FORMAT(2X,10F10.0)
30  FORMAT(15X,6F10.0,5X)
X=3.0=2.0*M
Y=GAMMA(X)
GAM=Y
NRZ=NR/MZ
CALL GGML(DSEED,MZ,SU)
CALL FFGML(SD,HR,MZ,M,H,GAM,N,LL)
CALL GGML(DSEED,HR,R)
IF(CZ,GT,1.0)GOTO 35
CALL FFGML(G,R,HR,MZ,M,B,GAM,N,CZ,LL)
GOTO 37
35  CONTINUE
CALL FFGML(G,R,NR,MZ,M,H,GAM,N,CZ,LL)
37  CONTINUE
DO 40 J=1,HR
40  ZA(J)=S(J)+G(J)
CALL STMH
IF(LL.NE,0) GO TO 70
WRITE(6,50) Y
50  FORMAT(2X,14H GAMMA S=2H = ,F10.5)
WRITE(6,60) H,B,MZ,C
60  FORMAT(2X,4H M = ,F5.2,4H N = ,F4.1,5H NT = ,I3,10H LAG1 SCC=,F4.1)
WRITE(6,10) AV,STT
70  CONTINUE
DO 80 M=1,NR
80  ZA(M)=(ZA(M)-AV)/STT
DO 90 M=1,NR
90  ZA(M)=STD*ZA(M)+R4
CALL STMH
IF(LL.NE,0) GO TO 100
WRITE(6,20) (ZA(J),J=1,NR)
WRITE(6,10) AV,STT
100 CONTINUE
RETURN
END

```

```

SUBROUTINE ARMA
COMMON/AF/ZA,NR,LL
COMMON/AB/DSEED,G,M
COMMON/AC/PH,TH
COMMON/AF1/HR,STD
COMMON/AF3/AV,STT
DIMENSION ZA(200),CO(20)
REAL R(300),G(300)
DOUBLE PRECISION DSEED
NT=NR*10
SIGE=SQRT(1.-PH**2)/(1.+TH**2+2*PH*TH)
CALL GGML(DSEED,NT,G)
R(1)=G(1)
DO 10 N=2,NT
10  R(N)=PH*R(N-1)+SIGE*(G(N)-TH*G(N-1))
DO 20 N=1,NR
20  ZA(N)=M1+STT)*R(N+10)
CALL STMH
DO 25 N=1,NR
25  ZA(N)=(ZA(N)-AV)/STT
CONTINUE
DO 27 N=1,NR
27  ZA(N)=ZA(N)+STT*M1
IF(LL.EQ,0) WRITE(6,30) (ZA(I),I=1,NR)
30  FORMAT(2X,10F10.0)
RETURN
END

```

Table A.4. Continued.

```

C      SUBROUTINE CF
C      FILE 3 YQNON#MONTHLY HISTORIC STATS
C      FILE 4 YQHT# ANNUAL HISTORIC STATS
C      FILE 10 # YQANN # MONTHLY#ANNUAL HIST, CORRELATION MATRICES
C      PROGRAM READS NTRACE MONTHLY OR SEASONAL VALUES, COMPUTES
C      STATISTICS, AGGREGATES TO ANNUAL AND COMPUTES STATISTICS WITH
C      HISTORIC SEASONAL AND ANNUAL COMPARISONS,
COMMON/AE/Z,N,IWR
COMMON/GT/XG,NTRACE,IMIS,LN,NCL,ISTART
COMMON/SC/YG
COMMON/SCF/TA,MV,HBD,H6,HH,HSC
COMMON/CY1/PRICE,ALV,ALP,ALM,CONST,YPOT
DIMENSION SAH(12),BYM(12),SSD(12),SS(12),SXX(1,1),SYY(12,12),
*SYA(12,1),Y(100,12),YT(100,12),X(100,1),AM(50,12),SD(50,12)
* S(50,12),AA(50,1),SDA(50,1),SA(50,1),HA(50,1)
* X1(100,1),SDY(12),SDX(1),HXX(1,1),HYZ(12,12),SDY1(12),SDY2(12),
* HYY(12,12),HYA(12,1),SYZ(12,12),SOX1(1),SDX2(1),SC(50,1),
* ERL(50),FHS(50),SRL(50),SHB(50),RLX(50),RLN(50),RSX(50),RSN(50)
* XG(100,50),YG(100,12,50),NX(50),N(12),DY(12),Z(200)
* GMM(12),GMS(12),GSD(12),GSS(12),GSK(12),GSKS(12)
* SHXM(12),SHNM(12),DBARM(12),DSTNM(12),SMXS(12),SHNS(12)
* DSTNS(12),SHXK(12),SHNK(12),DBARK(12),DSTNK(12),DBARS(12)
* ETA(100,12),ETP(12),YACT(100),BEN(100),CYA(50),CYB(50)
* CYX(50),CYH(50),BA(50),BS(50),BX(50),BN(50),YTOT(50),
* BTOT(50),SIZE(50),RP(50),RLRSX(50),RSRLX(50),HYI(12),AVE(12),
* SDH(12),SCY(12)
10     FORMAT(16I5)
20     FORMAT(1H ,15,T10,12F10,2)
30     FORMAT(1H ,12E10,4)
40     FORMAT(1H ,14,'OCTOBER',T23,'NOVEMBER',T33,'DECEMBER',T44,'JANUAR
* 1,T53,'FEBRUARY',T66,'MARCH',T76,'APRIL',T88,'MAY',T97,'JUNE',
* T107,'JULY',T115,'AUGUST',T122,'SEPTEMBER')
50     FORMAT(1H ,T10,12F10,2)
60     FORMAT(1H ,T10,12E10,4)
70     FORMAT(1H ,T5,'E(RL)',T15,'E(RS)',T25,'S(RL)',T35,'S(RS)',T44,'MAX
* RL',T54,'MIN RL',T64,'MAX RS',T74,'MIN RS',T85,'BAM',T95,'SBM')
      NY=12
      WRITE(6,*)N,NY,NTRACE,IWR,ISTART,NCL
      READ(16,*)(SAH(J),J=1,12),(BYM(J),J=1,12),(SSD(J),J=1,12),
* (SS(J),J=1,12),FJZ,ESZ,SJZ,SSZ,JZX,JZN,SZX,SZN,NXM
* ,(FTP(J),J=1,12),ABFN,SBE,SBEX,BEMN,TOTB,AYACT,SYACT,YAX
* ,YAN,TOTY,PRICE,ALV,ALP,ALM,CONST,YPOT,AC,MSIZE,MRSRLX,MRLRSX
      READ(10,*)HXX(1,1),((HYY(I,J),I=1,NY),J=1,NY),(HYX(I,1),I=1,NY)
* ,((HYZ(I,J),I=1,NY),J=1,NY),(HYI(J),J=1,NY)
      N4=12*H
      LAG=0
      DO 220 K=1,NTRACE
      IF(IWR,E,0)PRINT *,'GENERATED MONTHLY VALUES BY YEARS'
      IF(IWR,E,0)WRITE(6,40)
      DO 110 J=1,NY
      X(I,1)=0.0
      DO 105 J=1,NY
      Y(I,J)=YG(I,J,K)
105    CONTINUE
      IYEAR=ISTART+(I-1)
      IF(IWR,E,0)WRITE(6,20)IYEAR,(Y(I,J),J=1,NY)
110    CONTINUE
      DO 130 J=1,NY
      CALL F3NDH(Y,N,J,A,V,DS,SK,100)
      IF(K,E,1)CALL SOLAG(Y,4,Y,LAG,SOY,SOY)
      IF(K,E,1)CALL SOLAG(Y,N,NY,1,SDY1,SDY2)

```

Table A.4. Continued.

```

A4(K,J)=A
AVE(J)=A
SDM(J)=DS
SD(K,J)=DS
S(K,J)=SK
DO 120 I=1,N
YT(I,J)=Y(I,J)-A4(K,J)
120 CONTINUE
130 CONTINUE
L=0
IWR1=IWR
IF(K.EQ.1)IWR1=0
CALL DIVERT(Y,N,ETA)
CALL CROPY(ETP,ETA,N,YTOT(K),RTOT(K),YACT,BEN,AC)
CALL F2MON(YACT,N,CYA(K),CYS(K),CYX(K),CYN(K))
CALL F2MON(BEN,N,BA(K),BS(K),BX(K),BN(K))
CALL SEUPEK(ETA,N,ETP,SIZE(K))
CALL CRUSH(Y,ETP,N,IWR1,ERL(K),ERS(K),SRL(K),SRB(K),RLX(K),
RLN(K),RSX(K),RSN(K),NX(K),RSRLX(K),RLRSX(K))
IF(IWR.EQ.1)GOTO 135
IF(K.EQ.1)WRITE(6,40)
IF(K.EQ.1)PRINT /,'HIS. MONTHLY MEANS'
IF(K.EQ.1)WRITE(6,50)(SAM(J),J=1,NY)
IF(K.EQ.1)PRINT /,'GEN. MONTHLY MEANS'
IF(K.EQ.1)WRITE(6,50)(AM(I,J),J=1,NY)
IF(K.EQ.1)WRITE(6,40)
IF(K.EQ.1)PRINT /,'HIS. MONTHLY ST. DEV.'
IF(K.EQ.1)WRITE(6,50)(SSD(J),J=1,NY)
IF(K.EQ.1)PRINT /,'GEN. MONTHLY ST. DEV.'
IF(K.EQ.1)WRITE(6,50)(SD(I,J),J=1,NY)
IF(K.EQ.1)WRITE(6,40)
IF(K.EQ.1)PRINT /,'HIS. MONTHLY SKEWS'
IF(K.EQ.1)WRITE(6,50)(SS(J),J=1,NY)
IF(K.EQ.1)PRINT /,'GEN. MONTHLY SKEWS'
IF(K.EQ.1)WRITE(6,50)(S(I,J),J=1,NY)
135 CONTINUE
IF(K.EQ.1)CALL MONCOR(Y,AVE,N,SDM,SCY,0)
IF(K.EQ.1)CALL COVAR(YT,YT,SYY,N,12,12,LAG,1,1,12,12,SDY,SDY)
IF(K.EQ.1)CALL COVAR(YT,YT,SYZ,N,12,12,1,1,1,12,12,SDY1,SDY2)
IF(IWR.EQ.1)GOTO 200
IF(K.EQ.1)PRINT /,'HY1 HISTORIC MONTHLY SERIAL CORRELATION'
IF(K.EQ.1)WRITE(6,30)(HY1(J),J=1,NY)
IF(K.EQ.1)PRINT /,'SCY GENERATED MONTHLY SERIAL CORRELATION'
IF(K.EQ.1)WRITE(6,30)(SCY(J),J=1,NY)
IF(K.EQ.1)PRINT /,'HYY'
DO 170 I=1,NY
IF(K.EQ.1)WRITE(6,30)(HYY(I,J),J=1,NY)
170 CONTINUE
IF(K.EQ.1)PRINT /,'SYY GENERATED'
IF(K.EQ.1)WRITE(6,*)NTRACE
DO 180 I=1,NY
IF(K.EQ.1)WRITE(6,30)(SYY(I,J),J=1,NY)
180 CONTINUE
IF(K.EQ.1)PRINT /,'HYZ'
DO 190 I=1,NY
IF(K.EQ.1)WRITE(6,30)(HYZ(I,J),J=1,NY)
190 CONTINUE
IF(K.EQ.1)PRINT /,'SYZ GENERATED'
DO 200 I=1,NY
IF(K.EQ.1)WRITE(6,30)(SYZ(I,J),J=1,NY)
200 CONTINUE

```

Table A.4. Continued.

```

CALL AGGATE(Y,X,N,NY,1)
CALL F3HD1(X,N,1,A,V,DS,SK,100)
IF(K,EQ,1)CALL SDLAG(X,N,1,LAG,SDX,SDX)
M=HOURS(X,N,A,DS)
AA(K,1)=A
MA(K,1)=M
SDA(K,1)=DS
SA(K,1)=SK
DO 210 I=1,N
IYEAR=ISTART+(I-1)
IF(IWR,EQ,0)WRITE(6,20)IYEAR,X(I,1)
XT(I,1)=X(I,1)-AA(K,1)
210 CONTINUE
IF(K,EQ,1)PRINT /,'GEN. ANNUAL STATISTICS'
IF(K,EQ,1)WRITE(6,*)A,DS,SK,M
IF(K,EQ,1)CALL COVAR(YT,XT,SYX,N,12,1,LAG,1,1,12,1,SDY,SDX)
IF(K,EQ,1)PRINT /,'MYX'
IF(K,EQ,1)WRITE(6,30)(MYX(I,1),I=1,NY)
IF(K,EQ,1)PRINT /,'SYX GENERATED'
IF(IWR,EQ,0)WRITE(6,30)(SYX(I,1),I=1,NY)
CALL SDLAG(X,N,1,1,SDX1,SDX2)
CALL COVAR(XT,XT,SXX,N,1,1,1,1,1,1,SDX1,SDX2)
SC(K,1)=SXX(1,1)
IF(K,EQ,1)PRINT /,'LAG 1 SERIAL CORR.'
IF(K,EQ,1)WRITE(6,*)HSC
IF(K,EQ,1)PRINT /,'LAG 1 SERIAL CORR. GENERATED'
IF(K,EQ,1)WRITE(6,*)SXX(1,1)
RP(K)=FLOAT(K)/FLOAT(NTRACE+1)
220 CONTINUE
IF(NTRACE,EQ,1)RETURN
DO 230 J=1,NY
CALL F3HD1(AM,NTRACE,J,A,V,DS,SK,50)
GMM(J)=A
GMS(J)=DS
MMEAN=SAM(J)
IF(IWR,EQ,0)WRITE(6,*)MMEAN,A,V,DS,SK,J,NTRACE
CALL F3HD1(SD,NTRACE,J,A,V,DS,SK,50)
GSSD(J)=A
GSSS(J)=DS
STDDEV=GSSD(J)
IF(IWR,EQ,0)WRITE(6,*)STDDEV,A,V,DS,SK,J,NTRACE
CALL F3HD1(S,NTRACE,J,A,V,DS,SK,50)
GSK(J)=A
GSKS(J)=DS
SKEW=GSS(J)
IF(IWR,EQ,0)WRITE(6,*)SKEW,A,V,DS,SK,J,NTRACE
230 CONTINUE
CALL DM1(AM,SAM,NTRACE,SAM,SMXM,SMNM,NY,DBAR,DSFNH)
CALL DM1(SD,GSD,NTRACE,GSD,SMXB,SMNB,NY,DBARS,DSTNB)
CALL DM1(S,SS,NTRACE,SS,SMXB,SMNB,NY,DBARS,DSTNB)
CALL F2HD1(FRL,NTRACE,GRL,GHLS,ERLX,ERLN)
CALL F2HD1(SRL,NTRACE,BRLM,BRLS,BRLX,BRLN)
CALL F2HD1(ERS,NTRACE,GRS,GHSS,ERSX,ERSN)
CALL F2HD1(ERS,NTRACE,SRSM,SHSS,SRSX,SRSN)
CALL F2HD1(HX,NTRACE,ENX,SHX,KNX,XNN)
CALL DAM1(ERL,EJZ,R1,R2,DRLH,DRLS,NTRACE)
CALL DAM1(FRS,FSZ,R1,R2,DHSD,DHSS,NTRACE)
CALL F2HD1(SIZE,NTRACE,ASIZE,SSIZE,SIZE,SIZE)
CALL F2HD1(TOT,NTRACE,TOYA,TOYS,TOYX,TOYN)
CALL F2HD1(TOT,NTRACE,TOBA,TOBS,TOBX,TOBN)
CALL F2HD1(CYA,NTRACE,CYAA,CYAS,YCX,YCN)

```

Table A.4. Continued.

```

CALL F2MOM(CY9,NTRACE,CY5A,CY5S,A1,A2)
CALL F2MOM(B4,NTRACE,RAA,BAB,ARX,ARN)
CALL F2MOM(B8,NTRACE,R9A,R9S,A1,A2)
CALL DAMM(YTOT,TOTY,R1,R2,DYTA,DYTS,NTRACE)
CALL DAMM(BTOT,TOTB,R1,R2,DBTA,DBTS,NTRACE)
CALL DAMM(CYA,AYACT,R1,R2,DYA,DYS,NTRACE)
CALL DAMM(CYB,SYACT,R1,R2,DYBA,DYSS,NTRACE)
CALL DAMM(BA,ABEN,R1,R2,DBA,DBS,NTRACE)
CALL DAMM(BS,SBEN,R1,R2,DBSA,DBSS,NTRACE)
CALL DAMM(SIZE,MSIZE,R1,R2,DSZA,DSZS,NTRACE)
WRITE(6,240)
WRITE(6,55)
240  FORMAT(1H0,'COMPARISON MONTHLY MEANS')
WRITE(6,40)
WRITE(6,45)
WRITE(6,245)
WRITE(6,50)(BAM(J),J=1,NY)
WRITE(6,255)
WRITE(6,50)(GMM(J),J=1,NY)
WRITE(6,260)
WRITE(6,50)(GMM8(J),J=1,NY)
WRITE(6,270)
WRITE(6,50)(SMXM(J),J=1,NY)
WRITE(6,280)
WRITE(6,50)(SMNM(J),J=1,NY)
WRITE(6,290)
WRITE(6,55)
WRITE(6,50)(OBAM(J),J=1,NY)
WRITE(6,300)
WRITE(6,50)(OSTNM(J),J=1,NY)
WRITE(6,250)
WRITE(6,55)
250  FORMAT(1H0,'COMPARISON OF MONTHLY STAN. DEV.')
WRITE(6,40)
WRITE(6,45)
WRITE(6,245)
WRITE(6,50)(SSD(J),J=1,NY)
WRITE(6,255)
WRITE(6,50)(GSSD(J),J=1,NY)
WRITE(6,260)
WRITE(6,50)(GSS8(J),J=1,NY)
WRITE(6,270)
WRITE(6,50)(SMX8(J),J=1,NY)
WRITE(6,280)
WRITE(6,50)(SMNS(J),J=1,NY)
WRITE(6,290)
WRITE(6,55)
WRITE(6,50)(DBARS(J),J=1,NY)
WRITE(6,300)
WRITE(6,50)(DSTNS(J),J=1,NY)
245  FORMAT(1H,'HISTORIC STATISTIC')
255  FORMAT(1H,'AVERAGE GENERATED STATISTIC')
260  FORMAT(1H,'STAN. DEV. OF AVER. GEN. STAT.')
WRITE(6,265)
WRITE(6,55)
265  FORMAT(1H,'COMPARISON OF MONTHLY SKEWS')
270  FORMAT(1H,'MAXIMUM GEN. STATISTIC')
280  FORMAT(1H,'MINIMUM GEN. STATISTIC')
290  FORMAT(1H,'MEAN DEVIATION STATISTIC')
300  FORMAT(1H,'ST. DEV. OF DEV. STATISTIC')
45   FORMAT(1H,'TR,43(')

```

Table A.4. Continued.

```

55  FORMAT(1H ,43('!'))
505  FORMAT(1H ,1MONTHLY CROSSING PROPERTIES!)
      WRITE(6,40)
      WRITE(6,45)
      WRITE(6,245)
      WRITE(6,50)(SS(J),J=1,NY)
      WRITE(6,255)
      WRITE(6,50)(GSK(J),J=1,NY)
      WRITE(6,260)
      WRITE(6,50)(GSKS(J),J=1,NY)
      WRITE(6,270)
      WRITE(6,50)(SMXK(J),J=1,NY)
      WRITE(6,280)
      WRITE(6,50)(SMNK(J),J=1,NY)
      WRITE(6,290)
      WRITE(6,55)
      WRITE(6,50)(DBARK(J),J=1,NY)
      WRITE(6,300)
      WRITE(6,50)(DBTNK(J),J=1,NY)
      WRITE(6,505)
      WRITE(6,55)
      WRITE(6,500)
      WRITE(6,55)
      WRITE(6,450)N,NXN,ENX,SNX,XXN,XNN
      WRITE(6,460)EJZ,GRL,GRLS,ERLX,ERLN,DRLB,DRLS
      WRITE(6,470)SJZ,SRLM,SRLS,SRLX,SRLN
      WRITE(6,480)ESZ,GRS,GRSS,ERSX,ERSN,DSSB,DRSS
      WRITE(6,490)SSZ,SRSN,SRSS,SRSX,SRSN
      WRITE(6,55)
      WRITE(6,510)
      WRITE(6,530)TOTY,TOYA,TOYS,TOYX,TOYN,DYTA,DYTS
      WRITE(6,540)TOTB,TOHA,TOBS,TQBX,TOBN,DBTA,DBTS
      WRITE(6,560)AYACT,CYAA,CYAB,YCX,YCN,DYA,DYS
      WRITE(6,570)BYACT,CYSA,CYSS,DYSA,DYSS
      WRITE(6,580)ABEN,BAA,BAS,ABX,ABN,DBA,DRB
      WRITE(6,590)SBEH,BSA,BSS,DBSA,UBSS
      WRITE(6,610)HSIZE,ASIZE,SSIZE,SIZX,SIZN,DSIZA,DSIZB
      CALL QKRSRT(RSRLX,NTRACE)
      CALL QKRSRT(RLRSX,NTRACE)
      CALL QKRSRT(RLX,NTRACE)
      CALL QKRSRT(RSX,NTRACE)
      CALL QKRSRT(CYA,NTRACE)
      CALL QKRSRT(BA,NTRACE)
      CALL QKRSRT(SIZE,NTRACE)
      WRITE(6,900)
      WRITE(6,950)HSIZE,AYACT,ADEN,JZX,HRLRSX,SZX,HRBRLX
      DO 1000 K=1,NTRACE
      WRITE(6,620)HP(K),SIZE(K),CYA(K),BA(K),RLX(K),RLRSX(K),RSX(K)
      *,RSRLX(K)
1000  CONTINUE
      CALL F2MON(HSKLX,NTRACE,ARSRLX,SRSRLX,0,0)
      CALL F2MON(RLRSX,NTRACE,ARLRSX,SRLRSX,0,0)
      CALL F2MON(RLX,NTRACE,ARLX,SRLX,0,0)
      CALL F2MON(RSX,NTRACE,ARSX,SRSX,0,0)
      CALL F2MON(CYA,NTRACE,ACYA,SCYA,0,0)
      CALL F2MON(BA,NTRACE,ABA,SBA,0,0)
      CALL F2MON(SIZE,NTRACE,ASIZE,SSIZE,0,0)
200  FORMAT(1H ,M15,9)
      WRITE(6,991)ASIZE,ACYA,ADA,ARLX,ARLRSX,ARSX,ARSRLX
      WRITE(6,992)SSIZE,SCYA,SRA,SRLX,SRLRSX,SRSX,SRSRLX
991  FORMAT(1H ,1 MEANS!,9X,7E15,9)

```

Table A.4. Continued.

```

442  FORMAT(1H , ' ST DEV',BX,7E15,9)
950  FORMAT(1H , 'HISTORIC',T17,7E15,9)
900  FORMAT(1H , 'X', 'PROB LESS THAN', ' RESERVOIR SIZE', ' ANN CROP YIELD
*1, ' ANN CROP BENEFIT', ' MAX RUN LENGTH', 'X', ' RUN/MAX SUM',
*2X, ' MAX RUN SUM', ' SUM/MAX RUN')
TODM=0.
TODS=0.
TODSK=0.
DO 550 J=1,4Y
TODM=TODM+ABS(DBARM(J))
TODS=TODS+ABS(DBARS(J))
TODSK=TODSK+ABS(DBARK(J))
550  CONTINUE
TMD=TODM+TODS+TODSK+ABS(DRLB)+ABS(DRSB)
WRITE(6,55)
WRITE(6,600)TODM, TODS, TODSK, TMD
WRITE(6,55)
600  FORMAT(1H , 'TOTAL MONTHLY DEVIATIONS, MEAN',F10,3,
*1 ' ST. DEV.',F10,3, ' SKEW',F10,3, 'TOTAL ALL',F10,3)
500  FORMAT(1H , 'CROSSING PROPERTIES',T40, 'HIST',T50, 'MEAN',
*157, 'ST. DEV.',T67, 'MAXIMUM',T77, 'MINIMUM',T85, 'MEAN DEV.',
*196, 'ST. DEV.',)
510  FORMAT(1H , 'CROP LOSS FUNCTION',T40, 'HIST',T50, 'MEAN',
*157, 'ST. DEV.',T67, 'MAXIMUM',T77, 'MINIMUM',T85, 'MEAN DEV.',
*196, 'ST. DEV.',)
450  FORMAT(20H MEAN CROSSINGS PER ,12,7H YEARS ,T34,7F10,2)
460  FORMAT(20H MEAN RUN LENGTH ,T34,7F10,2)
470  FORMAT(31H STD DEV OF THE RUN LENGTHS ,T34,7F10,2)
480  FORMAT(17H MEAN RUN SUM ,T34,7F10,1)
490  FORMAT(28H STD DEV OF THE RUN SUMS ,T34,7F10,1)
530  FORMAT(1H , 'TOTAL YIELD' ,T34,5E10,4,2F10,4)
540  FORMAT(1H , 'TOTAL BENEFIT' ,T34,5E10,4,2F10,4)
560  FORMAT(1H , 'ANNUAL AVERAGE YIELD' ,T34,5E10,4,2F10,4)
580  FORMAT(1H , 'ANNUAL AVERAGE BENEFIT' ,T34,5E10,4,2F10,4)
570  FORMAT(1H , 'ANNUAL ST DEV YIELD' ,T34,3E10,4,20X,2F10,4)
610  FORMAT(1H , 'RESERVOIR SIZE' ,T34,7F10,2)
C ANNUAL AVERAGES OVER NTRACES OF GENERATED VALUES
PRINT //, 'ANNUAL STATISTICS AVERAGED OVER NTRACE GEN.'
WRITE(6,55)
C AA=ANNUAL MEANS TA=HIST. ANNUAL MEAN AAA=GEN MEAN OF MEAN
CALL F3M01(AA,NTRACE,1,AAA,V,AA6,9K,50)
C SDA=ANN. ST. DEV. HSD=HIST. ST. DEV. ASDM=AVER. ST DEV
CALL F3M01(SDA,NTRACE,1,ASDM,V,ASDS,9K,50)
C SA=ANN SKEW HS=HIST ANN SKEW ASKM=AVER SKEW
CALL F3101(SA,NTRACE,1,ASKM,V,ASKS,9K,50)
C MA=ANN HURST HH=HIST HURST AHM=AVER HURST
CALL F3401(MA,NTRACE,1,AHM,V,AHS,9K,50)
C SC=LAG 1 HSC=HIST LAG 1 ABCM=AVER LAG 1
CALL F3401(SC,NTRACE,1,ASCH,V,ASCS,9K,50)
CALL DAMM(AA,TA,SAAX,SAAN,DAAB,DAAS,NTRACE)
CALL DAMM(SDA,HSD,BSDAX,SDAN,DSDAB,DSDAS,NTRACE)
CALL DAMM(SA,HS,SSAX,SSAN,DSAB,DSAS,NTRACE)
CALL DAMM(MA,HH,SHAX,SHAN,DHAB,DHAS,NTRACE)
CALL DAMM(SC,HSC,SSCX,SSCN,DSCB,DSCS,NTRACE)
WRITE(6,310)
WRITE(6,55)
310  FORMAT(1H , 'ANNUAL STAT',T16, 'MEAN',T25, 'ST. DEV',
*139, 'SKEW',T46, 'LAG ONE',T58, 'HURST')
WRITE(6,245)
WRITE(6,350)TA, HSD, H8, HSC, HH
WRITE(6,255)
WRITE(6,350)AAA, ASDM, ASKM, ASCH, AHM
WRITE(6,260)
WRITE(6,350)AAS, ASDS, ASKS, ASCS, AHS
WRITE(6,270)
WRITE(6,350)SAAA, SSUAX, SSAX, SSCX, SHAX
WRITE(6,280)
WRITE(6,350)SAAN, SSDAN, SSAN, SSCN, SHAN
WRITE(6,290)
WRITE(6,55)
WRITE(6,350)DAAB, DSDAB, DSAB, DSCB, DHAB
WRITE(6,300)
WRITE(6,350)DAAS, DSDAS, DSAS, DSCS, DHAS
TANN=ABS(DAAB)+ABS(DSDAB)+ABS(DSAB)+ABS(DSCB)+ABS(DHAS)
TOTAL=TANN+TMD
WRITE(6,55)
WRITE(6,605)TANN, TOTAL
WRITE(6,55)
605  FORMAT(1H , 'TOTAL ANNUAL DEV.',F10,3,T65, 'TOTAL FOR MODEL',
*1F10,3)
350  FORMAT(1H , T13,2F10,2,3F10,3)
RETURN
END

```


Table A.4. Continued.

```

SUBROUTINE SPLIT
COMMON/AE/ZA,N,IMR
COMMON/AB/DSEED,G,N
COMMON/GT/X,NTRACE,INIS,LN,NCL,ISTART
COMMON/SC/YG
C PROGRAM TO READ DISAGGREGATED COEF, MATRICES A,H,C AND
C ANNUAL GENERATED OR HISTORIC TIME SERIES AND DISAGGREGATE TO SEAS
C LEVEL(MONTHLY), WRITES DISAG MONTHS TO A FILE YOISA.
DIMENSION A(12,12),B(12,12),C(12,12),X(100,50),TAM(12),MN(12),
*Z(12,1),X1(100,1),Y(100,12),YT(100,12),TSM(12),ZA(200)
*,YG(100,12,50)
DOUBLE PRECISION DSEED
10 FORMAT(8F10,0)
20 FORMAT(16I5)
30 FORMAT(12F10,2)
40 FORMAT(1H,12E10,4)
PRINT //,'NY=# OF MONTHS'
PRINT //,'NZ=# OF PREVIOUS SEASONS'
PRINT //,'NYR=# OF YEARS'
PRINT //,'I2= COUNTER # FOR STARTING PREVIOUS SEASON'
PRINT //,'NOT=1 IF NO TRANSFORM, NOT=0 IF TRANSFORM'
PRINT //,'INIS=1 THEN READ HISTORIC TIME SERIES'
PRINT //,'IVS=1, THEN VALENCIA-SCHAAKE DISAG'
PRINT //,'LN= LINE # TO PRINT OUT GEN. YRS IN MONTH S/H'
READ(12,/)NZ,I2,NOT,AL,IVS,ISTART,NCL,(Z(I,1),I=1,NZ)
IF(INIS,NE,1)ISTART=1979
NY=12
WRITE(6,/)NY,NZ,N,I2,NOT,INIS,NTRACE,IMR,IVS,LN,AL,NCL,ISTART
C NOT=1 NO TRANSFORM
C INIS=1 READ IN HISTORIC ANNUAL SERIES
C IMR=1 WRITE INPUT DATA
C NTRACE=# OF TRACES GENERATED DATA
C N=# OF YEARS EACH TRACE
PRINT //,'INITIAL VALUES OF PREVIOUS YEARS MONTHS W/D MEAN SUB'
WRITE(6,40)Z(1,1),I=1,NZ)
WRITE(6,/)AL,DSEED
PRINT //,'TRANSFORMED ANNUAL AND MONTHLY MEANS'
READ(11,/)TA,TS,(TAM(K),K=1,NY),(TSM(K),K=1,NY)
WRITE(6,/)TA,TS,(TAM(K),K=1,NY),(TSM(K),K=1,NY)
IF(IVS,EQ,1)GOTO 60
CALL TFORM(Z,Z,AL,NZ,1,0,NOT)
DO 50 J=1,NZ
MN(J)=I2+J-1
WRITE(6,/)MN(J),J
Z(J,1)=(Z(J,1)-TAM(J))
50 CONTINUE
PRINT //,'NEW Z WITH MEAN SUB'
WRITE(6,40)Z(1,1),I=1,NZ)
60 PRINT //,'A MATRIX'
DO 70 I=1,NY
READ(13,/)A(1,1)
IF(IVS,EQ,0)WRITE(6,40)A(1,1)
70 CONTINUE
IF(IVS,EQ,1)GOTO 80
PRINT //,'B MATRIX'
DO 80 I=1,NY
READ(14,/)B(1,J),J=1,NZ)
IF(IVS,EQ,0)WRITE(6,40)B(1,J),J=1,NZ)
80 CONTINUE
PRINT //,'C MATRIX'
DO 90 I=1,NY

```

Table A.4. Continued.

```

READ(15,/) (C(I,J), J=1, NY)
IF(IWR.EQ.0) WRITE(6,40) (C(I,J), J=1, NY)
90  CONTINUE
IF(IHIS.EQ.0) GOTO 110
DO 100 I=1, N
READ(18,30) X(I,1)
100 CONTINUE
110 CONTINUE
CALL TFORM(X, X, AL, U, NTRACE, 0, NOT)
DO 170 K=1, NTRACE
IF(IWR.EQ.0) PRINT /, IX=ANNUAL VALUES!
IF(IWR.EQ.0) WRITE(6,40) (X(I,K), I=1, N)
DO 120 I=1, N
X1(I,1)=X(I,K)=TA
120 CONTINUE
CALL DMONTH(X1, YT, A, B, C, N, NZ, DSEED, Z, MN, IVS, LN)
DO 150 I=1, N
DO 140 J=1, NY
YT(I,J)=YT(I,J)+TAH(J)
140 CONTINUE
150 CONTINUE
CALL TFORM(Y, YT, AL, N, NY, 1, NOT)
DO 160 I=1, N
IF(IWR.EQ.0) WRITE(6,40) (Y(I,J), J=1, NY)
DO 155 J=1, NY
YG(I,J,K)=Y(I,J)
155 CONTINUE
160 CONTINUE
170 CONTINUE
RETURN
END

```

Table A.4. Continued.

```

SUBROUTINE CROBM(Y,Q,NR,LL,EJZ,ESZ,SJZ,
*SSZ,JZX,JZN,SZX,SZN,NX,RBRLX,MLRSX)
DIMENSION Q(12),SZ(100),JZ(100),Y(100,12),YD(100,12),ZA(100)
DO 10 L=1, NR
  JZ(L)=0
  SZ(L)=0.0
10 CONTINUE
  NX=0
  JX=0
  SX=0.
  LE=0
  N=8
  I=1
  SS=0.0
  JJ=0
  CALL DIVER(Y, NR, YD)
20 S=0.0
  J=0
  N=N+1
  IF(N.LE.12)GOTO 25
  N=8
  I=I+1
25 ZA(N)=YD(I,1)
  IF(I=NR)30,30,60
30 IF(ZA(N)-J(N))40,20,20
40 IF(ZA(N-1)-Q(N-1))20,20,50
50 J=J+1
  S=S+Q(N)-ZA(N)
  N=N+1
  IF(N.LE.12)GOTO 55
  N=8
  I=I+1
55 IF(I=NR)60,60,80
60 ZA(N)=YD(I,N)
  IF(Q(N)-ZA(N))70,70,50
70 L=L+1
  JJ=JJ+J
  SS=SS+S
  JZ(L)=J
  SZ(L)=S
  GOTO 20
80 NX=L
  JX=JJ
  SX=SS
  JZ1=-10
  SZ1=-1.E15
  DO 1000 L=1, NX
  IF(SZ(L).GT.SZ1)GOTO 400
  GOTO 500
400 SZ1=SZ(L)
  MLRSX=JZ(L)
500 CONTINUE
  IF(JZ(L).GT.JZ1)GOTO 600
  GOTO 1000
600 JZ1=JZ(L)
  RBRLX=SZ(L)
1000 CONTINUE
  IF(LL.NE.0)GOTO 200
  WRITE(N,100)
100 FORMAT(1H, 'DOWN CROSSINGS TOTAL DEFICIT RUN LENGTHS AND SUMS')
  WRITE(6,120)N

```

Table A.4. Continued.

```

WRITE(6,130)IX
WRITE(6,140)SX
110 FORMAT(1H,'FLOD',20X,6F15.2)
120 FORMAT(1H,'CROSSINGS',15X,6I15)
130 FORMAT(1H,'TOTAL RUN LENGTH',8X,6I15)
140 FORMAT(1H,'TOTAL RUN SUM',11X,6F15.2)
150 WRITE(6,160)(JZ(L),L=1,NX)
160 FORMAT(1H,'DEFICIT RUN LENGTHS AT CROSSING LEVEL',1ARE',201
*3/5(152,2013/))
WRITE(6,170)(K(K),K=8,12)
170 FORMAT(1H,'DEFICIT RUN SUMS AT CROSSING LEVEL ARE',5F10.2)
180 WRITE(6,190)(SZ(L),L=1,NX)
190 FORMAT(10F10.2)
200 CONTINUE
CALL F2MOM(SZ,NX,EJZ,8JZ,JZX,JZN)
CALL F2MOM(SZ,NX,ESZ,8SZ,8ZX,8ZN)
IF(LL.NE.0)GOTO 1200
WRITE(6,850)
WRITE(6,900)(EJZ,8JZ,JZX,JZN,RLR6X)
WRITE(6,950)(ESZ,8SZ,8ZX,8ZN,RSRLX)
850 FORMAT(1H,'16X,MEAN',2X,'8T,DEV.',7X,'MAX',7X,'MIN',
*5X,'R/MAX')
900 FORMAT(1H,'RUN LENGTH',5F10.2)
950 FORMAT(1H,'RUN SUM',3X,5E10.4)
1200 CONTINUE
RETURN
END

SUBROUTINE BMONTH(X,UX,A,d,C,NY,M,DSEED,Z,MN,IV8,LM)
DIMENSION UX(100,12),A(12,1),R(12,12),C(12,12),E(12,1),
*DUM(12,1),X(100,1),Z(12,1),DUM2(12,1),DUM3(12,1),Y(12,1),MN(12)
*,R(12),T(100,1)
DOUBLE PRECISION DSEED
10 FORMAT(1H,'12E10.4)
DO 70 I=1,NY
CALL GGNDS(DSEED,12,R)
CALL ANORM(R,12)
DO 20 J=1,12
E(J,1)=R(J)
20 CONTINUE
IF(I.LE.LN)PRINT /,'E(J,*)'
IF(I.LE.LN)CALL F3MOM(E,12,1,EA,V,ESD,ESK,12)
IF(I.LE.LN)WRITE(6,*) (E(J,1),J=1,12),EA,ESD,ESK
T(1,1)=X(1,1)
XJ=X(1,1)
IF(I.LE.LN)WRITE(6,*)XJ
CALL MMULT(A,T,DUM,12,1,1,12,1,100,1,12,1)
IF(I.LE.LN)PRINT /,'A*x'
IF(I.LE.LN)WRITE(6,*) (DUM(J,1),J=1,12)
IF(IV8.EQ.1)GOTO 30
CALL MMULT(D,2,DUM2,12,1,4,12,12,12,1,12,1)
IF(I.LE.LN)PRINT /,'B*Z'
IF(I.LE.LN)WRITE(6,*) (DUM2(J,1),J=1,12)
CALL MADSUB(DUM,DUM2,DUM3,12,1,1,12,1,12,1,12,1)
IF(I.LE.LN)PRINT /,'A*x+B*Z'
IF(I.LE.LN)WRITE(6,*) (DUM3(J,1),J=1,12)
CALL MMULT(C,E,DUM,12,1,12,12,12,12,1,12,1)
IF(I.LE.LN)PRINT /,'C*E'
IF(I.LE.LN)WRITE(6,*) (DUM(J,1),J=1,12)
IF(I.LE.LN)PRINT /,'Y=A*x+B*Z+C*E'
CALL MADSUB(DUM3,DUM,Y,12,1,1,12,1,12,1,12,1)
GOTO 40
30 CONTINUE
CALL MMULT(C,E,DUM,12,1,12,12,12,12,1,12,1)
IF(I.LE.LN)PRINT /,'C*E'
IF(I.LE.LN)WRITE(6,*) (DUM2(J,1),J=1,12)
CALL MADSUB(DUM,DUM2,Y,12,1,1,12,1,12,1,12,1)
IF(I.LE.LN)PRINT /,'Y=A*x+B*Z+C*E'
40 IF(I.LE.LN)WRITE(6,*) (Y(J,1),J=1,12)
IF(IV8.EQ.1)GOTO 50
DO 50 J=1,M
M1=MN(J)
Z(J,1)=Y(M1,1)
50 CONTINUE
DO 60 J=1,12
60 UX(I,J)=Y(J,1)
70 CONTINUE
RETURN
END

```

Table A.4. Continued.

```
SUBROUTINE MMULT(A,B,C,N1,N2,N3,N4,N5,N6,N7,N8,N9)
DIMENSION A(N4,N5),B(N6,N7),C(N8,N9)
DO 10 I=1,N1
DO 10 J=1,N2
C(I,J)=0.
DO 10 K=1,N3
10 C(I,J)=C(I,J)+A(I,K)*B(K,J)
RETURN
END
```

```
SUBROUTINE MADSUB(A,B,C,N1,N2,D,N3,N4,N5,N6,N7,N8)
INTEGER D
DIMENSION A(N3,N4),B(N5,N6),C(N7,N8)
DO 20 I=1,N1
DO 20 J=1,N2
IF(D,LT,0)GOTO 10
C(I,J)=A(I,J)+B(I,J)
GOTO 20
10 C(I,J)=A(I,J)-B(I,J)
20 CONTINUE
RETURN
END
```

Table A.4. Continued.

```

SUBROUTINE QKRSRT(NA,JJ)
C 26 CARD PUNCH
C DIMENSION NA(JJ),NLT(20),NUT(20)
C REAL NA,NT,IX
C
C QUICKERSORT IS A WAY OF SORTING ELEMENTS IN AN ARRAY INTO
C ASCENDING ORDER. THE ARRAY IS CONTINUALLY SPLIT INTO
C PARTS SUCH THAT THE ELEMENTS OF ONE PART ARE LESS THAN
C ALL ELEMENTS OF THE OTHER, WITH A THIRD PART IN THE
C MIDDLE CONSISTING OF A SINGLE ELEMENT. THIS METHOD IS
C CONSIDERABLY FASTER THAN THE STANDARD COMPARISON-TRANS-
C POSITION METHOD WHERE THE NUMBER OF COMPARISONS IS ON
C THE ORDER OF N (ARRAY SIZE) SQUARED. QUICKERSORT REQUIRES
C ONLY ON THE ORDER OF 'N * LOG N' COMPARISONS.
C THE CALL IS : CALL QKRSRT NA,N'
C WHERE NA: ARRAY NAME
C N: ARRAY LENGTH.
C
C IN THIS VERSION THERE IS ESSENTIALLY NO LIMIT TO THE
C LENGTH OF THE SORTED ARRAY. THE ABSOLUTE LIMIT IS E TO
C THE 13.8+ 1.E. LARGER THAN ANY INTERNALLY STORED ARRAY
C IN THE GE 635. ANY SORT OF ALPHANUMERIC DATA IN THE
C ARRAY WILL BE SORTED.
C
C QUICKERSORT IS ALGORITHM # 271, COLLECTED ALGORITHMS
C FROM CACH.
C
J=JJ
I=1
M=1
10 I=I+1
IF(J.LE.I) GO TO 90
IP=(J+I)/2
NT=NA(IP)
NA(IP)=NA(I)
NQ = J
K=I
20 K=K+1
IF(K.GT.NQ) GO TO 50
IF(NA(K).LE.NT) GO TO 20
NQ=NQ+1
30 NQ=NQ+1
IF(NQ.I.T.K) GO TO 40
IF(NA(NQ).GT.NT) GO TO 30
NX=NA(K)
NA(K) = NA(NQ)
NA(NQ)=NX
NQ=NQ+1
GO TO 20
40 NQ=K-1
50 NA(I)=NA(NQ)
NA(NQ)=NT
IF(2*NQ-1=J) 70,70,60
60 NLT(M)=I
NUT(M)=NQ-1
I=NQ+1
GO TO 80
70 NLT(M)=NQ+1
NUT(M)=J
J=NQ-1
80 M=M+1
GO TO 10

```

Table A.4. Continued.

```

90  IF(I,GE,J) GO TO 100
    IF(NA(I).LE,NA(J)) GO TO 100
    NX=NA(I)
    NA(I)=NA(J)
    NA(J)=NX
100  M=M-1
    IF(M,EQ,0) RETURN
    I=NLT(M)
    J=NUT(M)
    GO TO 10
END

SUBROUTINE SDLAG(X,N,M,LAG,SD1,SD2)
DIMENSION X(100,M),SD1(M),SD2(M)
NLAG=M-LAG
B=FLOAT(NLAG)
DO 30 J=1,M
S=0.
SL=0.
T=0.
TL=0.
DO 10 I=1,NLAG
L=I+LAG
T=T+X(I,J)
TL=TL+X(L,J)
10  CONTINUE
    XM=T/B
    XHL=TL/H
    DO 20 I=1,NLAG
L=I+LAG
S=S+(X(I,J)-XM)**2
SL=SL+(X(L,J)-XHL)**2
20  CONTINUE
    A=S/B
    AL=SL/B
    SD1(J)=SQRT(A)
    SD2(J)=SQRT(AL)
30  CONTINUE
    RETURN
END

SUBROUTINE ANORM(SU,NX)
C
C  SUBROUTINE TO TRANSFORM NX UNIFORM RANDOM NUMBERS IN INTERVAL
C  (0,1) TO NX INDEPENDENT STANDARD NORMAL VARIATES
C
DIMENSION SU(NX)
NYY=NX-1
AN=B.*ATAN(1.)
DO 10 N=1,NYY,2
AS=SQRT(-2.*ALOG(SU(N)))*COS(AN*SU(N+1))
BS=SQRT(-2.*ALOG(SU(N)))*SIN(AN*SU(N+1))
SU(N)=AS
10  SU(N+1)=BS
    RETURN
END

SUBROUTINE AGGATE(X,Y,N,M,NSEA)
C
C  NSEA= # OF SEASONS DESIRED TO AGGREGATE UP TO IE.
C  MONTHLY--QUARTERLY, NSEA=4) Q--SEMI,NSEA=2) S--ANNUAL, NSEA=1
C  M=8, NSEA=2) H=A, NSEA=1
DIMENSION X(100,M),Y(100,NSEA)
DO 40 I=1,M
IC=1
K=1
NIC=IC+M/NSEA
DO 30 J=1,M
IF(J,EQ,NIC)GOTO 10
GOTO 20
10  K=K+1
IC=IC+M/NSEA
NIC=IC+M/NSEA
20  Y(I,K)=Y(I,K)+X(I,J)
30  CONTINUE
40  CONTINUE
    RETURN
END

```

Table A.4. Continued.

```

SUBROUTINE TFUNM(X,Y,AL,N,M,INV,NOT)
C   BOX-COX TRANSFORMATION AFTER HINKLEY
C*  NOT=1 THEN NO TRANSFORM
C*  INV=1 THEN INVERSE TRANSFORM
      DIMENSION X(100,M),Y(100,M)
      IF(NOT.EQ.0)GOTO 40
      IF(INV.EQ.1)GOTO 20
      DO 10 I=1,N
      DO 10 J=1,M
      Y(I,J)=X(I,J)
10   CONTINUE
      RETURN
20   CONTINUE
      DO 30 I=1,N
      DO 30 J=1,M
      X(I,J)=Y(I,J)
30   CONTINUE
      RETURN
40   CONTINUE
      IF(INV.EQ.1)GOTO 80
      IF(AL.EQ.0)GOTO 60
      DO 50 I=1,N
      DO 50 J=1,M
      Y(I,J)=(X(I,J)**AL-1.0)/AL
50   CONTINUE
      RETURN
60   CONTINUE
      DO 70 I=1,N
      DO 70 J=1,M
      Y(I,J)=ALOG(X(I,J))
70   CONTINUE
      RETURN
80   CONTINUE
      IF(AL.EQ.0)GOTO 100
      DO 90 I=1,N
      DO 90 J=1,M
      IF(Y(I,J).LT.0.0001)Y(I,J)=0.01
      X(I,J)=(Y(I,J)*AL+1.0)**(1.0/AL)
90   CONTINUE
      RETURN
100  CONTINUE
      DO 110 I=1,N
      DO 110 J=1,M
      X(I,J)=EXP(Y(I,J))
110  CONTINUE
      END

```


Table A.4. Continued.

```

SUBROUTINE COVAR(X,Y,SKY,N,M1,M2,LAG,I1,J1,ND1,ND2,SDX,SDY)
C COVARIANCE MATRIX ON DATA WITH MEAN ALREADY SUBTRACTED OFF
C I1= STARTING SEASON OF X GOING TO M1; J1= START OF Y GO TO M2
C K= YEAR COUNTER ; LAG = LAG #
C DIMENSION X(100,ND1),Y(100,ND2),SKY(ND1,ND2),TSKY(12,12)
*,SDX(ND1),SDY(ND2)
NLAG=N-LAG
DO 10 I=1,ND1
DO 10 J=1,ND2
TSKY(I,J)=0.0
10 CONTINUE
DO 30 K=1,NLAG
L=K+LAG
DO 20 I=I1,M1
DO 20 J=J1,M2
J2=J+J1+1
I2=I+I1+1
TSKY(I,J)=TSKY(I,J)+X(K,I)*Y(L,J)
SKY(I2,J2)=TSKY(I,J)/FLOAT(NLAG)
SKY(I2,J2)=SKY(I2,J2)/(SDX(I)*SDY(J))
20 CONTINUE
30 CONTINUE
RETURN
END

```

```

FUNCTION HURSK(X,N,XBAR,XSD)
DIMENSION X(N)
DMIN=1.E15
DMAX=-1.E15
D=0.
DO 10 I=1,N
Y=X(I)-XBAR
D=D+Y
IF(D.GT,DMAX)DMAX=D
IF(D.LT,DMIN)DMIN=D
10 CONTINUE
R=DMAX+DMIN
A=ALOG10(R)-ALOG10(XSD)
B=ALOG10(N)-ALOG10(2)
HURSK=A/B
RETURN
END

```

Table A.4. Continued.

```

SUBROUTINE F3001(X,N,A,S,SD,S,H,NO)
DIMENSION X(N),Y(10000)
DO 10 I=1,N
Y(I)=X(I,N)
10 CONTINUE
C AVERAGE
A=AMEAN(Y,N)
C VARIANCE
V=VAR(Y,A,N)
SD=SQRT(V)
C SKEW
CALL SKEW(Y,SD,S,H,A)
RETURN
END

SUBROUTINE SKEW(X,S,CS,N,A)
DIMENSION X(1000)
SUM=0.
DO 10 I=1,N
10 SUM=SUM+(X(I)-A)**3
UBV=((S**2)*(N-1))/N
BV=SQRT(UBV**3)
BSK=(SUM/3)/BV
C CORRECTION FOR SINGLE SAMPLE BIAS. REP. BOBEE AND ROBITALLE. WRR.
C VOL. 11, NO. 6, 1975, P851, EQ. 6.
ALPHA=(SQRT((N*(N-1)))/(N-2))*(1.+(8.5)/N)
CS=ALPHA*BSK
RETURN
END

FUNCTION VAR(X,A,N)
DIMENSION X(N)
S=0.
DO 10 I=1,N
10 S=S+(X(I)-A)**2
VAR=S/(N-1)
RETURN
END

```

Table A.4. Continued.

```

FUNCTION AMEAN(X,N)
DIMENSION X(N)
B=FLOAT(N)
S=0.
DO 10 I=1,N
10  S=S+X(I)
AMEAN=S/B
RETURN
END

SUBROUTINE DMH(GX,HS,NTRACE,SD,TMAX,TMIN,NY,DRAR,DSTH)
DIMENSION GX(50,12),DEV(50,12),HS(12),SD(12),DRAP(12)
*,DSTN(12),G(50),TMAX(12),TMIN(12)
DO 100 J=1,NY
DO 50 I=1,NTRACE
DEV(I,J)=(HS(J)-GX(I,J))/(SD(J))
G(I)=GX(I,J)
50  CONTINUE
CALL DMHRT(G,NTRACE)
TMAX(J)=G(NTRACE)
TMIN(J)=R(1)
100 CONTINUE
DO 200 J=1,NY
CALL FPHOH(DEV,NTRACE,J,A,V,DS,SK,50)
DRAR(J)=A
DSTH(J)=DS
200 CONTINUE
RETURN
END

SUBROUTINE DAMH(AGX,AHS,ATMAX,ATMIN,ARAR,ASTH,N)
DIMENSION AGX(N),DEV(50)
210 CONTINUE
DO 300 I=1,N
DEV(I)=(AHS-AGX(I))/AHS
300 CONTINUE
CALL FPHOH(DEV,N,ARAR,ASTH,A1,A2)
CALL DMHRT(AGX,N)
ATMAX=AGX(N)
ATMIN=AGX(1)
RETURN
END

```

Table A.4. Continued.

```

SUBROUTINE F2HMM(X, Y, A, S, AX, AN)
DIMENSION X(N), Y(100)
DO 10 I=1, N
Y(I)=X(I)
10 CONTINUE
A=AFAN(Y, I)
V=VAR(Y, A, 0)
S=SUMT(Y)
CALL WKRRT(Y, N)
AX=Y(N)
AN=Y(1)
RETURN
END

```

```

SUBROUTINE DIVERG(Q, N, ETA)
DIMENSION W(100, 12), ETA(100, 12)
DO 50 I=1, N
DO 30 J=8, 12
IF(Q(I, J), GT, 17510, )GOTO 20
IF(Q(I, J), GT, 16905, )ETA(I, J)=3592.
ETA(I, J)=, 221*Q(I, J)-107, 836
IF(ETA(I, J), LT, 10, )ETA(I, J)=10.
GOTO 30
20 IF(Q(I, J), GT, 24150, )GOTO 25
ETA(I, J)=, 453*Q(I, J)-3930, 38
GOTO 30
25 ETA(I, J)=7010.
30 CONTINUE
50 CONTINUE
RETURN
END

```

Table A.4. Continued.

```

SUBROUTINE CROPHY(ETP,ETA,N,TOTY,TOTB,YACT,BEN,AC)
COMMON/CY1/PPICE,ALV,ALP,ALM,CONST,YPOT
DIMENSION IPI(12),ETA(100,12),YACT(100),BEN(100)
TOTY=0.0
TOTB=0.0
CYPAC=(CONST*YPOT)*AC
DO 10 I=1,N
RV=(ETA(I,8)+ETA(I,9))/(ETP(8)+ETP(9))
RP=ETA(I,10)/ETP(10)
RM=(ETA(I,11)+ETA(I,12))/(ETP(11)+ETP(12))
RVY=RV*ALV
RPF=RP*ALP
RHM=RM*ALM
YACT(I)=CYPAC*RVY+RPF+RHM
BEN(I)=YACT(I)*PRICE
TOTY=TOTY+YACT(I)
TOTB=TOTB+BEN(I)
10 CONTINUE
RETURN
END

```

```

SUBROUTINE SEUPEK(GX,NY,DEM,SIZE)
DIMENSION GX(100,12),DEM(12),D(1850)
DEV=0.0
DO 10 J=1,12
IF(J.GE.8)GOTO 10
DEM(J)=0.0
10 CONTINUE
900 FORMAT(1H , 'DEMAND=' , 12F10.2)
PEAK=-1.E15
TROUGH=1.E15
SIZE1=PEAK
IP=0
K=0
N2=NY*2
NP=NY*24
DO 200 I=1,N2
IF(I.LE.NY)GOTO 20
L=I-NY
GOTO 30
20 L=I
30 CONTINUE
DO 150 J=1,12
DIF=GX(L,J)-DEM(J)
DEV=DEV+DIF
IF(DEV.GE.PEAK)GOTO 40
IP=1
IF(DEV.LE.TROUGH)TROUGH=DEV
GOTO 150
40 IF(IP.EQ.0)GOTO 45
SIZE=PEAK-TROUGH
IF(SIZE.GT.SIZE1)SIZE1=SIZE
SIZE=SIZE1
IP=0
TROUGH=1.E15
45 PEAK=DEV
150 CONTINUE
200 CONTINUE
950 FORMAT(1H , 'RESERVOIR SIZE=' , E15.9)
RETURN
END

```

Table A.4. Continued.

```

SUBROUTINE NONCOR(L, AVE, N, S, R, LAG)
DIMENSION W(100,12), AVE(12), S(12), R(12), P1(12), A2(12), A1(12)
, S1(12)
NL=N-LAG
DO 20 J=1,12
A1(J)=0.0
A2(J)=0.0
P1(J)=0.0
20 CONTINUE
DO 40 I=1,NL
IL=I+LAG
DO 40 J=1,12
D1=Q(I,J)-AVE(J)
A2(J)=A2(J)+D1*D1
IF(J, EQ, 1) GO TO 30
K=J-1
D2=Q(IL,K)-AVE(K)
GO TO 35
30 IF(I, EQ, 1) GO TO 35
K=I2
D2=Q(IL-1,K)-AVE(K)
35 P1(J)=P1(J)+D1*D2
A1(J)=A1(J)+D2*D2
40 CONTINUE
EN1=EN-1
DO 42 J=1,12
S1(J)=SQRT(A1(J)/EN1)
S(J)=SQRT(A2(J)/EN1)
42 CONTINUE
DO 47 J=1,12
IF(J, EQ, 1) GO TO 45
K=J-1
GO TO 44
43 K=I2
44 R(J)=P1(J)/(S(J)*S(K)*(N-1))
IF(LAG, NE, 0) R(J)=P1(J)/(S(J)*S1(K)*NL)
47 CONTINUE
RETURN
END

```

```

SUBROUTINE XFGNH(G, K, NR, NZ, M, R, GAM, W, CZ, LL)
DIMENSION F(300), G(300), W(20), RM(20)
C
C SUBROUTINE GENERATES NR HIGH FREQUENCY NUMBERS OF FAST FRACTIONAL
C GAUSSIAN NOISE WITH THEORETICAL VALUES OF LAG1 SERIAL CORRELATION
C COEFFICIENT=C AND STANDARD DEVIATION=STD.
SS=(B*(N-1,0))/(2.0*H*H-H)/GAM
STA=SQRT(1.0-SS)
CLO=0.0
CL1=0.0
DO 5 N=1,NZ
RM(N)=1.0/FXP((1.0/B)**FLD(N))
CLO=CLO+W(N)*RM(N)
CL1=CL1+W(N)*RM(N)*RM(N)
5 CONTINUE
C=(2.0**((2.0*H-1,0)-1.0-CL1))/(1.0-CLO)
CAT=SQRT(1.0-C*C)
G(1)=R(1)
DO 10 J=2,NR
G(J)=C*G(J-1)+R(J)*CAT
10 G(J)=G(J)*STA
STA=STA*STA
IF(C, GE, 1.0, OR, C, LT, 0.0) GO TO 35
IF(LL, NE, 0) GO TO 40
WRITE(6,20) STA,C
20 FORMAT(2X,34H VARIANCE OF PFGN HIGH FREQ NOS = ,F20,4)
,12H LAG1 SEC = ,F20,4)
WRITE(6,30) NR,NZ,M,R,GAM
30 FORMAT(2110,3F20,5)
GO TO 40
35 WRITE(6,20) STA,C
STOP
40 RETURN
END

```

Table A.5. Definition of program variables.

Name	Description
A(12,12)	A coefficient matrix for VS or MR disaggregation model
AA	interval parameter for Broken Line model
AA	generated annual means
AA(MAN,1)	annual generated mean for each trace
AAA	average of the MAN generated annual means
AAS	standard deviation of MAN annual means
ABAR	average deviation statistics in subroutine DAMM
ABEN	historic average annual crop benefit
ABN	minimum of MAN average annual crop benefits
ABX	maximum of MAN average annual crop benefits
AGX	generated value in subroutine DAMM
AHM	average value in subroutine DAMM
AHM	average of MAN generated Hurst coefficients
AHS	historic value in subroutine DAMM
AHS	standard deviation deviation of MAN Hurst coefficients
AL	transformation exponent
AM	autocorrelation parameter for ARMA-Markov model
AM(MAN,12)	monthly mean generated streamflows for each trace
ASCM	average of MAN annual lag-one serial correlation coefficients
ASCS	standard deviation of MAN lag-one annual serial correlations
ASDM	average of the MAN generated annual standard deviations
ASDS	standard deviation of MAN annual standard deviations

Table A.5. Continued.

Name	Description ^b
ASIZE	average of MAN reservoir sizes
ASKM	average of MAN generated annual skews
ASKS	standard deviation of MAN annual skews
ASTN	standard deviation of deviation statistic in sub-routine DAMM
ATMAX	maximum deviation statistic
ATMIN	minimum deviation statistic
AV	average generated deviates
AVE(12)	monthly averages
AWN	low frequency component constant in FFGN model
AYACT	historic average annual crop yield
B	quality parameter for FFGN model
B(12,12)	B coefficient matrix for MR disaggregation model
BA	generated average annual crop benefits
BA(MAN)	average annual crop benefit
BAA	average of MAN average annual benefits
BAS	standard deviation of MAN average annual crop benefits
BB	Broken Line model constant as a function of the Hurst coefficient
BD	Broken Line model constant as a function of the Hurst coefficient and quality parameter BZ
BM	historic mean annual streamflow
BN(MAN)	minimum annual crop benefit
BS	generated standard deviation of annual crop benefits
BS(MAN)	standard deviation of the annual crop benefit

Table A.5. Continued.

Name	Description
BSA	average of MAN average annual crop benefit standard deviation
BSS	standard deviation of MAN average annual crop benefit standard deviation
BWN	low frequency component constant in FFGN model
BX(MAN)	maximum annual crop benefit
BZ	quality parameter in Broken Line model
CAT	high frequency standard deviation in the FFGN model
C(NZ)	a low frequency component of FFGN model
C1	parameter for ARMA-Markov model
C2	parameter for ARMA-Markov model
C(12,12)	C coefficient matrix for VS or MR disaggregation model
CC(NZ)	square root of 1 minus C(NZ) in FFGN model
CO(20)	not used; lag correlation
COO(MAN)	not used; average lag-one correlations
COR(20)	not used; summation of correlations
CRR(20)	not used; average lag correlations
CYA(MAN)	average annual crop yield
CYAA	average of MAN average annual yields
CYAS	standard deviation of MAN average annual yields
CYN(MAN)	minimum annual crop yield per trace
CYS(MAN)	standard deviation of the annual crop yield
CYSA	average of MAN standard deviations of average annual crop yields
CYSS	average of MAN average annual crop yield standard deviations

Table A.5. Continued.

Name	Description
CYX(MAN)	maximum annual crop yield per trace
CZ	serial correlation parameter for FFGN model
DA	Broken Line model interval spacings
DAAS	standard deviation of deviation of annual means to historic
DAAB	average deviation of annual means to historic
DBA	average deviation of generated annual crop benefits to historic
DBARM(12)	average deviation from historic value of monthly means and generated means
DBARK(12)	average deviation from the historic value of monthly skews of the generated monthly skews
DBARS(12)	average deviation from historic value of monthly standard deviations from generated monthly standard deviations
DBS	standard deviation of deviations of generated annual crop benefits to historic
DBSA	average deviation of generated standard deviations of annual crop benefits to historic
DBSS	standard deviation of deviations of generated annual benefits to historic
DBTA	average deviation of generated total crop benefit from historic
DBTS	standard deviation of deviations of generated total crop benefit from historic
DEV(MAN)	deviation statistic, the relative difference between historic and generated
DHAB	average deviation of Hurst coefficient to historic
DHAS	standard deviations of deviations of Hurst coefficients to historic

Table A.5. Continued.

Name	Description
DRLB	average deviation of generated run lengths from historic
DRLS	standard deviation of the deviations of generated run lengths from historic
DRSB	average deviation of generated run sums from historic
DRSS	standard deviation of the deviations of generated run sums from historic
DSAB	average deviation of annual skew to historic
DSAS	standard deviation of deviations of annual skew to historic
DSCB	average deviation of annual lag-one serial correlation to historic
DSCS	standard deviation of deviations of annual lag-one serial correlations to historic
DSDAB	average deviation of annual standard deviations to historic
DSDAS	standard deviation of deviation of annual standard deviations to historic
DSEED	seed for generating random numbers
DSIZA	average deviation of generated reservoir size to historic
DSIZS	standard deviation of deviations of generated reservoir size to historic
DSTNK(12)	standard deviation of the deviation of the generated monthly skews from the historic monthly skews
DSTNM(12)	standard deviation of the deviation from historic monthly means of the generated monthly means
DSTN(12)	standard deviation of monthly deviation statistic
DSTNS(12)	standard deviation of the deviation from historic monthly standard deviations and generated monthly standard deviations

Table A.5. Continued.

Name	Description
DYA	average deviation of generated annual crop yield to historic
DYS	standard deviation of deviations of generated annual crop yield to historic
DYSS	standard deviations of deviations of generated standard deviation of annual crop yield to historic
DYTA	average deviation of generated total crop yield from historic
DYSA	average deviation of standard deviations of generated annual crop yields to historic
DYTS	standard deviation of the deviation of generated total crop yield from historic
EJZ	historic run length
ENX	mean of MAN down crossings
ERL(MAN)	generated expected run length per trace
ERLN	minimum expected run length for MAN traces
ERLX	maximum expected run length for MAN traces
ERS(MAN)	generated expected run sum per trace
ERSN	minimum of MAN expected run sums
ERSX	maximum of MAN expected run sums
ESZ	historic run sum
FA	random starting interval spacing for Broken Line model
G(300)	normal random numbers with zero mean and unit variance
G(NR)	high frequency component in the FFGN model

Table A.5. Continued.

Name	Description
GAM	gamma function of $3-2^H$ in the FFGN model
GMM(12)	average over MAN traces of the mean monthly flows
GMMS(12)	standard of MAN traces of mean monthly flows deviation
GRL	mean of MAN expected run lengths
GRLS	standard deviation of MAN expected run length
GRS	mean of MAN expected run sums
GRSS	standard deviation of MAN expected run sums
GSK(12)	average over MAN traces for the monthly skews
GSKS(12)	standard deviation of MAN traces of monthly skews
GSSD(12)	average for MAN traces of the monthly standard deviation
GSSS(12)	standard deviation for MAN traces of monthly standard deviations
GX(MAN,12)	generated monthly value in subroutine DMM
H	Hurst coefficient for FFGN model
HA(MAN,1)	generated Hurst per trace
HBM	historic mean of the annual time series
HH	Hurst coefficient for Broken Line model
HH	historic Hurst coefficient
HHH	historic Hurst coefficient for the annual time series
HM(MAN)	mean Hurst coefficient for each generated trace
HRLRSX	historic run length for the maximum run sum
HRSRLX	historic run sum for the maximum run length

Table A.5. Continued.

Name	Description
HS	historic annual skew
HS(12)	historic monthly value in subroutine DMM
HSC	historic serial lag-one coefficient for the annual time series
HSD	historic annual standard deviations
HSIZE	historic reservoir size
HSTD	historic standard deviation of the annual time series
HXX(1,1)	historic lag-one serial correlation
HY1(12)	historic monthly serial lag-one correlations
HYX(12,1)	historic annual-monthly crop correlation
HYY(12,12)	historic monthly cross correlations
HYZ(12,12)	historic cross correlation matrix between previous year's months and current year's months
IHIS	option to read historic time series
ISTART	starting year for time series to be generated
IWR	write option in subroutine CF same as LL
IY	starting time for flows in DEFCIT subroutine
JL	array of run lengths in DEFCIT subroutine
LL	option to write output
LN	option to write out number of lines in subroutine SPLIT
MAN	number of generated traces
MN(12)	month number of previous year's months in MR disaggregation model
MR1	option to set $A_0 = A_1$ in BKL model if $\rho(1)$ is > than maximum $\check{\rho}(1)$

Table A.5. Continued.

Name	Description
N	number of broken lines in Broken Line model
NAM	number of serial correlations to compute
NCL	number of crossing levels in historic time series
NJ	stochastic model number
NR	number of annual streamflows to generate
NT	number of years plus 10 for generation sequence
NTRACE	number of traces generated same as MAN
NX(7)	number of downcrossings per crossing level
NZ	number of summations in FFGN model
PH	ϕ parameter for the ARMA-Markov model
PHI	θ parameter for ARMA(1,1) model
QX(NR,12)	disaggregated monthly flow in subroutine DMONTH
R(300)	random number generated either uniformly distributed in BKL subroutine or normally distributed in MARKOV models
R1	serial correlation parameter for ARI model
RAM	FGN autocorrelation in the ARMA-Markov model
RD(NZ,NR)	the low frequency component in FFGN model
RLN(MAN)	minimum generated run length
RLRSX(MAN)	run length for the maximum run sum per trace
RLX(MAN)	maximum generated run length
RP(MAN)	probability less than plotting point
RS	array of run sums in DEFCIT subroutine
RSN(MAN)	minimum generated run sum

Table A.5. Continued.

Name	Description
RSRLX(MAN)	run sum for the maximum run length per trace
RSX(MAN)	maximum generated run sum
S	summation of Broken Line model weighting function
S(MAN,12)	monthly skew for each generated trace
SA	ARMA-Markov model variance for the Markov term
SA	generated annual skews
SA(MAN,1)	annual skew generated per trace
SAAN	minimum deviation of annual means to historic
SAAX	maximum deviation of annual means to historic
SAM(12)	monthly average streamflows, historic
SB	ARMA-Markov model variance for the ARMA term
SBEN	historic standard deviation of annual crop benefits
SC	generated annual lag-one serial correlation coefficient
SCY(12)	monthly serial correlations
SD(MAN,12)	monthly standard deviation for each generated trace
SDA(MAN,1)	annual generated standard deviation per trace
SDA	generated annual standard deviations
SDM(12)	monthly standard deviations
SHAN	minimum deviation of Hurst coefficients to historic
SHAX	maximum deviation of Hurst coefficients to historic
SIGE	standard deviation for the ARMA(1,1) model
SIZN	minimum of MAN reservoir sizes

Table A.5. Continued.

Name	Description
SIZX	maximum of MAN reservoir sizes
SK	historic skew of the annual time series
SMNK(12)	minimum skew for the generated monthly flows
SMNM(12)	minimum mean monthly flow generated for each month
SMNS(12)	minimum standard deviation of generated monthly flows
SMXK(12)	maximum skew of the generated monthly flows
SMXM(12)	maximum mean monthly flow generated for each month
SMXS(12)	maximum standard deviation of generated monthly flows
SNX	standard deviation of MAN downcrossings
SQ	quality parameter for FFGN model
SQ(2000)	normally distributed random number for FFGN subroutine
SRL(MAN)	generated standard deviation for the run lengths
SRLM	mean of MAN standard deviation of run lengths
SRLN	minimum of MAN run length standard deviations
SRLS	standard deviation of MAN standard deviations of run lengths
SRLX	maximum of MAN run length standard deviations
SRS(MAN)	generated standard deviation for the run sums
SRSM	mean of MAN run sum standard deviation
SRSN	minimum of MAN run sum standard deviations
SRSS	standard deviation of MAN run sum standard deviations
SRSX	maximum of MAN run sum standard deviations
SS	constant in the high frequency component of the FFGN model
SS(12)	historic monthly steamflow skews
SSAN	minimum deviation of annual skews to historic

Table A.5. Continued.

Name	Description
SSAX	maximum deviation of annual skews to historic
SSCN	minimum deviation of annual lag-one serial correlations to historic
SSCX	maximum deviation of annual serial lag-one correlations to historic
SSD(12)	historic monthly standard deviations for streamflows
SSDAN	minimum deviation of annual standard deviations to historic
SSDAX	maximum deviation of annual standard deviations to historic
SSIZE	standard deviation of MAN reservoir sizes
STD	historic annual streamflow standard deviation
STT	standard deviation of the generated deviates
SVM(12)	historic monthly streamflow variances
SYACT	historic standard deviation of annual crop yield
TA	historic annual means
TANN	total annual deviations
TAM(12)	historic monthly means
TAVE(MAN)	average annual generated streamflow for each trace
TH	ϕ parameter for the ARMA-Markov model
TH1	θ parameter for ARMA(1,1) model
TITLE(20)	title of generated time series
TMAX(12)	maximum monthly deviation statistic
TMD	total summation of all monthly deviations including run length and run sum deviations

Table A.5. Continued.

Name	Description
TMIN(12)	minimum monthly deviation statistic
TN	number of intervals per simple broken line in the Broken Line model
TOBA	average of MAN total benefits
TOBN	minimum of MAN total benefits
TOBS	standard deviation of MAN total benefits
TOBX	maximum of MAN total benefits
TODM	summation of the absolute value of monthly mean deviations
TODS	summation of the absolute value of monthly standard deviations
TODSK	summation of the absolute value of monthly skew deviations
TOTAL	total of monthly and annual deviations
TOTB	historic total crop benefit
TOTY	historic total crop yield
TOYA	average of MAN total yields
TOYN	minimum of MAN total yields
TOYS	standard deviation of MAN total yields
TOYX	maximum of MAN total yields
TSTD(MAN)	standard deviation of generated streamflows for each trace
TSM(12)	historic monthly standard deviations
VTD	historic variance of the annual time series
W	weights in the FFGN model

Table A.5. Continued.

Name	Description
W(20)	Broken Line model weighting function
W(NZ)	weighting function in the low frequency part of the FFGN model
WA	the square root of 1 minus S in Broken Line model MAUT
X(NR,MAN)	MAN generated or historic annual time series of length NR
X1(NR,1)	annual streamflow with mean subtracted
XNN	minimum of MAN downcrossings
XNX	maximum of MAN downcrossings
Y(NR,12)	monthly generated flows disaggregated from X1 and untransformed
YA(NR,N)	simple generated broken line unweighted and standardized
YCN	minimum of MAN average annual crop yields
YCX	maximum of MAN average annual crop yields
YG(NR,12,MAN)	MAN generated untransformed disaggregated monthly flows
YT(NR,12)	monthly generated flows with mean subtracted
Z	historic previous year's months for Mejia-Rousselle disaggregation model
ZA	annual streamflow values generated

APPENDIX B

User Manual for Parameter Estimation

Program for Disaggregation Model

Table B.1. Description of input formats.

Data Segment	Card No. in Data Segment	Format	Description
Program PREP			
Data PREP	1	Format Free N	Number of data points in input time series
	1	Format Free IREAD	Input option for aggregation of time series = 0: read aggregated annual time series from file = 1: aggregate monthly time series from file
	1	Format Free ISTART	Starting year of time series
	1	Format Free NTR	Number of transformations for transformation loop when analyzing time series
	1	Format Free ISTAT	Program option for computing historic sta- tistics = 0: does not compute historic statistics = 1: computes historic statistics
	1	Format Free IDIS	Output option for transformation routine = 0: writes out transformation goodness of fit for several different transformations = 1: does not compute transformation goodness
	1	Format Free IWR	output option for data analysis = 0: does not write out input time series, and various statistical computations in program = 1: writes out all time series inputs, aggregations and statistical com- putations

Table B.1. Continued.

Data Segment	Card No. in Data Segment	Format	Symbol	Description
	1	Format Free	IS13	Number of years past starting year to begin time series analysis
	1	Format Free	MONANN	Program option for aggregation = 0: aggregates from monthly to quarterly to semiannual to annual = 1: aggregates only from monthly to annual
	1	Format Free	NOT	Program option for transformation = 0: transformation of the time series = 1: no transformation of the time series
Disaggregation Seasonal Model	2	Format Free	IVS	Model option for seasonal disaggregation model = 0: Mejia-Rousselle model computed = 1: Valencia-Schaake model computed
	2	Format Free	IY	Beginning index for disaggregated season, Y
	2	Format Free	MY	Ending index for disaggregated season, Y
	2	Format Free	NDY	Seasonal dimension number = 12: monthly = 4: quarterly = 2: semi-annually
	2	Format Free	MX	Ending index for aggregated season, X
	2	Format Free	IZ	Beginning index for previous seasons in MR model

Table B.1. Continued.

Data Segment	Card No. in Data Segment	Format	Symbol	Description
	2	Format Free	NDZ	Previous season dimension = 12: monthly = 4: quarterly = 2: semi-annually
Disaggregation Seasonal Model	2	Format Free	ICYR	Matrix decomposition option for BB^T solution = 0: Principal components method = 1: Young's lower triangular method
Transformations	3	Format Free	AL(J)	Transformation exponents, J=1, NTR
Data PREP	4	Format Free	IHO	Program option for historic statistics = 0: computes disaggregation model = 1: computes historic untransformed. statistics only
	4	Format Free	IDF	Input format option for time series = 0: Logan monthly time series format (12F10.2) = 1: other format (12F6.0)
Crop production model	5	Format Free	AC	Area of demand for consumptive use in acres
	5	Format Free	EFF	Irrigation conveyance efficiency (canal losses)

Table B.1. Continued.

Data Segment	Card No. in Data Segment	Format	Symbol	Description
	5	Format Free	PRICE	Price in dollars of unit crop yield
	5	Format Free	YPOT	Potential crop yield in units per season
Crop production model (continued)	6	Format Free	ALV	exponent for vegetative stage of crop production model
	6	Format Free	ALP	exponent for pollination stage of crop production model
	6	Format Free	ALM	exponent for maturation stage of crop production model
	6	Format Free	CONST	Constant for crop production model
	7	Format Free	TITLE	Title of time series analyzed

Table B.2. Sample input.

Input:

65, 1, 1914, 1, 1, 1, 1, 0, 1, 0

1, 1, 12, 12, 1, 12, 12, 0

0.333

0,1

1500, 0.5, 2.45, 86.63

0.347, 0.574, 0.33, 0.97

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Table B.3. Sample output.

IREAD=1, AGGREGATES AND WRITES TO FILES, IREAD=0, READS DATA FROM FILE,
 NTR=# OF TRANSFORMATIONS,
 ISTAT=1, WRITES OUT DATA & STATS,
 IDIS=1, WRITES OUT TRANS DATA & PUTS ON FILES,
 IWR=1, WRITES OUT TRANS DATA BEFORE MEAN SUBTRACTED,
 MONANN=1 AGGREGATE FROM MONTHLY TO ANNUAL,
 NOT=1 NO TRANSFORM,
 NCL=# OF CROSSING LEVELS,
 N=65, IREAD=1, ISTART=1914, NTR=1, ISTAT=1, ICIS=1, IWR=1, IS13=0, MONANN=1, NOT=0,
 IVS=1 THEN DO VALENCIA=SCHAAKE DISAG A,B,
 IY=BEGINNING MONTH OR SEASON,
 NY=END COUNTER FOR LOWER LEVEL DISAGGREGATED SEASONS,
 NDY=DIMENSION OF LOWER LEVEL SEASONS,
 MX=END COUNTER FOR HIGHER LEVEL SEASON,
 IZ=BEGINNING MONTH OR SEASON OF PREVIOUS YEAR,
 NDZ=DIMENSION OF PREVIOUS SEASONS,
 ICYR=1, THEN C MATRIX BY YOUNGS RECURSIVE VICE PRCOMP,
 IVS=1, IY=1, NY=12, NDY=12, MX=1, IZ=12, NDZ=12, ICYR=0, NZ=1, NY=12,
 AL(J)= TRANSFORM EXPONENT IF =1 THEN LOG TRANS,
 <EXP>=0,333,
 IMO=1, THEN ONLY HISTORIC STATS DONE, STOP,
 IMO=0, IDF=1,
 ALV=0,347, ALP=0,574, ALM=0,33, CONST=0,97,
 AC=1500,0, EFF=0,5, PRICE=2,45, YPOT=86,63,
 BLACK BP3

	OCTOBER	NOVEMBER	DECEMBER	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER
1914	6150,00	5470,00	4890,00	5270,00	4530,00	7620,00	21100,00	23700,00	12600,00	9590,00	8850,00	8210,00
1915	6700,00	6070,00	6520,00	5740,00	5200,00	5650,00	6130,00	6210,00	5800,00	5040,00	4350,00	4550,00
1916	4970,00	4760,00	4370,00	4210,00	4260,00	10800,00	27000,00	22800,00	11500,00	9350,00	7930,00	7380,00
1917	6950,00	5820,00	5480,00	5080,00	4450,00	5010,00	13600,00	41900,00	25900,00	14000,00	11100,00	9280,00
1918	8480,00	7500,00	7010,00	6270,00	5780,00	9840,00	12800,00	16300,00	8930,00	8300,00	7560,00	6250,00
1919	6090,00	5480,00	5310,00	4880,00	4520,00	6030,00	9940,00	10200,00	6660,00	5230,00	4890,00	4750,00
1920	4850,00	4350,00	4130,00	4270,00	3930,00	4730,00	9580,00	35200,00	13900,00	9410,00	8180,00	7320,00
1921	7010,00	6600,00	6150,00	5710,00	5510,00	11500,00	17400,00	41900,00	20300,00	12200,00	10500,00	9280,00
1922	8670,00	7620,00	7320,00	6890,00	5830,00	7440,00	14000,00	37900,00	16400,00	10600,00	9780,00	8450,00
1923	7870,00	6960,00	6950,00	6640,00	5180,00	5850,00	14900,00	38800,00	14900,00	11400,00	9900,00	8330,00
1924	8480,00	7260,00	6580,00	6270,00	5580,00	5820,00	12700,00	14700,00	7680,00	6640,00	5870,00	5500,00
1925	5580,00	5040,00	5070,00	4440,00	4060,00	5960,00	13400,00	15700,00	8930,00	7070,00	5510,00	5650,00
1926	5490,00	4880,00	5070,00	4840,00	3880,00	5010,00	10200,00	7870,00	5380,00	5140,00	4960,00	4410,00
1927	4460,00	4390,00	4250,00	4210,00	3870,00	4940,00	12500,00	20200,00	10100,00	6950,00	6460,00	5740,00
1928	5710,00	5390,00	5080,00	4630,00	4490,00	7320,00	12000,00	19700,00	7740,00	7010,00	6400,00	5510,00
1929	5600,00	5330,00	4610,00	4300,00	3920,00	5490,00	10400,00	20100,00	9820,00	7010,00	6210,00	5730,00
1930	5550,00	5210,00	5010,00	3900,00	4220,00	5020,00	8570,00	7870,00	5860,00	5320,00	5440,00	4670,00
1931	4540,00	3900,00	3650,00	3580,00	3050,00	3680,00	3800,00	4480,00	3500,00	3070,00	3690,00	2860,00
1932	2970,00	3000,00	3070,00	3010,00	2990,00	4670,00	17600,00	31900,00	12000,00	8360,00	7260,00	5750,00
1933	5590,00	4960,00	4350,00	4050,00	3530,00	4270,00	7260,00	13800,00	10300,00	6460,00	5380,00	4720,00
1934	4590,00	4250,00	4030,00	3730,00	3260,00	3820,00	3840,00	3610,00	2970,00	2780,00	2710,00	2570,00
1935	2670,00	2740,00	2770,00	2660,00	2590,00	3230,00	7600,00	10500,00	6250,00	4280,00	3720,00	3290,00
1936	3360,00	3310,00	3140,00	3100,00	2960,00	4330,00	24170,00	34810,00	10940,00	7660,00	6590,00	5620,00
1937	5470,00	5220,00	4660,00	4250,00	3720,00	5060,00	9590,00	21910,00	9470,00	6920,00	5730,00	4860,00
1938	5060,00	4770,00	4670,00	4310,00	3800,00	6260,00	15670,00	16270,00	8910,00	7020,00	6140,00	5400,00
1939	5340,00	5070,00	4900,00	4280,00	3600,00	6140,00	9050,00	7530,00	5230,00	4370,00	3920,00	3650,00
1940	3720,00	3510,00	3500,00	3490,00	3220,00	4140,00	5520,00	5440,00	3770,00	3280,00	3000,00	2860,00
1941	3020,00	2840,00	2910,00	2840,00	2740,00	3160,00	3660,00	5130,00	3430,00	2970,00	2820,00	2590,00
1942	2870,00	2760,00	2830,00	2730,00	2420,00	2910,00	8750,00	6170,00	4990,00	4090,00	3420,00	3180,00
1943	3200,00	3270,00	3370,00	3530,00	3380,00	6030,00	20690,00	14480,00	8730,00	6900,00	6100,00	5130,00
1944	5860,00	4540,00	4330,00	4080,00	3530,00	3860,00	5530,00	4190,00	6530,00	5340,00	4630,00	4830,00
1945	4240,00	4110,00	3710,00	3590,00	3700,00	4330,00	5570,00	11810,00	12310,00	7660,00	6180,00	5320,00

Table B.3. Continued.

1946	5240.00	5060.00	5060.00	5000.00	4090.00	8130.00	33680.00	22600.00	12270.00	9240.00	7960.00	6690.00
1947	6890.00	6160.00	5740.00	5160.00	4700.00	6480.00	9360.00	12540.00	7280.00	6330.00	5740.00	5120.00
1948	5270.00	4790.00	4600.00	4280.00	4100.00	4850.00	12680.00	26870.00	12050.00	8500.00	7300.00	6170.00
1949	6090.00	5720.00	5250.00	4890.00	4690.00	7090.00	16850.00	16500.00	9710.00	8140.00	7220.00	6320.00
1950	6430.00	5540.00	5330.00	5970.00	5410.00	7710.00	22760.00	30760.00	18770.00	11770.00	10100.00	8930.00
1951	8320.00	7690.00	7460.00	6460.00	6710.00	7050.00	24010.00	26060.00	13990.00	10920.00	9810.00	8390.00
1952	8020.00	6950.00	6630.00	6050.00	5330.00	6060.00	24350.00	37160.00	16410.00	12110.00	10230.00	8520.00
1953	8150.00	7150.00	6670.00	6510.00	5510.00	6430.00	8740.00	11260.00	11040.00	7470.00	6400.00	5630.00
1954	5490.00	5210.00	5170.00	5050.00	4400.00	5630.00	10280.00	8560.00	5870.00	5160.00	4720.00	4290.00
1955	4240.00	4010.00	3910.00	4070.00	3610.00	4030.00	7720.00	15140.00	7440.00	5710.00	5160.00	4590.00
1956	4660.00	4330.00	6830.00	7080.00	5380.00	7600.00	20380.00	19290.00	10770.00	8580.00	7340.00	6300.00
1957	6100.00	5650.00	5460.00	5040.00	5380.00	6690.00	10490.00	20580.00	13140.00	9100.00	7730.00	6760.00
1958	6810.00	6070.00	5980.00	5480.00	5320.00	6200.00	11120.00	20760.00	9240.00	7500.00	6720.00	5880.00
1959	6050.00	5610.00	5260.00	5020.00	4390.00	5650.00	8650.00	7890.00	5850.00	5070.00	4900.00	4570.00
1960	4740.00	4290.00	4060.00	4390.00	3800.00	6180.00	10160.00	9680.00	6260.00	5110.00	4450.00	3890.00
1961	4000.00	3900.00	4050.00	3740.00	3350.00	3630.00	4360.00	4610.00	3500.00	3130.00	2670.00	2800.00
1962	3240.00	3050.00	3040.00	3000.00	4500.00	4130.00	21930.00	15820.00	8350.00	6520.00	5880.00	5210.00
1963	4890.00	4460.00	4160.00	3810.00	5190.00	4720.00	7090.00	10900.00	6060.00	4770.00	4260.00	3840.00
1964	3970.00	3910.00	3540.00	3580.00	3090.00	3110.00	8000.00	17930.00	9520.00	6650.00	5620.00	4830.00
1965	4430.00	4150.00	5530.00	4880.00	5640.00	5670.00	19960.00	24400.00	13620.00	9590.00	8220.00	7500.00
1966	6930.00	6210.00	5590.00	4980.00	4430.00	6690.00	12810.00	11200.00	7120.00	6170.00	5330.00	4860.00
1967	4920.00	4510.00	4550.00	4430.00	3870.00	5750.00	9850.00	24630.00	15030.00	9240.00	7520.00	6730.00
1968	6810.00	5780.00	5660.00	5230.00	5060.00	6110.00	7960.00	13880.00	9390.00	7040.00	6520.00	5930.00
1969	6130.00	5550.00	5340.00	5160.00	4720.00	5640.00	17160.00	16260.00	9160.00	7760.00	6680.00	5790.00
1970	5990.00	5320.00	5250.00	5160.00	4600.00	5200.00	6210.00	15170.00	9030.00	6920.00	6200.00	5540.00
1971	5480.00	5310.00	5740.00	7100.00	6850.00	9590.00	26550.00	37730.00	21060.00	13800.00	11950.00	10310.00
1972	9820.00	8300.00	7970.00	7980.00	7020.00	16730.00	27450.00	33430.00	18020.00	13580.00	11610.00	9600.00
1973	9150.00	7840.00	7490.00	6870.00	5630.00	6910.00	10740.00	19640.00	10410.00	8500.00	7500.00	6880.00
1974	6200.00	5800.00	5790.00	5760.00	5050.00	10530.00	18660.00	27350.00	14370.00	10810.00	6950.00	7510.00
1975	7310.00	6600.00	6350.00	5900.00	4680.00	6660.00	6590.00	25140.00	18140.00	10870.00	9050.00	7360.00
1976	7830.00	6640.00	6080.00	5830.00	5520.00	6830.00	15240.00	20800.00	9730.00	7960.00	6820.00	5730.00
1977	5800.00	4990.00	4910.00	4570.00	3990.00	4220.00	4390.00	4690.00	4060.00	3130.00	2980.00	2980.00
1978	3380.00	3510.00	3650.00	3460.00	3310.00	7460.00	16690.00	17680.00	9220.00	6640.00	5780.00	5370.00
J#1:	A=5678,3076923, V=2744226,77881, SD=1656,57078896, S=0,367232523962,											
J#2:	A=5176,61538464, V=1788835,2404, SD=1337,4734541, S=0,276321833328,											
J#3:	A=5043,23076922, V=1597272,21155, SD=1263,83235105, S=0,236544458527,											
J#4:	A=4810,15384614, V=1440592,16347, SD=1200,24670942, S=0,433565307449,											
J#5:	A=4416,0, V=1062630,625, SD=1030,83976689, S=0,39881097826,											
J#6:	A=6081,2307692, V=5156029,71150, SD=2270,68925914, S=2,28224303386,											
J#7:	A=13039,8481539, V=46853739,0383, SD=6844,9791116, S=0,99469132768,											
J#8:	A=18538,3076923, V=106297639,279, SD=10310,0746495, S=0,71711472974,											
J#9:	A=10117,0769231, V=22243236,6345, SD=4716,27359623, S=1,08071843818,											
J#10:	A=7463,6923076, V=7506501,7788, SD=2739,79958735, S=0,519790524471,											
J#11:	A=6526,9230769, V=5108531,00952, SD=2260,20596617, S=0,476747100716,											
J#12:	A=5749,5384616, V=3439851,34622, SD=1854,6836243, S=0,446126182474,											
CONSUMPTIVE USE	0.13 2.32 7.14 5.44 2.54											
DEMAND ACFT#	32,26 581,02 1785,33 1361,10 634,17											
TOTY=18644840,9407, AYACT=286843,706779, SYACT=147112,917659, YAX=645638,58504, YAN=61124,506946,												
TOTB=45679860,3042, ABEN=702767,0816, SBEN=360426,648262, BEX=1581814,53336, REMN=149755,042019,												
ODOWN CROSSINGS TOTAL DEFICIT RUN LENGTHS AND SUMS												
CROSSINGS	46											
TOTAL RUN LENGTH	93											
TOTAL RUN SUM	40025,05											
DEFICIT RUN LENGTHS AT CROSSING LEVEL ARE	2 1 2 2 2 2 2 2 2 2 3 1 2 4 3 2 2 2 2 3											
	3 3 2 2 2 2 2 1 1 2 2 1 2 2 1 2 2 3 2 2 2 2											
	1 2 1 1 3 2											
DEFICIT RUN SUMS AT CROSSING LEVEL ARE	32,26 581,02 1785,33 1361,10 634,17											
1287,11	59,07 1125,78 597,59 582,12 1130,20 398,69 398,69 440,68 984,34											
2110,89	45,81 745,66 2355,54 1609,22 168,85 566,65 453,94 1530,21 2084,37											
2252,33	1746,24 489,30 1158,93 436,26 694,83 14,87 94,43 297,03 1178,82											
960,03	235,87 1158,93 1249,54 2159,51 621,90 1366,67 650,63 820,80 365,54											

Table B.3. Continued.

178.41	462.78	130.21	1989.14	617.08
RUN LENGTH	TEAN	ST. DEV.	MIN	R/MAX
2.02	0.65	4.00	1.00	4.00
RUN SUM	STORME+03	STORME+03	1487E+02	2356E+04
DEMAND	0.00	0.00	0.00	0.00
RESERVOIR SIZE	344185110E+04			
MONTHLY HISTORIC STATISTICS				
FILE SYSTEM				
	OCTOBER	NOVEMBER	JANUARY	FEBRUARY
	5676.11	5316.62	4810.15	4416.00
	2746E+07	1782E+07	1408E+07	1041E+07
	1656.57	1537.47	1200.25	1010.84
	0.27	0.28	0.43	0.40
	DECEMBER	MARCH	APRIL	MAY
	5643.21	6081.21	11019.85	18538.31
	1897E+07	1515E+07	4488E+06	1063E+08
	1263.63	2270.48	8844.98	10110.03
	0.24	0.28	0.99	0.72
	JUNE	JULY	AUGUST	SEPTEMBER
	10117.08	7463.69	6526.92	5749.34
	2224E+08	7507E+07	5108E+07	3440E+07
	5716.27	2719.80	2240.21	1854.88
	1.08	0.52	0.48	0.45
	START=1914, NCL=0, EXP=2480.0.			
	ANNUAL FLOWS			
1914	117980.00			
1915	67960.00			
1916	119330.00			
1917	148570.00			
1918	195020.00			
1919	73980.00			
1920	169850.00			
1921	150060.00			
1922	148940.00			
1923	137480.00			
1924	27080.00			
1925	26410.00			
1926	67130.00			
1927	88070.00			
1928	99980.00			
1929	66520.00			
1930	66640.00			
1931	83200.00			
1932	102560.00			
1933	78670.00			
1934	42180.00			
1935	52360.00			
1936	110180.00			
1937	64880.00			
1938	82280.00			
1939	63080.00			
1940	45430.00			
1941	36330.00			
1942	45100.00			
1943	84810.00			
1944	60650.00			
1945	71920.00			
1946	125020.00			
1947	81500.00			
1948	101460.00			
1949	98470.00			
1950	149480.00			
1951	136870.00			
1952	147820.00			
1953	90980.00			
1954	69830.00			
1955	69630.00			
1956	108580.00			
1957	102120.00			
1958	97080.00			
1959	68910.00			

Table B.3. Continued.

1960	67010.00				
1961	43940.00				
1962	84670.00				
1963	64150.00				
1964	73750.00				
1965	113590.00				
1966	82320.00				
1967	101030.00				
1968	85370.00				
1969	95350.00				
1970	80590.00				
1971	161470.00				
1972	171510.00				
1973	107580.00				
1974	126780.00				
1975	116650.00				
1976	105010.00				
1977	51190.00				
R1978	86150.00				
ARANGE=.448009385E+06					
ANNUAL-HISTORIC STATISTICS.					
FICE=HYQRT,					
A=92640.923076, V=984750692.88, SD=31380.7370091, SMO.499046392901, HRO.76369910123, SC#0.493734376527, SDO#31370.0827693,					
SD1=31217.9693847,					
YQ=TRANSFORMED MONTHLY					
.518564130E+02	.534437124E+02	.480995319E+02	.501365326E+02	.520506403E+02	.516776037E+02
.478853016E+02	.543003278E+02	.585028047E+02	.565514028E+02	.568806463E+02	.501000552E+02
.498212491E+02	.462898862E+02	.505169336E+02	.501713702E+02	.500127863E+02	.665025733E+02
.400480387E+02	.501397316E+02	.467637597E+02	.389482396E+02	.418836577E+02	.497578892E+02
.484058470E+02	.493361879E+02	.434000511E+02	.402800424E+02	.495592233E+02	.411307570E+02
.484058470E+02	.454665034E+02	.490077422E+02	.527717914E+02	.491007124E+02	.518076837E+02
.526758167E+02	.576645997E+02	.569278148E+02	.572487069E+02	.494212851E+02	.658660502E+02
.470152221E+02	.517074866E+02	.527510188E+02	.515517700E+02	.497093045E+02	.455850080E+02
.413136808E+02	.478241304E+02	.484100011E+02	.461707806E+02	.492011104E+02	.478775017E+02
.537506414E+02	.517969397E+02	.517969397E+02	.493074801E+02	.493074801E+02	.493074801E+02
.520045339E+02	.551055757E+02	.551055757E+02	.551055757E+02	.551055757E+02	.551055757E+02
K=1, A=49.9057708532, V=27.868751					
.497570892E+02	.516177396E+02	.477070892E+02	.498806229E+02	.491071110E+02	.491071110E+02
.458816671E+02	.531617557E+02	.458816671E+02	.458816671E+02	.458816671E+02	.458816671E+02
.477894944E+02	.460308987E+02	.477894944E+02	.477894944E+02	.477894944E+02	.477894944E+02
.401923616E+02	.480652692E+02	.401923616E+02	.401923616E+02	.401923616E+02	.401923616E+02
.474053359E+02	.484396570E+02	.474053359E+02	.474053359E+02	.474053359E+02	.474053359E+02
.465825733E+02	.449664861E+02	.465825733E+02	.465825733E+02	.465825733E+02	.465825733E+02
.499809697E+02	.560945145E+02	.499809697E+02	.499809697E+02	.499809697E+02	.499809697E+02
.458067080E+02	.503290006E+02	.458067080E+02	.458067080E+02	.458067080E+02	.458067080E+02
.404307756E+02	.462898862E+02	.404307756E+02	.404307756E+02	.404307756E+02	.404307756E+02
.507345315E+02	.500127983E+02	.507345315E+02	.507345315E+02	.507345315E+02	.507345315E+02
.507963792E+02	.531617557E+02	.507963792E+02	.507963792E+02	.507963792E+02	.507963792E+02
K=2, A=48.4082406473, V=20.53866626					
.478241304E+02	.529341316E+02	.478241304E+02	.478241304E+02	.478241304E+02	.478241304E+02
.450440919E+02	.518564130E+02	.450440919E+02	.450440919E+02	.450440919E+02	.450440919E+02
.484396570E+02	.455045403E+02	.484396570E+02	.484396570E+02	.484396570E+02	.484396570E+02
.405254112E+02	.458816671E+02	.405254112E+02	.405254112E+02	.405254112E+02	.405254112E+02
.470509392E+02	.478587192E+02	.470509392E+02	.470509392E+02	.470509392E+02	.470509392E+02
.458067080E+02	.433584756E+02	.458067080E+02	.458067080E+02	.458067080E+02	.458067080E+02
.493035291E+02	.554999511E+02	.493035291E+02	.493035291E+02	.493035291E+02	.493035291E+02
.538060907E+02	.497249506E+02	.538060907E+02	.538060907E+02	.538060907E+02	.538060907E+02
.403833025E+02	.451600319E+02	.403833025E+02	.403833025E+02	.403833025E+02	.403833025E+02
.503664149E+02	.493361879E+02	.503664149E+02	.503664149E+02	.503664149E+02	.503664149E+02
.507654731E+02	.524441711E+02	.507654731E+02	.507654731E+02	.507654731E+02	.507654731E+02
K=3, A=47.9865023643, V=18.959596					

Table B.3. Continued

491067124E+02	506104065E+02	513520123E+02	480733226E+02	522105707E+02	477494944E+02
455800355E+02	505168339E+02	539717915E+02	532748780E+02	522105707E+02	462161661E+02
475505732E+02	453520323E+02	469077831E+02	458933305E+02	441359878E+02	428110606E+02
402402533E+02	447321487E+02	43441521E+02	389963528E+02	406665978E+02	453045403E+02
457313173E+02	456162922E+02	422422665E+02	497111476E+02	388586721E+02	425969866E+02
448498038E+02	482110606E+02	48202050E+02	487419643E+02	456182922E+02	478241304E+02
513164288E+02	527621881E+02	515577438E+02	527055479E+02	483719923E+02	448105156E+02
54902446E+02	483340930E+02	497789108E+02	462701594E+02	440310897E+02	434829790E+02
489746696E+02	437709186E+02	48719443E+02	545842764E+02	481337487E+02	461792260E+02
506725408E+02	511035026E+02	508888846E+02	466914439E+02	422938580E+02	539166652E+02
665861766E+02	488751971E+02	455425176E+02	463530548E+02	507345315E+02	465097361E+02
442564277E+02	49882531E+02	508888846E+02	48508635E+02	5010052E+02	487713174E+02
448553509E+02	44016284E+02	464000511E+02	48163498E+02	45392449E+02	404307758E+02
40144361E+02	425961310E+02	412223972E+02	381294479E+02	359997150E+02	4344000511E+02
43230018E+02	433168235E+02	448886280E+02	471577853E+02	489275887E+02	419423740E+02
425969662E+02	433168235E+02	448886280E+02	471577853E+02	489275887E+02	429355492E+02
499636657E+02	534717533E+02	493035291E+02	498852533E+02	440680647E+02	471222206E+02
444666171E+02	484644171E+02	492708859E+02	460308987E+02	437300016E+02	418091733E+02
484059478E+02	472287636E+02	406196365E+02	467998388E+02	441792260E+02	440149284E+02
48371992E+02	470866033E+02	489171973E+02	444954801E+02	543275300E+02	503290006E+02
4445.832707581	V=14.4661492274	S=0.017212293219	TL=0.333		
539148109E+02	501290086E+02	631707649E+02	482361249E+02	611509075E+02	514976156E+02
472641775E+02	64562108E+02	55476751E+02	50503786E+02	50850808E+02	512661131E+02
482361249E+02	479966033E+02	551120144E+02	494212401E+02	483701594E+02	412332884E+02
479509392E+02	455800355E+02	43811740E+02	41248661E+02	45807708E+02	44458470E+02
52181311E+02	51826995E+02	50828008E+02	50746286E+02	37584416E+02	51876156E+02
43974362E+02	45867080E+02	57196899E+02	52919203E+02	47685016E+02	54517275E+02
56145521E+02	48400058E+02	51507732E+02	32675816E+02	50266009E+02	446635193E+02
35863491E+02	534156436E+02	52045339E+02	50329008E+02	51943815E+02	430251496E+02
45044091E+02	472287636E+02	407134559E+02	50397722E+02	534156436E+02	506414917E+02
51737339E+02	502975492E+02	488751947E+02	60603471E+02	735531171E+02	540266111E+02
626152123E+02	53331268E+02	536060907E+02	453902496E+02	554999511E+02	
M=6, Am=0.9549618936, V=37.353317434, S=1.02895644959, TL=0.333,					
797039124E+02	517969397E+02	667811934E+02	689506149E+02	670225724E+02	613772821E+02
60581382E+02	745607235E+02	69133685E+02	70561624E+02	668399198E+02	660989720E+02
619231429E+02	64471133E+02	85533686E+02	623443301E+02	58265657E+02	437300016E+02
748564745E+02	59729186E+02	43893214E+02	558633907E+02	83531013E+02	4043471E+02
71925030E+02	593876805E+02	499171973E+02	43974362E+02	53583399E+02	59152014E+02
499891027E+02	500743010E+02	61440054E+02	600915495E+02	668032743E+02	73735537E+02
718161885E+02	63136042E+02	63750871E+02	586671248E+02	62092773E+02	56711078E+02
7875308E+02	62532107E+02	63817338E+02	58455218E+02	61038249E+02	459190605E+02
40773848E+02	58517273E+02	68877024E+02	78188246E+02	6740783E+02	611726108E+02
76387642E+02	742028138E+02	520340624E+02	66280095E+02	67276713E+02	630461179E+02
M=7, Am=0.384478623, V=146.293817862, S=0.24676264726, TL=0.333,					
629670047E+02	520340624E+02	81845786E+02	10092989E+03	728921846E+02	619231429E+02
950711291E+02	10092989E+03	975147157E+02	963033617E+02	703254358E+02	719502266E+02
56551602E+02	78512040E+02	778345241E+02	783774407E+02	54551602E+02	66333442E+02
919083280E+02	68798252E+02	42938592E+02	625528999E+02	94709404E+02	80779447E+02
72485811E+02	556821801E+02	49640555E+02	48441588E+02	51915757E+02	499581515E+02
597074307E+02	65170015E+02	816171337E+02	665805697E+02	866370076E+02	732010316E+02
90765183E+02	65729703E+02	94858424E+02	64096304E+02	582018406E+02	71081688E+02
772703490E+02	730195107E+02	792377108E+02	566019581E+02	608018367E+02	46858685E+02
46307154E+02	63371759E+02	75396010E+02	83044330E+02	639770317E+02	840759935E+02
87187098E+02	726301139E+02	71097979E+02	97364350E+02	671222206E+02	749791472E+02
M=8, Am=7.333836256, V=230.925259482, S=0.073922679606, TL=0.333,					
666564053E+02	507963792E+02	605692108E+02	655461860E+02	591109690E+02	53331268E+02

Table B.3. Continued.

.689716691E+02	.786461995E+02	.730469181E+02	.706561624E+02	.560689124E+02	.591109690E+02
.494664171E+02	.617104813E+02	.562221930E+02	.611074568E+02	.509810730E+02	.424675698E+02
.655336862E+02	.621344184E+02	.400480387E+02	.521518603E+02	.634551909E+02	.603373252E+02
.590646098E+02	.489746696E+02	.436068181E+02	.421626931E+02	.481679197E+02	.586442188E+02
.529626861E+02	.661182653E+02	.660433916E+02	.550260544E+02	.650286491E+02	.608674167E+02
.765431844E+02	.691265209E+02	.730623568E+02	.636568679E+02	.510117326E+02	.554476751E+02
.631094994E+02	.676365631E+02	.598208449E+02	.509503786E+02	.521812311E+02	.424675698E+02
.577373572E+02	.515877582E+02	.604484936E+02	.684855890E+02	.545982067E+02	.708695498E+02
.601586386E+02	.596391909E+02	.593417326E+02	.796516682E+02	.754703321E+02	.623652471E+02
.697731124E+02	.756439645E+02	.609111948E+02	.447713634E+02	.597755300E+02	
K=9, A=60.240578557, V=98.282870391, S=0.146677307493, TL=0.333,					
.606034771E+02	.483380930E+02	.600689143E+02	.691436856E+02	.576159975E+02	.489746696E+02
.602034051E+02	.659119700E+02	.627601489E+02	.643729750E+02	.532748780E+02	.544631906E+02
.486750907E+02	.541365326E+02	.543003278E+02	.543003278E+02	.492708293E+02	.405254112E+02
.577615709E+02	.527621881E+02	.391106276E+02	.456182942E+02	.565263928E+02	.540542811E+02
.543275360E+02	.459563968E+02	.414951266E+02	.400480387E+02	.448886280E+02	.539993146E+02
.493361879E+02	.544361110E+02	.598208449E+02	.523859559E+02	.580985528E+02	.572243385E+02
.650934245E+02	.634147081E+02	.657422582E+02	.555260940E+02	.487419643E+02	.505169336E+02
.582894543E+02	.595022547E+02	.556042232E+02	.484396570E+02	.489744541E+02	.408068737E+02
.529341316E+02	.474053359E+02	.533030875E+02	.606034771E+02	.519157574E+02	.598208449E+02
.543818749E+02	.562731103E+02	.540542811E+02	.687988252E+02	.684156064E+02	.580985528E+02
.631911642E+02	.633132843E+02	.567775348E+02	.422938980E+02	.532748780E+02	
K=10, A=56.6138180696, V=53.4657104347, S=-0.158197055645, TL=0.333,					
.589251141E+02	.458816671E+02	.567024143E+02	.637772897E+02	.557599381E+02	.478241304E+02
.573227312E+02	.625528999E+02	.610203780E+02	.612809073E+02	.510117326E+02	.498852533E+02
.480652692E+02	.527621881E+02	.525891761E+02	.520340624E+02	.496605554E+02	.406196365E+02
.549729186E+02	.494664171E+02	.387545019E+02	.434000511E+02	.531334036E+02	.505792852E+02
.518266925E+02	.442163494E+02	.401923161E+02	.393114489E+02	.421188015E+02	.517074866E+02
.469077631E+02	.519453815E+02	.567775348E+02	.506104065E+02	.550790928E+02	.548663535E+02
.617104813E+02	.610857093E+02	.619886701E+02	.525891761E+02	.472287636E+02	.487419643E+02
.551848797E+02	.561967014E+02	.534997664E+02	.478587192E+02	.46230548E+02	.395598213E+02
.510423572E+02	.455425176E+02	.502345346E+02	.574208036E+02	.493035291E+02	.556562202E+02
.529341316E+02	.533878467E+02	.520045339E+02	.654384591E+02	.647837600E+02	.556042232E+02
.591572591E+02	.593876805E+02	.537783796E+02	.408068737E+02	.507345315E+02	
K=11, A=52.1946868134, V=43.2989336042, S=-0.144157157347, TL=0.333,					
.573963154E+02	.466189167E+02	.552902827E+02	.599112787E+02	.521518603E+02	.473348558E+02
.551320344E+02	.599112787E+02	.579786301E+02	.576888716E+02	.498532706E+02	.503290006E+02
.461051745E+02	.506104065E+02	.498852533E+02	.505792852E+02	.470509392E+02	.395103790E+02
.505792852E+02	.472287636E+02	.380234052E+02	.415402572E+02	.502345346E+02	.480652692E+02
.495312896E+02	.431074395E+02	.395103790E+02	.381294479E+02	.409462568E+02	.486415888E+02
.446535193E+02	.492708293E+02	.534156436E+02	.486080433E+02	.519157574E+02	.523568022E+02
.591109690E+02	.578340964E+02	.581463902E+02	.502660605E+02	.456560940E+02	.467637597E+02
.522984025E+02	.536115413E+02	.510423572E+02	.466914439E+02	.440957039E+02	.392112774E+02
.489083954E+02	.438932414E+02	.476156007E+02	.556042232E+02	.477200802E+02	.535277516E+02
.511949619E+02	.507654731E+02	.499809697E+02	.621554706E+02	.606255559E+02	.539442417E+02
.556302332E+02	.552376289E+02	.505792852E+02	.400962539E+02	.494339205E+02	
K=12, A=50.0113527409, V=34.352011394, S=-0.136733370582, TL=0.333,					
SDY, SDY1, SDY2,					
.52383E+01	.44970E+01	.43206E+01	.41769E+01	.38027E+01	.60645E+01
.12002E+02	.15079E+02	.98372E+01	.72556E+01	.65294E+01	.58158E+01
.51829E+01	.44707E+01	.43107E+01	.41638E+01	.37955E+01	.60849E+01
.12052E+02	.15195E+02	.99136E+01	.73101E+01	.65776E+01	.58606E+01
.52734E+01	.45288E+01	.43542E+01	.42026E+01	.38312E+01	.60797E+01
.11960E+02	.15148E+02	.98808E+01	.72730E+01	.65253E+01	.57868E+01
MONTHLY TRANSFORMED MEANS,					
.499057709E+02	.484082406E+02	.479865024E+02	.472004964E+02	.458327678E+02	.509549619E+02
.053844786E+02	.733538363E+02	.602405786E+02	.546136181E+02	.521946868E+02	.500113527E+02
YGM TRANSFORMED ANNUAL					
SDX, SDX1, SDX2,					
.15379E+02	.15497E+02	.15410E+02			
A=130.616624922, V=240.197192475, SD=15.4982964379, S=-0.10209639697, TL=0.333,					
TRANSFORMED MEANS, USE FOR INVERSE TRANSFORM,					
FILE **YMON,					
130.616624922, 15.4982964379, 49.9057708532, 48.4082406473, 47.9865023643, 47.2004964076, 45.8327677541, 50.9549618936,					

Table B.3. Continued.

65,384478623, 73.353836256, 60,240578557, 54,6138180696, 52,1946868134, 50,0113527409, 5,27908622538, 4,5319605347, 4,35426215311,
4,20945223895, 3,83225119577, 6,1117380296, 12,0951981324, 15,196224514, 9,9137717541, 7,312025057, 6,5801925203, 5,8610588969,
SXX,
.2365E+03
SYX,
.4451E+02
.4013E+02
.4064E+02
.4352E+02
.4096E+02
.6885E+02
.1505E+03
.2161E+03
.1409E+03
.1095E+03
.9866E+02
.8765E+02
SY,
.2744E+02 .2338E+02 .2119E+02 .1946E+02 .1623E+02 .1913E+02 .1294E+02 .2646E+02 .2118E+02 .1913E+02 .1805E+02 .1669E+02
.2338E+02 .2022E+02 .1836E+02 .1682E+02 .1410E+02 .1749E+02 .1325E+02 .2444E+02 .1912E+02 .1723E+02 .1626E+02 .1500E+02
.2119E+02 .1836E+02 .1667E+02 .1739E+02 .1456E+02 .1761E+02 .1620E+02 .2429E+02 .1918E+02 .1748E+02 .1641E+02 .1519E+02
.1946E+02 .1682E+02 .1739E+02 .1745E+02 .1431E+02 .1821E+02 .1969E+02 .2800E+02 .2171E+02 .1902E+02 .1775E+02 .1632E+02
.1623E+02 .1410E+02 .1456E+02 .1431E+02 .1446E+02 .1662E+02 .2140E+02 .2720E+02 .2053E+02 .1792E+02 .1689E+02 .1558E+02
.1913E+02 .1749E+02 .1761E+02 .1821E+02 .1662E+02 .3678E+02 .4838E+02 .4800E+02 .3374E+02 .2956E+02 .2730E+02 .2489E+02
.1294E+02 .1325E+02 .1620E+02 .1969E+02 .2140E+02 .4838E+02 .1440E+03 .1317E+03 .7827E+02 .6585E+02 .5945E+02 .5267E+02
.2646E+02 .2444E+02 .2429E+02 .2800E+02 .2720E+02 .4800E+02 .1317E+03 .2274E+03 .1381E+03 .1025E+03 .9128E+02 .7997E+02
.2118E+02 .1912E+02 .1918E+02 .2171E+02 .2053E+02 .3374E+02 .7827E+02 .1381E+03 .9677E+02 .6943E+02 .6146E+02 .5423E+02
.1913E+02 .1723E+02 .1748E+02 .1902E+02 .1792E+02 .2956E+02 .6585E+02 .1025E+03 .6943E+02 .5264E+02 .4706E+02 .4159E+02
.1805E+02 .1626E+02 .1641E+02 .1775E+02 .1689E+02 .2730E+02 .5945E+02 .9128E+02 .6146E+02 .4706E+02 .4263E+02 .3767E+02
.1669E+02 .1500E+02 .1519E+02 .1632E+02 .1558E+02 .2489E+02 .5267E+02 .7997E+02 .5423E+02 .4159E+02 .3767E+02 .3382E+02
A MATRIX=SYX*SYX**,
.1882E+00
.1697E+00
.1719E+00
.1840E+00
.1732E+00
.2911E+00
.6364E+00
.9135E+00
.5958E+00
.4629E+00
.4172E+00
.3706E+00
SYX(SXX=*)SY,
.8376E+01 .7552E+01 .7649E+01 .8190E+01 .7708E+01 .1296E+02 .2832E+02 .4066E+02 .2652E+02 .2060E+02 .1857E+02 .1650E+02
.7552E+01 .6808E+01 .6896E+01 .7384E+01 .6949E+01 .1188E+02 .2554E+02 .3666E+02 .2391E+02 .1858E+02 .1674E+02 .1487E+02
.7649E+01 .6896E+01 .6985E+01 .7479E+01 .7039E+01 .1183E+02 .2587E+02 .3713E+02 .2422E+02 .1881E+02 .1696E+02 .1506E+02
.8190E+01 .7384E+01 .7479E+01 .8007E+01 .7537E+01 .1267E+02 .2769E+02 .3975E+02 .2593E+02 .2014E+02 .1815E+02 .1613E+02
.7708E+01 .6949E+01 .7039E+01 .7537E+01 .7093E+01 .1192E+02 .2607E+02 .3742E+02 .2440E+02 .1896E+02 .1709E+02 .1518E+02
.1296E+02 .1188E+02 .1183E+02 .1267E+02 .1192E+02 .2004E+02 .4381E+02 .6289E+02 .4102E+02 .3187E+02 .2872E+02 .2552E+02
.2832E+02 .2554E+02 .2587E+02 .2769E+02 .2607E+02 .4381E+02 .9578E+02 .1375E+03 .8968E+02 .6967E+02 .6279E+02 .5578E+02
.4066E+02 .3666E+02 .3713E+02 .3975E+02 .3742E+02 .6289E+02 .1375E+03 .1974E+03 .1287E+03 .1000E+03 .9013E+02 .8007E+02
.2652E+02 .2391E+02 .2422E+02 .2593E+02 .2440E+02 .4102E+02 .8968E+02 .1287E+03 .8396E+02 .6523E+02 .5878E+02 .5223E+02
.2060E+02 .1858E+02 .1881E+02 .2014E+02 .1896E+02 .3187E+02 .6967E+02 .1000E+03 .6523E+02 .5068E+02 .4567E+02 .4057E+02
.1857E+02 .1674E+02 .1696E+02 .1815E+02 .1709E+02 .2872E+02 .6279E+02 .9013E+02 .5878E+02 .4567E+02 .4116E+02 .3657E+02
.1650E+02 .1487E+02 .1506E+02 .1613E+02 .1518E+02 .2552E+02 .5578E+02 .8007E+02 .5223E+02 .4057E+02 .3657E+02 .3248E+02
BBT,
.1906E+02 .1583E+02 .1355E+02 .1127E+02 .8521E+01 .6174E+01 .1538E+02 .1420E+02 .5343E+01 .1477E+01 .5197E+00 .1901E+00
.1583E+02 .1341E+02 .1146E+02 .9432E+01 .7151E+01 .5807E+01 .1228E+02 .1222E+02 .4792E+01 .1345E+01 .4763E+00 .1265E+00
.1355E+02 .1146E+02 .1168E+02 .9907E+01 .7526E+01 .5774E+01 .9663E+01 .1284E+02 .5040E+01 .1332E+01 .5457E+00 .1304E+00
.1127E+02 .9432E+01 .9907E+01 .9439E+01 .6775E+01 .5546E+01 .8008E+01 .1176E+02 .4222E+01 .1129E+01 .4045E+00 .1873E+00

Table B.3. Continued.

.6521E+01	.7151E+01	.7526E+01	.6775E+01	.7367E+01	.4700E+01	.4667E+01	.1021E+02	.3A77E+01	.1038E+01	.1981E+00	.4008E+00
.6174E+01	.5807E+01	.5774E+01	.5546E+01	.4704E+01	.1674E+02	.4570E+01	.1489E+02	.7277E+01	.2308E+01	.1422E+01	.6207E+00
.1538E+02	.1228E+02	.9663E+01	.8008E+01	.4667E+01	.4570E+01	.4826E+02	.5825E+01	.1140E+02	.3621E+01	.3336E+01	.3110E+01
.1420E+02	.1222E+02	.1284E+02	.1176E+02	.1021E+02	.1489E+02	.5825E+01	.3000E+02	.9325E+01	.2504E+01	.1149E+01	.9924E+01
.5343E+01	.4792E+01	.5040E+01	.4222E+01	.3877E+01	.7277E+01	.1140E+02	.9325E+01	.1281E+02	.4202E+01	.2674E+01	.2002E+01
.1477E+01	.1345E+01	.1332E+01	.1129E+01	.1038E+01	.2308E+01	.3821E+01	.2504E+01	.4202E+01	.1964E+01	.1384E+01	.1018E+01
.5197E+00	.4763E+00	.5457E+00	.4045E+00	.1981E+00	.1422E+01	.3336E+01	.1149E+01	.2674E+01	.1384E+01	.1475E+01	.1101E+01
.1901E+00	.1265E+00	.1304E+00	.1873E+00	.4008E+00	.6207E+00	.3110E+01	.9924E+01	.2002E+01	.1018E+01	.1101E+01	.1339E+01
NMAX=78,											
D VECTOR											
19.064	15.829	13.414	13.546	11.461	11.683	11.274	9.432	9.907	9.439	8.521	7.151
7.526	6.775	7.367	6.174	5.807	5.774	5.546	4.700	16.737	-15.384	-12.284	-9.663
-8.008	-4.667	4.570	48.261	-14.203	-12.216	-12.838	-11.759	-10.215	-14.890	-5.825	30.000
-5.343	-4.792	-5.040	-4.222	-3.877	-7.277	-11.403	9.325	12.810	-1.477	-1.345	-1.332
-1.129	-1.038	-2.308	-3.821	2.504	4.202	1.964	-0.520	-0.476	-0.546	-0.405	-0.198
-1.422	-3.336	1.149	2.674	1.384	1.475	0.190	0.126	0.130	0.187	0.401	-0.621
-3.110	-0.099	2.002	1.018	1.101	1.339						
E VALUES											
0.102	0.174	0.351	0.467	1.048	1.300	1.733	3.297	8.315	10.971	59.729	86.065
E VECTORS											
0.532	-0.293	0.040	-0.264	-0.194	0.026	0.213	-0.446	-0.057	-0.265	-0.057	-0.447
-0.655	0.375	-0.100	0.060	-0.214	-0.044	0.193	-0.381	-0.007	-0.210	-0.032	-0.377
0.230	0.019	-0.132	0.734	-0.193	-0.285	-0.278	0.201	-0.099	-0.143	0.012	-0.353
-0.113	0.039	-0.003	-0.601	-0.194	-0.349	-0.459	0.386	-0.090	-0.049	0.022	-0.307
-0.027	-0.010	0.071	0.001	-0.276	0.426	0.514	0.627	-0.134	-0.011	0.052	-0.241
0.054	-0.006	-0.014	0.010	-0.183	-0.076	0.063	-0.011	0.786	0.450	0.286	-0.227
0.047	0.029	-0.072	-0.028	-0.382	-0.146	0.077	-0.102	-0.224	-0.131	0.786	0.350
0.046	0.013	-0.074	-0.026	-0.426	-0.198	0.127	0.132	0.410	-0.468	-0.404	0.433
0.109	0.147	-0.200	-0.018	-0.564	0.169	-0.146	-0.183	-0.280	0.565	-0.330	0.137
-0.316	-0.558	0.529	0.130	-0.179	-0.384	0.167	-0.040	-0.144	0.222	-0.107	0.037
0.314	0.607	0.310	-0.053	0.134	-0.471	0.377	0.045	-0.119	0.168	-0.078	0.010
-0.061	-0.262	-0.734	-0.071	0.192	-0.385	0.384	0.087	-0.110	0.167	-0.059	-0.012
EIGENVALUE 1 EQUALS 0.10222											
EIGENVALUE 2 EQUALS 0.17373											
EIGENVALUE 3 EQUALS 0.35101											
EIGENVALUE 4 EQUALS 0.46679											
EIGENVALUE 5 EQUALS 1.04795											
EIGENVALUE 6 EQUALS 1.30029											
EIGENVALUE 7 EQUALS 1.73299											
EIGENVALUE 8 EQUALS 3.29746											
EIGENVALUE 9 EQUALS 8.31468											
EIGENVALUE 10 EQUALS 10.97135											
EIGENVALUE 11 EQUALS 59.72910											
EIGENVALUE 12 EQUALS 86.06540											
B MATRIX:											
.1701E+00	.1222E+00	.2384E-01	.1803E+00	.1990E+00	.2929E-01	.2799E+00	.8107E+00	.1658E+00	.8771E+00	.4370E+00	.4150E+01
.2093E+00	.1562E+00	.5908E-01	.4096E-01	.2194E+00	.5068E-01	.2546E+00	.6918E+00	.2081E-01	.6958E+00	.2483E+00	.3493E+01
.7367E+01	.7741E-02	.7840E-01	.5013E+00	.1972E+00	.3253E+00	.3658E+00	.3648E+00	.2854E+00	.4723E+00	.8962E+00	.3270E+01
.3619E-01	.1622E-01	.1578E-02	.4108E+00	.1986E+00	.3984E+00	.6041E+00	.7003E+00	.2594E+00	.1619E+00	.1695E+00	.2845E+01
.8680E-02	.3970E-02	.4194E-01	.7489E-03	.2821E+00	.4856E+00	.6771E+00	.1139E+01	.3873E+00	.3677E-01	.3999E+00	.2232E+01
.1711E-01	.2337E-02	.8544E-02	.6723E-02	.1875E+00	.8613E-01	.8238E-01	.2023E-01	.2266E+01	.1491E+01	.2211E+01	.2108E+01
.1497E-01	.1216E-01	.4257E-01	.1935E-01	.3911E+00	.1660E+00	.1009E+00	.1854E+00	.6487E+00	.4346E+00	.6073E+01	.3247E+01
.1483E-01	.5539E-02	.4355E-01	.1790E-01	.4359E+00	.2257E+00	.1676E+00	.2402E+00	.1181E+01	.1550E+01	.3121E+01	.4010E+01
.3482E-01	.6146E-01	.1183E+00	.1252E-01	.5774E+00	.1925E+00	.1922E+00	.3325E+00	.8060E+00	.1870E+01	.2550E+01	.1273E+01
.1011E+00	.2327E+00	.3135E+00	.8865E-01	.1828E+00	.4380E+00	.2193E+00	.7332E-01	.4153E+00	.7342E+00	.8290E+00	.3400E+00
.1005E+00	.2532E+00	.1835E+00	.3639E-01	.1371E+00	.5376E+00	.4968E+00	.8194E-01	.3437E+00	.5573E+00	.6061E+00	.0143E+01
.1944E-01	.1090E+00	.4351E+00	.4873E-01	.1966E+00	.4388E+00	.5057E+00	.1577E+00	.3158E+00	.5527E+00	.4534E+00	.1095E+00

Table B.4. Program listing.

```

$ RESET FREE
$ SET AUTOBIND
$ BIND EIGRS FROM IMSL/
$ BIND EHOQKS FROM IMSL/
$ BIND EHOUSS FROM IMSL/
$ BIND EQRTZS FROM IMSL/
$ BIND UERTST FROM IMSL/
$ BIND UGETID FROM IMSL/
FILE 1(TITLE="QSEMI",KIND=DISK,MAXRECSIZE=20,BLOCKSIZE=600,AREASIZE=
*450,SAVEFACTOR=999,SECURITYTYPE=CLASSA,SECURITYUSE=IO,AREAS=1000)
FILE 2(TITLE="QANNL",KIND=DISK,MAXRECSIZE=20,BLOCKSIZE=600,AREASIZE=
*450,SAVEFACTOR=999,SECURITYTYPE=CLASSA,SECURITYUSE=IO,AREAS=1000)
FILE 3(TITLE="YQMON",KIND=DISK,MAXRECSIZE=20,BLOCKSIZE=600,AREASIZE=
*450,SAVEFACTOR=999,SECURITYTYPE=CLASSA,SECURITYUSE=IO,AREAS=1000)
FILE 4(TITLE="YQORT",KIND=DISK,MAXRECSIZE=20,BLOCKSIZE=600,AREASIZE=
*450,SAVEFACTOR=999,SECURITYTYPE=CLASSA,SECURITYUSE=IO,AREAS=1000)
FILE 8(TITLE="RIVER",KIND=DISK,MAXRECSIZE=20,BLOCKSIZE=600,AREASIZE=
*450,SAVEFACTOR=999,SECURITYTYPE=CLASSA,SECURITYUSE=IO,AREAS=1000)
FILE 9(TITLE="QUART",KIND=DISK,MAXRECSIZE=20,BLOCKSIZE=600,AREASIZE=
*450,SAVEFACTOR=999,SECURITYTYPE=CLASSA,SECURITYUSE=IO,AREAS=1000)
FILE 10(TITLE="YQANN",KIND=DISK,MAXRECSIZE=20,BLOCKSIZE=600,AREASIZE=
*450,SAVEFACTOR=999,SECURITYTYPE=CLASSA,SECURITYUSE=IO,AREAS=1000)
FILE 11(TITLE="TAMON",KIND=DISK,MAXRECSIZE=20,BLOCKSIZE=600,AREASIZE=
*450,SAVEFACTOR=999,SECURITYTYPE=CLASSA,SECURITYUSE=IO,AREAS=1000)
FILE 12(TITLE="TAQTA",KIND=DISK,MAXRECSIZE=20,BLOCKSIZE=600,AREASIZE=
*450,SAVEFACTOR=999,SECURITYTYPE=CLASSA,SECURITYUSE=IO,AREAS=1000)
FILE 13(TITLE="A",KIND=DISK,MAXRECSIZE=20,BLOCKSIZE=600,AREASIZE=
*450,SAVEFACTOR=999,SECURITYTYPE=CLASSA,SECURITYUSE=IO,AREAS=1000)
FILE 14(TITLE="B",KIND=DISK,MAXRECSIZE=20,BLOCKSIZE=600,AREASIZE=
*450,SAVEFACTOR=999,SECURITYTYPE=CLASSA,SECURITYUSE=IO,AREAS=1000)
FILE 15(TITLE="C",KIND=DISK,MAXRECSIZE=20,BLOCKSIZE=600,AREASIZE=
*450,SAVEFACTOR=999,SECURITYTYPE=CLASSA,SECURITYUSE=IO,AREAS=1000)
FILE 16(KIND=REMOTE,MAXRECSIZE=22)
C
C PROGRAM READS DATA ON MONTHLY LEVEL AND AGGREGATES TO QUARTERLY,
C SEMI-ANNUALLY, AND ANNUALLY, TRANSFORMS THE DATA AND COMPUTES
C STATISTICS THEN WRITES AGGREGATED DATA, TRANSFORMED DATA AND
C STATISTICS TO FILES, COMPUTES CORRELATION MATRICES AND
C DISAGGREGATION COEFFICIENT MATRICES BASED ON MEJIA AND MOUSSELLE
C TECHNIQUE (NRR, P185, APR, 1976) AND WRITES TO FILE THE A,B,C MATR
C
COMMON/CU1/CK, TM, PC, PR, CU, AC, EFF
COMMON/CY1/PRICE, ALV, ALP, ALM, CONST, YPOT
DIMENSION Q(100,12),QQ(100,4),QS(100,2),QA(100,1),QB(100,1)
*,YQ(100,12),YQQ(100,4),YQS(100,2),YQA(100,1),AL(10)
*,TAM(12),TAQ(4),TAS(2),SAM(12),SVH(12),SSD(12),SS(12),SDX(1),SDX2(
*1),SDY(12),SDY1(12),SDY2(12),SDX1(1),AX(12,12),
*B(12,12),C(12,12),BXX(1,1),SYY(12,12),BZZ(12,12),SYZ(12,12),
*SZX(12,1),SXZ(1,12),BYX(12,1),YQ1(100,12),TSM(12)
*,HYY(12,12),MYX(12,1),MYZ(12,12),ETP(12),ETA(100,12),Z(12,1)
*,YACT(100),HEN(100),CK(5),TM(5),PC(5),PR(5),CU(5)
*,TITLE(20),MY1(12)
DATA CK/,53,82,1,05,1,,88/
DATA TM/56,3,63,1,72,9,71,4,62,/
DATA PC/,101,102,,1032,,096,,084/
DATA PR/1.86,1.78,,34,,87,,94/
10 FORMAT(16I5)
20 FORMAT(80A1)

```

Table B.4. Continued.

```

30  FORMAT(4F20,0)
40  FORMAT(20A4)
50  FORMAT(1H ,I5,T10,12F10,2)
60  FORMAT(1H ,6E15,9)
70  FORMAT(1H ,12E10,5)
80  FORMAT(12F10,2)
90  FORMAT(1H ,T10,'ANNUAL FLOWS')
100 FORMAT(1H ,T14,'OCTOBER',T23,'NOVEMBER',T33,'DECEMBER',T44,'JANUAR
    *Y',T53,'FEBRUARY',T66,'MARCH',T76,'APRIL',T88,'MAY',T97,'JUNE',
    *T107,'JULY',T115,'AUGUST',T122,'SEPTEMBER')
110 FORMAT(1H ,T10,12F10,2)
120 FORMAT(1H ,T10,12E10,4)
130 FORMAT(1H , 'YQ= TRANSFORMED MONTHLY')
140 FORMAT(1H , 'YQG=TRANSFORMED QUARTERLY')
150 FORMAT(1H , 'YQS=TRANSFORMED SEMI-ANNUAL')
160 FORMAT(1H , 'YQAS=TRANSFORMED ANNUAL')
    900 FORMAT(1H , 'INPUT',/)
C
C   ISTART= STARTING YEAR OF THE TIME SERIES
C   IWR=1, WRITES TRANSFORMED DATA
C   IS13= START YEAR INDEX FOR DIFFERENT TIME SERIES LENGTH THAN ORIG
C
    PRINT /, 'IREAD=1, AGGREGATES AND WRITES TO FILES. IREAD=0, READS DA
    TA FROM FILE'
    PRINT /, 'NTR=# OF TRANSFORMATIONS'
    PRINT /, 'ISTAT=1, WRITES OUT DATA & STATS'
    PRINT /, 'IDIS=1, WRITES OUT TRANS DATA & PUTS ON FILES'
    PRINT /, 'IWR=1, WRITES OUT TRANS DATA BEFORE MEAN SUBTRACTED'
    PRINT /, 'MONANN=1 AGGREGATE FROM MONTHLY TO ANNUAL'
    PRINT /, 'NOT=1 NO TRANSFORM'
    PRINT /, 'INCL=# OF CROSSING LEVELS'
    WRITE(16,900)
    READ(5,/)N,IREAD,ISTART,NTR,ISTAT,IDIS,IWR,IS13,MONANN,NOT
    WRITE(6,*/)N,IREAD,ISTART,NTR,ISTAT,IDIS,IWR,IS13,MONANN,NOT
C
    PRINT /, 'IYS=1 THEN DO VALENCIA=SCHAAKE DISAG A,B '
    PRINT /, 'IY=BEGINNING MONTH OR SEASON'
    PRINT /, 'MY=END COUNTER FOR LOWER LEVEL DISAGGREGATED SEASONS '
    PRINT /, 'NDY=DIMENSION OF LOWER LEVEL SEASONS '
    PRINT /, 'MX=END COUNTER FOR HIGHER LEVEL SEASON '
    PRINT /, 'IZ=BEGINNING MONTH OR SEASON OF PREVIOUS YEAR'
    PRINT /, 'NDZ=DIMENSION OF PREVIOUS SEASONS'
    PRINT /, 'ICYH=1, THEN C MATRIX BY YOUNG'S RECURSIVE VICE PRCOMP'
    WRITE(16,900)
    READ(5,/)IYS,IY,MY,NDY,MX,IZ,NDZ,ICYR
    NZ=MY-IZ+1
    NY=IY-IZ+1
    WRITE(6,*/)IYS,IY,MY,NDY,MX,IZ,NDZ,ICYR,NZ,NY
    PRINT /, 'AL(J)= TRANSFORM EXPONENT IF =1 THEN LOG TRANS '
    WRITE(16,900)
    READ(5,/)AL(J),J=1,NTR)
    WRITE(6,*/)(AL(J),J=1,NTR)
    PRINT /, 'IHO=1, THEN ONLY HISTORIC STATS DONE, STOP'
    WRITE(16,900)
    READ(5,/)IHO,IDF
    WRITE(6,*/)IHO,IDF
    WRITE(16,900)
    READ(5,/)AC,EF,PRICE,YPOT
    WRITE(16,900)
    READ(5,/)ALV,ALP,ALH,CONST
    WRITE(6,*/)ALV,ALP,ALH,CONST

```

Table B.4. Continued.

```

WRITE(6,*)AC,EFP,PRICE,YPOT
WRITE(16,900)
READ(5,40)(TITLE(I),I=1,18)
WRITE(6,40)(TITLE(I),I=1,18)
IF(IDP,EQ,1)GOTO 171
DO 170 I=1,N
READ(8,80)(Q(I,J),J=1,12)
170 CONTINUE
GOTO 175
171 CONTINUE
DO 175 I=1,N
READ(8,165)(Q(I,J),J=1,12)
175 CONTINUE
165 FORMAT(12F6,0)
IF(IS13,EQ,0)GOTO 200
DO 190 I=IS13,N
DO 180 J=1,12
I1=I-IS13+1
Q(I1,J)=Q(I,J)
180 CONTINUE
190 CONTINUE
N=N-IS13+1
WRITE(6,*)N
200 CONTINUE
IF(ISTAT,EQ,0)GOTO 380
IF(I=NR,EQ,0)GOTO 220
WRITE(6,100)
DO 210 I=1,N
IYEAR=I*START+(I-1)
210 WRITE(6,50)IYEAR,(Q(I,J),J=1,12)
220 CONTINUE
DO 230 J=1,12
CALL F3MOM(Q,N,J,A,V,SD,S)
SAM(J)=A
SYM(J)=V
SSD(J)=SD
SS(J)=S
WRITE(6,*)J,A,V,SD,S
230 CONTINUE
CALL CONUSE
CALL DEMAND(ETP)
CALL DIVERT(Q,N,ETA)
CALL CROPY(ETP,ETA,N,TOTY,TOTB,YACT,BEN,AC)
CALL F2MOM(YACT,N,AYACT,BYACT,YAX,YAN)
WRITE(6,*)TOTY,AYACT,SYACT,YAX,YAN
CALL F2MOM(BEN,N,ABEN,SBEN,BEX,BEMN)
WRITE(6,*)TOTB,ABEN,SBEN,BEX,BEMN
CALL CROSM(Q,ETP,N,O,EJZ,ESZ,SJZ,SSZ,JZX,
AJZN,DZX,SZN,NX,RSRLX,RLRSX)
CALL SEQPEK(ETA,N,ETP,SIZE)
IF(I=NR,EQ,0)GOTO 270
C HISTORIC MONTHLY STATISTICS
PRINT /,'MONTHLY HISTORIC STATISTICS'
PRINT /,'FILE 3=YQMON'
WRITE(6,100)
WRITE(6,110)(SAM(J),J=1,12)
WRITE(6,120)(SYM(J),J=1,12)
WRITE(6,110)(SSD(J),J=1,12)
WRITE(6,110)(SS(J),J=1,12)
270 CONTINUE
WRITE(3,*)(SAM(J),J=1,12),(SYM(J),J=1,12),(SSD(J),J=1,12),

```

Table B.4. Continued.

```

*(SS(J),J=1,12),EJZ,EBZ,SJZ,SSZ,JZX,JZN,DZX,BZN,NX,
*(ETP(J),J=8,12),ABEN,BBEN,BEX,BEMN,TOTB,AYACT,SYACT,YAX,YAN,
*TOTY,PRICE,ALV,ALP,ALM,CONST,YPOT,AC,BIZE,RBRLX,HLRSX
CLOSE(3,DISP=CRUNCH)
NN=NN+IS13-1
DO 280 K=1,NZ
I=IZ+K-1
280 Z(K,1)=Q(NN,I)
CONTINUE
TAL=AL(1)
WRITE(6,*)NZ,IZ,NDT,TAL,IVS,ISTART,NCL,(Z(I,1),I=1,NZ)
WRITE(12,/)NZ,IZ,NDT,TAL,IVS,ISTART,NCL,(Z(I,1),I=1,NZ)
CLOSE(12,DISP=CRUNCH)
IF(MONANN.EQ.1)GOTO 330
C AGGREGATE FROM MONTHLY TO QUARTERLY,QQ
IF(IREAD.EQ.1)CALL AGGATE(Q,QQ,N,12,4)
DO 290 I=1,N
IYEAR=ISTART+(I-1)
IF(IREAD.NE.1)READ(9,80)(QQ(I,J),J=1,4)
WRITE(6,50)IYEAR,(QQ(I,J),J=1,4)
IF(IREAD.EQ.1)WRITE(9,80)(QQ(I,J),J=1,4)
290 CONTINUE
CLOSE(9,DISP=CRUNCH)
DO 300 J=1,4
CALL F3MOM(QQ,N,J,A,V,8D,S)
WRITE(6,*)J,A,V,S
300 CONTINUE
C AGGREGATE FROM QUARTERLY TO SEMI-ANNUAL,QS
IF(IREAD.EQ.1)CALL AGGATE(QQ,QS,N,4,2)
DO 310 I=1,N
IYEAR=ISTART+(I-1)
IF(IREAD.NE.1)READ(1,80)(QS(I,J),J=1,2)
WRITE(6,50)IYEAR,(QS(I,J),J=1,2)
IF(IREAD.EQ.1)WRITE(1,80)(QS(I,J),J=1,2)
310 CONTINUE
CLOSE(1,DISP=CRUNCH)
DO 320 J=1,2
CALL F3MOM(QS,N,J,A,V,8D,8)
WRITE(6,*)J,A,V,S
320 CONTINUE
C AGGREGATE FROM SEMI-ANNUAL TO ANNUAL,QA
IF(IREAD.EQ.1)CALL AGGATE(QS,QA,N,2,1)
GOTO 340
330 CONTINUE
C AGGREGATE FROM MONTHLY TO ANNUAL,QA
IF(IREAD.EQ.1)CALL AGGATE(Q,QA,N,12,1)
340 CONTINUE
IF(IWR.EQ.1)WRITE(6,90)
DO 350 I=1,N
IF(IREAD.NE.1)READ(2,80)(QA(I,J),J=1,1)
IYEAR=ISTART+(I-1)
IF(IWR.EQ.1)WRITE(6,50)IYEAR,(QA(I,J),J=1,1)
IF(IREAD.EQ.1.AND.IWR.EQ.1)WRITE(2,80)(QA(I,J),J=1,1)
350 CONTINUE
CLOSE(2,DISP=CRUNCH)
CALL F3MOM(QA,N,1,A,V,8D,S)
M=HURSK(QA,N,A,8D)
CALL SDLAG(QA,N,1,1,8DX,8DX2)
SD0=8DX(1)
SD1=SDX2(1)
DO 360 I=1,N

```

Table B.4. Continued.

```

QB(I,1)=QA(I,1)-A
360 CONTINUE
CALL COVAR(QB,QB,SXX,N,1,1,1,1,1,1,SDX,SDX2)
SC=SXX(1,1)
C HISTORIC ANNUAL STATISTICS
PRINT /,'ANNUAL HISTORIC STATISTICS'
PRINT /,'FILE #YQQR1'
WRITE(6,*)A,V,SD,S,H,SC,SD0,SD1
WRITE(4,/)A,V,SD,S,H,SC
CLOSE(4,DISP=CRUNCH)
GOTO 390
380 CONTINUE
IF(MONANN.EQ.1)GOTO 400
DO 390 I=1,N
READ(9,80)(QQ(I,J),J=1,4)
READ(1,80)(QS(I,J),J=1,2)
READ(2,80)(QA(I,J),J=1,1)
390 CONTINUE
GOTO 410
400 CONTINUE
DO 410 I=1,N
READ(2,80)QA(I,1)
410 CONTINUE
IF(IHO.EQ.1)HDT=1
C
C MONTHLY TRANSFORM
C
WRITE(6,130)
DO 450 J=1,NTR
CALL TFORM(Q,Y,AL(J),N,12,0,NOT)
DO 440 K=1,12
IF(INR.EQ.1)WRITE(6,60)(YQ(I,K),I=1,N)
CALL F3MOM(YQ,N,K,A,V,SD,S)
IF(IDIS.EQ.1)GOTO 420
CALL AMEDN(YQ,N,K,EM)
DLAM=(A-EM)/SQRT(V)
WRITE(6,960)J,K,S,AL(J),DLAM
960 FORMAT(1H,'J= ',I3,' MONTH= ',I3,' SKEN= ',F7,4,' ALAM= ',F7,4,
* 'DLAM= ',F7,4)
GOTO 440
420 TL=AL(J)
TAM(K)=A
TSM(K)=SD
IF(INR.EQ.1)WRITE(6,*)K,A,V,S,TL
DO 430 I=1,N
YQ1(I,K)=YQ(I,K)
YQ(I,K)=YQ1(I,K)-A
430 CONTINUE
440 CONTINUE
450 CONTINUE
CALL SDLAG(YQ1,N,12,0,SDY,SDY)
CALL SDLAG(YQ1,N,12,1,SDY1,SDY2)
PRINT /,'SDY,SDY1,SDY2'
WRITE(6,70)(SDY(J),J=1,12)
WRITE(6,70)(SDY1(J),J=1,12)
WRITE(6,70)(SDY2(J),J=1,12)
PRINT /,'MONTHLY TRANSFORMED MEANS'
WRITE(6,60)(TAM(K),K=1,12)
IF(MONANN.EQ.1)GOTO 560
C
C QUARTERLY TRANSFORM

```

Table B.4. Continued.

```

C
WRITE(6,140)
DO 500 J=1,NTH
CALL TFORM(QQ,YQQ,AL(J),N,4,0,NOT)
DO 490 K=1,4
CALL F3MOM(YQQ,N,K,A,V,SD,8)
WRITE(6,*/)K
IF(IWR.EQ.1)WRITE(6,60)(YQQ(I,K),I=1,N)
IF(IDIS.EQ.1)GOTO 470
CALL AMEDN(YQQ,N,K,EM)
DLAM=(A-EM)/SQRT(V)
WRITE(6,*/)J,K,A,V,S,AL(J),DLAM,EM
GOTO 490
470 WRITE(6,*/)K,A,V,S,TL
TAQ(K)=A
DO 480 I=1,N
YQQ(I,K)=YQQ(I,K)-A
480 CONTINUE
CALL F3MOM(YQQ,N,K,A,V,SD,8)
WRITE(6,*/)K,A
490 CONTINUE
500 CONTINUE
C
C SEMI-ANNUAL TRANSFORM
C
510 WRITE(6,150)
DO 550 J=1,NTR
CALL TFORM(QS,YQS,AL(J),N,2,0,NOT)
DO 540 K=1,2
CALL F3MOM(YQS,N,K,A,V,SD,5)
IF(IDIS.EQ.1)GOTO 520
CALL AMEDN(YQS,N,K,EM)
DLAM=(A-EM)/SQRT(V)
WRITE(6,*/)J,K,A,V,S,AL(J),DLAM,EM
GOTO 540
520 WRITE(6,*/)K,A,V,S,TL
TAS(K)=A
DO 530 I=1,N
YQS(I,K)=YQS(I,K)-A
530 CONTINUE
CALL F3MOM(YQS,N,K,A,V,SD,5)
WRITE(6,*/)K,A
540 CONTINUE
550 CONTINUE
C
C ANNUAL TRANSFORM
C
560 IF(IWR.EQ.1)WRITE(6,160)
DO 600 J=1,NTR
CALL TFORM(QA,YQA,AL(J),N,1,0,NOT)
CALL F3MOM(YQA,N,1,A,V,SD,5)
CALL SLAG(YQA,N,1,0,SDX,SDX)
CALL SLAG(YQA,N,1,1,SDX1,SDX2)
IF(IWR.EQ.0)GOTO 570
PRINT /,'SDX,SDX1,SDX2'
WRITE(6,70)SDX,SDX1,SDX2
570 CONTINUE
IF(IDIS.EQ.1)GOTO 560
CALL AMEDN(YQA,N,1,EM)
DLAM=(A-EM)/SQRT(V)
WRITE(6,950)J,AL(J),DLAM,S

```


Table B.4. Continued.

```

950 FORMAT(1H , 'J=', I3, ' ALAM=', F5, 3, ' DLAM=', F7, 4, ' SKEN=', F7, 4 )
GOTO 600
580 IF(IWR.EQ.1)WRITE(6,*)A,V,SD,S,TL
DO 590 I=1,N
YQA(I,1)=YQA(I,1)+A
590 CONTINUE
TA=A
TS=SD
600 CONTINUE
IF(IMO.EQ.1)GOTO 620
IF(IWR.EQ.0)GOTO 610
PRINT /, 'TRANSFORMED MEANS ,USE FOR INVERSE TRANSFORM'
PRINT /, 'FILE **TAMON'
610 CONTINUE
WRITE(11,/)TA,TS,(TAM(K),K=1,12),(TSM(K),K=1,12)
IF(IWR.EQ.1)WRITE(6,/)TA,TS,(TAM(K),K=1,12),(TSM(K),K=1,12)
CLOSE(11,DISP=CRUNCH)
CALL DAGL(YQA,YQ,SXX,SYX,SZZ,SYZ,SZX,SKZ,SYX,IY,MX,MY,N,IZ,NDZ,NDY
*,IVS)
620 CONTINUE
IF(HOT.EQ.0)GOTO 640
PRINT /, 'SXX SYX SYZ HISTORIC'
PRINT /, 'FILE 10=YGANN'
CALL MONCOR(Q,SAM,N,SSD,HYI,1)
CALL COVAR(YQ,YQA,HYX,N,MY,MX,0,IY,1,NDY,1,SDY,SDX)
CALL COVAR(YQ,YQ,HYY,N,MY,MY,0,IY,IY,NDY,NDY,SDY,SDY)
CALL COVAR(YQ,YQ,HYZ,N,MY,MY,1,IY,IY,NDZ,NDY,SDY1,SDY2)
WRITE(10,/)SXX(1,1),((HYY(I,J),I=1,NY),J=1,NY),(HYX(I,1),I=1,NY)
*,((HYZ(I,J),I=1,NY),J=1,NY),(HYI(J),J=1,NY)
CLOSE(10,DISP=CRUNCH)
PRINT /, 'HYX'
DO 630 I=1,NY
WRITE(6,120)HYX(I,1)
630 CONTINUE
PRINT /, 'HYY'
DO 640 I=1,NY
WRITE(6,120)(HYY(I,J),J=1,NY)
640 CONTINUE
PRINT /, 'HYZ'
DO 650 I=1,NY
WRITE(6,120)(HYZ(I,J),J=1,NY)
650 CONTINUE
IF(IMO.EQ.1)GOTO 710
660 CONTINUE
IF(IVS.EQ.1)GOTO 670
CALL DISAG(NZ,AX,R,C,NY,SXX,SYX,SZZ,SYZ,SZX,SKZ,SYX,ICYR,IWR)
GOTO 680
670 CONTINUE
CALL VDISAG(AX,C,SXX,SYX,SYX,NY,ICYR,IWR)
680 CONTINUE
DO 690 I=1,NY
WRITE(13,/)AX(I,1)
690 CONTINUE
IF(IVS.EQ.1)GOTO 700
DO 700 I=1,NY
WRITE(14,/)(B(I,J),J=1,NZ)
700 CONTINUE
DO 710 I=1,NY
WRITE(15,/)(C(I,J),J=1,NY)
710 CONTINUE
CLOSE(13,DISP=CRUNCH)
CLOSE(14,DISP=CRUNCH)
CLOSE(15,DISP=CRUNCH)
STOP
END

```

Table B.4. Continued.

```

SUBROUTINE MMULT(A,B,C,N1,N2,N3,N4,N5,N6,N7,N8,N9)
DIMENSION A(N4,N5),B(N6,N7),C(N8,N9)
DO 10 I=1,N1
DO 10 J=1,N2
C(I,J)=0.
DO 10 K=1,N3
10 C(I,J)=C(I,J)+A(I,K)*B(K,J)
RETURN
END

```

```

SUBROUTINE MADSUB(A,B,C,N1,N2,D,N3,N4,N5,N6,N7,N8)
INTEGER D
DIMENSION A(N3,N4),B(N5,N6),C(N7,N8)
DO 20 I=1,N1
DO 20 J=1,N2
IF(D.LT.0)GOTO 10
C(I,J)=A(I,J)+B(I,J)
GOTO 20
10 C(I,J)=A(I,J)-B(I,J)
20 CONTINUE
RETURN
END

```

```

SUBROUTINE MINV(A,N1,N2,N3,NY,DET,TEST,NI)
C 26 CARD PUNCH
C SQUARE MATRIX INVERSION, GAUSSIAN ELIMINATION,
C INVERSE BETWEEN N1 AND N2 WITH OPTIONAL SOLUTIONS STARTING AT N3 AND
C GOING TO N3 + NY = 1.
C DIAGONAL ELEMENTS < TESTI SET TO ZERO.
C DETERMINANT RETURNED AS DET, NI IS THE NUMBER OF ROWS OF A IN CALLIN
DIMENSION A(N1,NI)
NK=N3+NY+1
DET=1.0
DO 80 L=N1,N2
IF (ABS(A(L,L)).GT.TEST) GO TO 10
DET=0.0
A(L,L)=0.0
GO TO 20
10 DET=DET*A(L,L)
A(L,L)=1.0/A(L,L)
20 DO 50 I=N1,N2
IF (I.EQ.L) GO TO 50
A(I,L)=A(I,L)*A(L,L)
DO 30 J=N1,N2
IF (J.EQ.L) GO TO 30
A(I,J)=A(I,J)-A(I,L)*A(L,J)
30 CONTINUE
IF (NY.LE.0) GO TO 50
DO 40 J=N3,NK
A(I,J)=A(I,J)-A(I,L)*A(L,J)
40 CONTINUE
DO 60 J=N1,N2
IF (J.EQ.L) GO TO 60
A(L,J)=A(L,L)*A(L,J)
60 CONTINUE
IF (NY.LE.0) GO TO 80
DO 70 J=N3,NK
A(L,J)=A(L,L)*A(L,J)
70 CONTINUE
80 IF (NY.LE.0) GO TO 100
DO 90 I=N1,N2
DO 90 J=N3,NK
A(I,J)=A(I,J)
90 RETURN
100 END

```

Table B.4. Continued.

```

SUBROUTINE QKRST(NA,JJ)
C 26 CARD PUNCH
DIMENSION NA(JJ),NLT(20),NUT(20)
REAL NA,NT,NX

C
C QUICKERSORT IS A WAY OF SORTING ELEMENTS IN AN ARRAY INTO
C ASCENDING ORDER, THE ARRAY IS CONTINUALLY SPLIT INTO
C PARTS SUCH THAT THE ELEMENTS OF ONE PART ARE LESS THAN
C ALL ELEMENTS OF THE OTHER, WITH A THIRD PART IN THE
C MIDDLE CONSISTING OF A SINGLE ELEMENT. THIS METHOD IS
C CONSIDERABLY FASTER THAN THE STANDARD COMPARISON-TRANS-
C POSITION METHOD WHERE THE NUMBER OF COMPARISONS IS ON
C THE ORDER OF N (ARRAY SIZE) SQUARED. QUICKERSORT REQUIRES
C ONLY ON THE ORDER OF N * LOG N COMPARISONS.
C THE CALL IS : CALL QKRST NA,N
C WHERE NA( ARRAY NAME,
C N( ARRAY LENGTH,
C IN THIS VERSION THERE IS ESSENTIALLY NO LIMIT TO THE
C LENGTH OF THE SORTED ARRAY, THE ABSOLUTE LIMIT IS E TO
C THE 13,8+ I.E. LARGER THAN ANY INTERNALLY STORED ARRAY
C IN THE GE 635, ANY SORT OF ALPHANUMERIC DATA IN THE
C ARRAY WILL BE SORTED.
C
C QUICKERSORT IS ALGORITHM # 271, COLLECTED ALGORITHMS
C FROM CACH,
C
J=JJ
I=1
M=1
10 I1=I+1
IF(J,LE,I1) GO TO 90
NP=(J+I)/2
NT=NA(NP)
NA(NP)=NA(I)
NQ = J
K=I
20 K=K+1
IF(K,GT,NQ) GO TO 50
IF(NA(K),LE,NT) GO TO 20
NQ=NQ+1
30 NQ=NQ+1
IF(NQ,LT,K) GO TO 40
IF(NA(NQ),GE,NT) GO TO 30
NX=NA(K)
NA(K) = NA(NQ)
NA(NQ)=NX
NQ=NQ-1
GO TO 20
40 NQ=K-1
50 NA(I)=NA(NQ)
NA(NQ)=NT
IF(2*NQ-I=J) 70,70,60
60 NLT(M)=I
NUT(M)=NQ-1
I=NQ+1
GO TO 80
70 NLT(M)=NQ+1
NUT(M)=J
J=NQ-1
M=M+1
80 GO TO 10
90 IF(I,GE,J) GO TO 100
IF(NA(I),LE,NA(J)) GO TO 100
NX=NA(I)
NA(I)=NA(J)
NA(J)=NX
100 M=M+1
IF(M,EG,0) RETURN
I=NLT(M)
J=NUT(M)
GO TO 10
END

```

Table B.4. Continued.

```

SUBROUTINE CROSSM(Y,0, NR, LL, EJZ, ESZ, SJZ,
*SSZ, JZX, JZN, SZX, SZN, NX, RSRLX, RLRX)
DIMENSION Q(12), SZ(100), JZ(100), Y(100,12), YD(100,12), ZA(100)
DO 10 L=1, NR
  JZ(L)=0
  SZ(L)=0,0
10  CONTINUE
  NX=0
  JX=0
  SX=0,
  L=0
  N=8
  I=1
  SS=0.0
  JJ=0
20  CALL DIVERT(Y, NR, YD)
  S=0.0
  J=0
  N=N+1
  IF(N, LE, 12) GOTO 25
  N=8
  I=I+1
25  ZA(I)=YD(I, N)
  IF(I=NR) 30, 30, 80
30  IF(ZA(N)=Q(N)) 40, 20, 20
40  IF(ZA(N)=Q(N)) 20, 20, 50
50  J=J+1
  S=S+Q(N)-ZA(N)
  N=N+1
  IF(N, LE, 12) GOTO 55
  N=8
  I=I+1
55  IF(I=NR) 60, 60, 80
60  ZA(N)=YD(I, N)
  IF(Q(N)=ZA(N)) 70, 70, 50
70  L=L+1
  JJ=JJ+J
  SS=SS+S
  JZ(L)=J
  SZ(L)=S
  GOTO 20
80  NX=L
  JX=JJ
90  SX=SS
  JZ1=-10
  SZ1=-1, E15
  DO 1000 L=1, NX
  IF(SZ(L), GT, SZ1) GOTO 400
  GOTO 500
400  SZ1=SZ(L)
  RLRX=JZ(L)
500  CONTINUE
  IF(JZ(L), GT, JZ1) GOTO 600
  GOTO 1000
600  JZ1=JZ(L)
  RSRLX=SZ(L)
1000 CONTINUE
  IF(LL, NE, 0) GOTO 200
  WRITE(6, 100)
100  FORMAT(1MO, 'DOWN CROSSINGS TOTAL DEFICIT RUN LENGTHS AND SUMS')
  WRITE(6, 120) NX

```

Table B.4. Continued.

```

WRITE(6,130)JX
WRITE(6,140)SX
110 FORMAT(1H,'FLOW',20X,6F15.2)
120 FORMAT(1H,'CROSSINGS',15X,6I15)
130 FORMAT(1H,'TOTAL RUN LENGTH',8X,6I15)
140 FORMAT(1H,'TOTAL RUN SUM',11X,6F15.2)
150 WRITE(6,160){JZ(L),L=1,NX}
160 FORMAT(1H,'DEFICIT RUN LENGTHS AT CROSSING LEVEL', 'ARE',20I
*3/5(152,2013/))
WRITE(6,170){Q(K),K=8,12}
170 FORMAT(1H,'DEFICIT RUN SUMS AT CROSSING LEVEL ARE',5F10.2)
180 WRITE(6,190){SZ(L),L=1,NX}
190 FORMAT(10F10.2)
200 CONTINUE
CALL F2MOM(JZ,NX,EJZ,8JZ,JZX,JZN)
CALL F2MOM(SZ,NX,ESZ,8SZ,SZX,SZN)
IF(LL.NE.0)GOTO 1200
WRITE(6,850)
WRITE(6,900){EJZ,SJZ,JZX,JZN,MLRSX}
WRITE(6,950){ESZ,SSZ,SZX,SZN,MSRLX}
850 FORMAT(1H,'MEAN',2X,'ST. DEV.',7X,'MAX',7X,'MIN',
*5X,'P/MAX')
900 FORMAT(1H,'RUN LENGTH',5F10.2)
950 FORMAT(1H,'RUN SUM',3X,5E10.4)
1200 CONTINUE
RETURN
END

SUBROUTINE VDISAG(A,B,SXX,SYX,SYY,N,ICYR,IWR)
DIMENSION A(12,1),R(12,12),BB(12,12),AT(1,12),SYX(12,1),SYY(12,12)
*,DUM(12,12),R(12,12),SXX(1,1),SXY(1,12)
10 FORMAT(1H,'12E10.4)
PRINT /,'A MATRIX=SYXSXX='
DO 20 I=1,N
A(I,1)=SYX(1,1)/SXX(1,1)
WRITE(6,10)A(I,1)
SXY(1,I)=SYX(I,1)
20 CONTINUE
CALL MMULT(A,SXY,DUM,N,N,1,12,1,1,12,12,12)
IF(IWR.EQ.1)PRINT /,'SYX(SXX=*)SXY'
DO 30 I=1,N
IF(IWR.EQ.1)WRITE(6,10)(DUM(I,J),J=1,N)
30 CONTINUE
CALL MAOSUB(SYY,DUM,BB,N,N,-1,,12,12,12,12,12)
IF(IWR.EQ.1)PRINT /,'BB'
DO 40 I=1,N
IF(IWR.EQ.1)WRITE(6,10)(BB(I,J),J=1,N)
40 CONTINUE
IF(ICYR.EQ.1)GOTO 50
CALL PRCOMP(B,BB,R,N,IWR)
GOTO 60
50 CONTINUE
CALL TRIDIA(BB,B,N,12)
60 CONTINUE
PRINT /,'B MATRIX'
DO 70 I=1,N
WRITE(6,10)(B(I,J),J=1,N)
70 CONTINUE
RETURN
END

```

Table B.4. Continued.

```

SUBROUTINE DISAG(M,A,B,C,N1,SXX,SYX,SZZ,SYZ,SZX,SXZ,SYX,ICYH,IWH)
DIMENSION SZZ(12,12),SYY(12,12),SYZ(12,12),SYX(12,1),SXX(1,1),
* SXZ(1,12),SZX(12,1)
DIMENSION CCT(12,12),C(12,12),B(12,12),A(12,1),T(1,1),DUM(1,1),
* S(12,1),SZZ1(12,12),DUM2(12,12),DUM1(12,1),DUM2(1,12),BT(12,12),
* AT(1,12),DUMC(12,12),DUM3(12,12),R(12,12)
10  FORMAT(1H,' A MATRIX')
20  FORMAT(1H,' 12E10,4)
30  FORMAT(1H,' B MATRIX')
40  FORMAT(1H,' C MATRIX')
50  FORMAT(1H,' CCT')
60  FORMAT(1H,' SZZ=1')
70  FORMAT(1H,' SYY=ASXXAT=ASXZBT=BSZXAT')
80  FORMAT(1H,' SYY=ASXXAT')
90  FORMAT(1H,' SYY=ASXXAT=ASXXBT')
100 FORMAT(1H,' SYX= SXZSZZ(-1)SZX')
110 FORMAT(1H,' SYX=SYZSZZ(-1)SZX')
    DO 120 I=1,M
    DO 120 J=1,M
120  SZZ1(I,J)=SZZ(I,J)
C   SZZ1(-1)
    CALL MINV(SZZ1,1,M,0,0,0,0,12)
    IF(IWR.EQ.1)WRITE(6,60)
    DO 130 I=1,M
    IF(IWR.EQ.1)WRITE(6,20)(SZZ1(I,J),J=1,M)
130  CONTINUE
C   SYZSZZ(-1)
    CALL MMULT(SYZ,SZZ1,DUMZ,N1,M,M,12,12,12,12,12,12)
    IF(IWR.EQ.1)PRINT /,'SYZSZZ(-120)=(N1,M)'
    DO 140 I=1,N1
    IF(IWR.EQ.1)WRITE(6,20)(DUMZ(I,J),J=1,M)
140  CONTINUE
C   SYZSZZ(-1)SZX
    CALL MMULT(DUMZ,SZX,DUM1,N1,1,M,12,12,12,1,12,1)
    IF(IWR.EQ.1)PRINT /,'SYZSZZ(-120)SZX=(N1,1)'
    DO 150 I=1,N1
    IF(IWR.EQ.1)WRITE(6,20)(DUM1(I,J),J=1,1)
150  CONTINUE
C   S=SYX=SYZSZZ(-1)SZX
    CALL MADSUB(SYX,DUM1,S,N1,1,-1,12,1,12,1,12,1)
    IF(IWR.EQ.1)WRITE(6,110)
    DO 160 I=1,N1
    IF(IWR.EQ.1)WRITE(6,20)S(I,1)
160  CONTINUE
C   SXZSZZ(-1)
    CALL MMULT(SXZ,SZZ1,DUM2,1,M,M,1,12,12,12,1,12)
    IF(IWR.EQ.1)PRINT /,'SXZSZZ(-120)=(1,M)'
    IF(IWR.EQ.1)WRITE(6,20)(DUM2(I,J),J=1,M)
C   SXZSZZ(-1)SZX
    CALL MMULT(DUM2,SZX,DUM,1,1,M,1,12,12,1,1,1)
    IF(IWR.EQ.1)PRINT /,'SXZSZZ(-120)SZX=(1,1)'
    IF(IWR.EQ.1)WRITE(6,20)DUM(1,1)
C   T=SYX=SXZSZZ(-1)SZX
    CALL MADSUB(SXX,DUM,T,1,1,-1,1,1,1,1,1,1)
    IF(IWR.EQ.1)WRITE(6,100)
    IF(IWR.EQ.1)WRITE(6,20)T(1,1)
C   T(-1)=(SXX=SXZSZZ(-1)SZX)(-1)
    CALL MINV(T,1,1,0,0,0,0,TEST,1)
    DO 170 I=1,1
    DO 170 J=1,1
170  T(1,J)=1./T(1,J)

```

Table B.4. Continued.

```

C  A=ST
  CALL MMULT(S,T,A,N1,1,1,12,1,1,12,1)
  WRITE(6,10)
  DO 180 I=1,N1
    WRITE(6,20)A(I,1)
180  CONTINUE
C  ASXZ
  CALL MMULT(A, SXZ, DUMZ, N1, M, 1, 12, 1, 1, 12, 12, 12)
  IF(IWR.EQ.1)PRINT /, 'ASXZ=(N120,M)'
  DO 190 I=1,N1
    IF(IWR.EQ.1)WRITE(6,20)(DUMZ(I,J),J=1,M)
190  CONTINUE
C  SYZ=ASXZ
  CALL MADSUB(SYZ,DUMZ,DUM3,N1,M,-1,,12,12,12,12,12,12)
  IF(IWR.EQ.1)PRINT /, 'SYZ=ASXZ=(N120,M)'
  DO 200 I=1,N1
    IF(IWR.EQ.1)WRITE(6,20)(DUM3(I,J),J=1,M)
200  CONTINUE
C  B=(SYZ-ASXZ)SZZ(-1)
  CALL MMULT(DUM3,SZZ1,B,N1,M,M,12,12,12,12,12,12)
  WRITE(6,30)
  DO 210 I=1,N1
    WRITE(6,20)(B(I,J),J=1,M)
210  CONTINUE
C  BT
  DO 230 I=1,N1
    DO 220 J=1,M
      BT(J,I)=B(I,J)
220  CONTINUE
230  CONTINUE
  IF(IWR.EQ.1)PRINT /, 'BT=(M,N120)'
  DO 240 I=1,M
    IF(IWR.EQ.1)WRITE(6,20)(BT(I,J),J=1,N1)
240  CONTINUE
C  AT
  DO 250 I=1,N1
    AT(I,I)=A(I,1)
250  AT(I,I)=A(I,1)
  IF(IWR.EQ.1)PRINT /, 'AT'
  IF(IWR.EQ.1)WRITE(6,20)(AT(I,I),I=1,N1)
C  ASXX
  CALL MMULT(A, SXX, DUM1, N1, 1, 1, 12, 1, 1, 1, 12, 1)
  IF(IWR.EQ.1)PRINT /, 'ASXX=(N120,1)'
  DO 260 I=1,N1
    IF(IWR.EQ.1)WRITE(6,20)DUM1(I,1)
260  CONTINUE
C  ASXXAT
  CALL MMULT(DUM1, AT, DUMC, N1, N1, 1, 12, 1, 1, 12, 12, 12)
  IF(IWR.EQ.1)PRINT /, 'ASXXAT=(N120,N1)'
  DO 270 I=1,N1
    IF(IWR.EQ.1)WRITE(6,20)(DUMC(I,J),J=1,N1)
270  CONTINUE
C  SY=ASXXAT
  CALL MADSUB(SY,DUMC,DUM3,N1,N1,-1,,12,12,12,12,12,12)
  IF(IWR.EQ.1)WRITE(6,80)
  DO 280 I=1,N1
    IF(IWR.EQ.1)WRITE(6,20)(DUM3(I,J),J=1,N1)
280  CONTINUE
C  ASXZ
  CALL MMULT(A, SXZ, DUMZ, N1, M, 1, 12, 1, 1, 12, 12, 12)
  IF(IWR.EQ.1)PRINT /, 'ASXZ=(N120,M)'
  DO 290 I=1,N1
    IF(IWR.EQ.1)WRITE(6,20)(DUMZ(I,J),J=1,M)

```

Table B.4. Continued.

```

290 CONTINUE
C ASXZBT
CALL MMULT(DUMZ,BT,DUMC,N1,N1,M,12,12,12,12,12)
IF(IWR,EQ,1)PRINT /,'ASXZBT=(N120,N1)'
DO 300 I=1,N1
IF(IWR,EQ,1)WRITE(6,20)(DUMC(I,J),J=1,N1)
300 CONTINUE
C SYY=ASXXAT=ASXZBT
CALL MADSUB(DUM3,DUMC,CCT,N1,N1,=1,,12,12,12,12,12)
IF(IWR,EQ,1)WRITE(6,90)
DO 310 I=1,N1
IF(IWR,EQ,1)WRITE(6,20)(CCT(I,J),J=1,N1)
310 CONTINUE
C BSZX
CALL MMULT(B,BSZX,DUM1,N1,1,M,12,12,12,1,12,1)
IF(IWR,EQ,1)PRINT /,'BSZX=(N120,1)'
DO 320 I=1,N1
IF(IWR,EQ,1)WRITE(6,20)DUM1(I,1)
320 CONTINUE
C BSZXAT
CALL MMULT(DUM1,AT,DUM3,N1,N1,1,12,1,1,12,12,12)
IF(IWR,EQ,1)PRINT /,'BSZXAT=(N120,N1)'
DO 330 I=1,N1
IF(IWR,EQ,1)WRITE(6,20)(DUM3(I,J),J=1,N1)
330 CONTINUE
C SYY=ASXXAT=ASXZBT=BSZXAT
CALL MADSUB(CCT,DUM3,DUMC,N1,N1,=1,,12,12,12,12,12)
IF(IWR,EQ,1)WRITE(6,70)
DO 340 I=1,N1
IF(IWR,EQ,1)WRITE(6,20)(DUMC(I,J),J=1,N1)
340 CONTINUE
C BSZZ
CALL MMULT(B,BSZZ,DUM3,N1,M,M,12,12,12,12,12,12)
IF(IWR,EQ,1)PRINT /,'BSZZ=(N120,M)'
DO 350 I=1,N1
IF(IWR,EQ,1)WRITE(6,20)(DUM3(I,J),J=1,M)
350 CONTINUE
C BSZZBT
CALL MMULT(DUM3,BT,DUMZ,N1,N1,M,12,12,12,12,12,12)
IF(IWR,EQ,1)PRINT /,'BSZZBT=(N120,N1)'
DO 360 I=1,N1
IF(IWR,EQ,1)WRITE(6,20)(DUMZ(I,J),J=1,N1)
360 CONTINUE
C CCT=SYY=ASXXAT=ASXZBT=BSZXAT=BSZZBT
CALL MADSUB(DUMC,DUMZ,CCT,N1,N1,=1,,12,12,12,12,12)
IF(IWR,EQ,1)WRITE(6,50)
DO 370 I=1,N1
IF(IWR,EQ,1)WRITE(6,20)(CCT(I,J),J=1,N1)
370 CONTINUE
IF(ICYR,EQ,1)GOTO 380
CALL PRCOMP(C,CCT,R,N1,IWR)
GOTO 390
380 CONTINUE
CALL TRIDIA(CCT,C,N1,12)
390 CONTINUE
WRITE(6,40)
DO 400 I=1,N1
WRITE(6,20)(C(I,J),J=1,N1)
400 RETURN
END

```


Table B.4. Continued.

```

SUBROUTINE SBLAG(X,N,M,LAG,SD1,SD2)
DIMENSION X(100,M),SD1(M),SD2(M)
NLAG=N-LAG
B=FLOAT(NLAG)
DO 30 J=1,M
S=0.
SL=0.
TL=0.
TL=0.
DO 10 I=1,NLAG
L=I+LAG
T=X(I,J)
TL=TL+X(L,J)
10 CONTINUE
A=T/B
XML=T/L/B
DO 20 I=1,NLAG
L=I+LAG
S=S+(X(I,J)-XML)**2
SL=SL+(X(L,J)-XML)**2
20 CONTINUE
A=S/B
AL=S1/B
SD1(J)=SORT(A)
SD2(J)=SORT(AL)
30 CONTINUE
RETURN
END

```

```

SUBROUTINE AGGATE(X,Y,N,M,NSEA)
NSEA= # (IF SEASONS DESIRED TO AGGREGATE UP TO IE,
C MONTHLY--QUARTERLY, NSEA=4) Q--SEMI,NSEA=2) S--ANNUAL, NSEA=1
C M--S, NSEA=2) H--A, NSEA=1
DIMENSION X(100,M),Y(100,NSEA)
DO 40 I=1,N
IC=1
K=1
NIC=IC+M/NSEA
DO 30 J=1,M
IF(J,EQ,NIC)GOTO 10
GOTO 20
10 K=K+1
IC=IC+M/NSEA
NIC=IC+M/NSEA
20 Y(I,K)=Y(I,K)+X(I,J)
30 CONTINUE
40 CONTINUE
RETURN
END

```

Table B.4. Continued.

```

SUBROUTINE TFORM(X,Y,AL,N,M,INV,NOT)
C    BOX-COX TRANSFORMATION AFTER HINKLEY
DIMENSION X(100,M),Y(100,M)
IF(NOT.EQ,0)GOTO 40
IF(INV.EQ,1)GOTO 20
DO 10 I=1,N
DO 10 J=1,M
Y(I,J)=X(I,J)
10  CONTINUE
RETURN
20  CONTINUE
DO 30 I=1,N
DO 30 J=1,M
X(I,J)=Y(I,J)
30  CONTINUE
RETURN
40  CONTINUE
IF(INV.EQ,1)GOTO 80
IF(AL.EQ,0)GOTO 60
DO 50 I=1,N
DO 50 J=1,M
Y(I,J)=(X(I,J)**AL-1.0)/AL
50  CONTINUE
RETURN
60  CONTINUE
DO 70 I=1,N
DO 70 J=1,M
Y(I,J)=ALOG(X(I,J))
70  CONTINUE
RETURN
80  CONTINUE
IF(AL.EQ,0)GOTO 100
DO 90 I=1,N
DO 90 J=1,M
X(I,J)=(Y(I,J)*AL+1.0)**(1.0/AL)
90  CONTINUE
RETURN
100 CONTINUE
DO 110 I=1,N
DO 110 J=1,M
X(I,J)=EXP(Y(I,J))
110 CONTINUE
END

```

Table B.4. Continued.

```

SUBROUTINE DAGL(X,Y,SXX,SYX,SZZ,SYZ,SZX,SXZ,SYX,IY,MX,MY,N,IZ,NDZ,
*NDY,IVS)
DIMENSION X(100,1),Y(100,NDY),SXX(1,1),SYX(NDY,NDY),SZZ(NDZ,NDZ),
*SYZ(NDY,NDZ),SZX(NDZ,1),SXZ(1,NDZ),SYX(NDY,1),DUMX(100,1),DUMY(100
* ,12),SDX(1),SDX2(1),SDY(12),SDY1(12),SDY2(12)
10  FORMAT(1H ,12E10.4)
    MY=MY-IY+1
    MX=1
    LAG=0
    MZ=MY
    IZ=MZ-IZ+1
    SDX(1)=1.0
    SDX2(1)=1.0
    DO 30 J=IY,MY
    SDY(J)=1.0
    SDY1(J)=1.0
    SDY2(J)=1.0
    DO 20 I=1,N
    DUMY(I,J)=Y(I,J)
    DUMX(I,1)=X(I,1)
20  CONTINUE
30  CONTINUE
    CALL COVAR(X,DUMX,SXX,N,MX,MX,LAG,1,1,1,SDX,SDX)
    PRINT /,'SXX'
    DO 40 I=1,MX
    WRITE(6,10)(SXX(I,J),J=1,MX)
40  CONTINUE
    IF(IVS,Eq.1)GOTO 80
    CALL COVAR(Y,X,SZX,N,MZ,MX,1,IZ,1,NDZ,1,SDY1,SDX2)
    PRINT /,'SZX'
    DO 60 I=1,MZ
    WRITE(6,10)(SZX(I,J),J=1,MX)
    DO 50 J=1,MX
    SXZ(J,I)=SZX(I,J)
50  CONTINUE
60  CONTINUE
    PRINT /,'SXZ'
    DO 70 I=1,MZ
    WRITE(6,10)(SXZ(I,J),J=1,NZ)
70  CONTINUE
    CALL COVAR(Y,X,SYX,N,MY,MX,LAG,IY,1,NDY,1,SDY,SDX)
    PRINT /,'SYX'
    DO 90 I=1,MY
    WRITE(6,10)(SYX(I,J),J=1,MX)
90  CONTINUE
    CALL COVAR(Y,DUMY,SYX,N,MY,MY,LAG,IY,IY,NDY,NDY,SDY,SDY)
    PRINT /,'SYX'
    DO 100 I=1,MY
    WRITE(6,10)(SYX(I,J),J=1,MY)
100 CONTINUE
    IF(IVS,Eq.1)RETURN
    CALL COVAR(Y,DUMY,SZZ,N,MZ,MZ,LAG,IZ,IZ,NDZ,NDZ,SDY,SDY)
    PRINT /,'SZZ'
    DO 110 I=1,MZ
    WRITE(6,10)(SZZ(I,J),J=1,NZ)
110 CONTINUE
    LAG=1
    CALL COVAR(Y,DUMY,SYZ,N,MZ,MY,LAG,IZ,IY,NDZ,NDY,SDY1,SDY2)
    PRINT /,'SYZ'
    DO 130 I=1,MY
    DO 120 J=1,NZ
    SYZ(I,J)=SYZ(J,I)
120 CONTINUE
130 CONTINUE
    DO 140 I=1,MY
    WRITE(6,10)(SYZ(I,J),J=1,NZ)
140 CONTINUE
    RETURN
    END

```

Table B.4. Continued.

```

SUBROUTINE TRIDIA(C,B,N,NCOL)
DIMENSION C(NCOL,NCOL),B(NCOL,NCOL)
C IS SYMMETRIX INPUT MATRIX, BBT, B IS LOWER TRI OUTPUT MATRIX
10  FORMAT(1H,'J=',I3,T10,12E10,4)
20  FORMAT(1H,'J=',I3,'B(J,J)=' ,E10,4)
      H(1,1)=SQRT(C(1,1))
      PRINT /,'B(J,*)'
      DO 30 J=2,N
      B(J,1)=C(J,1)/B(1,1)
      WRITE(6,10)J,B(J,1)
30  CONTINUE
      J=2
      B(2,2)=C(2,2)-B(2,1)**2
      PRINT /,'C(*,2)=B(2,1)**2'
      *WRITE(6,20)J,B(2,2)
      IF(B(2,2).LT.0.)B(2,2)=0.
      B(2,2)=SQRT(B(2,2))
      *WRITE(6,20)J,B(2,2)
      DO 80 J=3,N
      J1=J-1
      DO 60 K=2,J1
      BELM=0.
      KM=K-1
      DO 40 K1=1,KM
      BELM=BELM+B(J,K1)*B(K,K1)
40  CONTINUE
      B(J,K)=C(J,K)-BELM
      IF(B(K,K).NE.0.)GOTO 50
      B(J,K)=0.
      GOTO 60
50  B(J,K)=B(J,K)/B(K,K)
60  CONTINUE
      PRINT /,'FOR ROW J, B(J,K),K=*,J=1'
      WRITE(6,10)J,(B(J,K),K=1,J1)
      DELM=0.
      DO 70 L=1,J1
      DELM=DELM+B(J,L)**2
70  CONTINUE
      B(J,J)=C(J,J)-DELM
      IF(B(J,J).LT.0.)B(J,J)=0.
      PRINT /,'C(J,J)=DELM'
      *WRITE(6,20)J,B(J,J)
      H(J,J)=SQRT(B(J,J))
      *WRITE(6,20)J,B(J,J)
80  CONTINUE
      RETURN
      END

```

Table B.4. Continued.

```

SUBROUTINE PRCOMP(B,BBT,R,ICOL,IWR)
C  DECOMPOSES BBT TO OBTAIN B BY PRINCIPLE COMPONENT ANALYSIS
C  ICOL= DIMENSION OF BBT
    DIMENSION BBT(ICOL,ICOL),B(ICOL,ICOL),ALAMBD(12),Q(78),D(12),WK(12
    *),R(ICOL,ICOL)
10  FORMAT(1H,12F10.3)
20  FORMAT(1H,'E VALUE')
30  FORMAT(1H,'E VECTOR')
40  FORMAT(1H,'Q VECTOR')
    IP=1
    L=0
    DO 50 I=1,ICOL
    DO 50 J=1,I
    L=L+1
50  Q(L)=BBT(I,J)
    NMAX=L
    IF(IWR.EQ.1)WRITE(6,*)NMAX
    IF(IWR.EQ.1)WRITE(6,40)
    IF(IWR.EQ.1)WRITE(6,10)(Q(I),I=1,NMAX)
    CALL FIGRS(Q,ICOL,IP,D,R,ICOL,WK,IER)
    IF(IWR.EQ.1)WRITE(6,20)
    IF(IWR.EQ.1)WRITE(6,10)(D(I),I=1,ICOL)
    IF(IWR.EQ.1)WRITE(6,30)
    DO 60 I=1,ICOL
    IF(IWR.EQ.1)WRITE(6,10)(R(I,J),J=1,ICOL)
60  CONTINUE
    BOUND=(*,01)*D(ICOL)
    DO 90 I=1,ICOL
    ALAMBD(I)=D(I)
    WRITE(6,70)I,ALAMBD(I)
70  FORMAT(10X,'EIGENVALUE',I3,' EQUALS',F15.5)
    IF(D(I).LT.BOUND)GOTO 100
    IF(D(I).GE.0.0)GOTO 80
    D(I)=0.0
    GOTO 90
80  D(I)=SQRT(D(I))
90  CONTINUE
    GOTO 120
100 WRITE(6,110)
110 FORMAT(10X,'MATRIX BBT IS NOT POSITIVE SEMIDEFINITE. STOP,')
    STOP
120 L=0
    DO 130 I=1,ICOL
    DO 130 J=1,ICOL
130  B(I,J)=R(I,J)*D(J)
    RETURN
    END

```

Table B.4. Continued.

```

SUBROUTINE COVAR(X,Y,SDX,N,M1,M2,LAG,I1,J1,ND1,ND2,SDX,SDY)
C COVARIANCE MATRIX ON DATA WITH MEAN ALREADY SUBTRACTED OFF
C I1= STARTING SEASON OF X GOING TO M1; J1= START OF Y GO TO M2
C K= YEAR COUNTER ; LAG = LAG #
DIMENSION X(100,ND1),Y(100,ND2),SDX(ND1,ND2),TSXY(12,12)
*,SDX(ND1),SDY(ND2)
NLAG=N-LAG
DO 10 I=1,ND1
DO 10 J=1,ND2
TSXY(I,J)=0.0
10 CONTINUE
DO 30 K=1,NLAG
L=K+LAG
DO 20 I=1,M1
DO 20 J=1,M2
J2=J+1
I2=I+1
TSXY(I,J)=TSXY(I,J)+X(K,I)*Y(L,J)
SDX(I2,J2)=SDX(I,J)/FLOAT(NLAG)
SDY(I2,J2)=SDY(I,J)/(SDX(I)*SDY(J))
20 CONTINUE
30 CONTINUE
RETURN
END

```

```

FUNCTION HURSK(X,N,XBAR,XSD)
DIMENSION X(N)
DMIN=1.E15
DMAX=-1.E15
D=0.
DO 10 I=1,N
Y=X(I)-XBAR
D=D+Y
IF(D.GT.DMAX)DMAX=D
IF(D.LT.DMIN)DMIN=D
10 CONTINUE
R=DMIN/DMAX
WRITE(6,900)R
900 FORMAT(1H,'RANGE',E15.9)
A=ALOG10(R)=ALOG10(YSD)
B=ALOG10(N)=ALOG10(2)
HURSK=A/B
RETURN
END

```

Table B.4. Continued.

```

SUBROUTINE F3MOM(X,N,M,A,V,SD,S)
DIMENSION X(100,M),Y(10000)
DO 10 I=1,N
Y(I)=X(I,M)
10 CONTINUE
C AVERAGE
A=MEAN(Y,N)
C VARIANCE
V=VAR(Y,A,N)
SD=SQRT(V)
C SKEW
CALL SKEW(Y,SD,S,N,A)
RETURN
END

SUBROUTINE AMEDN(X,N,M,EM)
DIMENSION X(100,12),Y(100)
DO 10 I=1,N
Y(I)=X(I,M)
10 CONTINUE
CALL MKRSRT(Y,N)
FN2=FLOAT(N/2)
IN2=N/2
GIF=FN2-[N2
IN3=IN2+1
IF (DIF.GT.0.)GOTO 20
EM=(Y(IN2)+Y(IN3))/2.
GOTO 30
20 EM=Y(IN3)
30 RETURN
END

SUBROUTINE SKEW(X,S,CS,N,A)
DIMENSION X(1000)
SUM=0.
DO 10 I=1,N
10 SUM=SUM+(X(I)-A)**3
UBV=((S**2)*(N-1))/N
BV=SQRT(UBV**3)
BSK=(SUM/N)/BV
C CORRECTION FOR SINGLE SAMPLE BIAS, REF. BOBEE AND ROBITALLE, WRR.
C VOL. 11, NO. 6, 1975, P851, EQ.6,
ALPHA=(SQRT(N*(N-1)))/(N-2)*(1+((B,S)/N))
CS=ALPHA*BSK
RETURN
END

```

Table B.4. Continued.

```

FUNCTION VAR(X,A,N)
DIMENSION X(N)
S=0.
DO 10 I=1,N
10 S=S+(X(I)-A)**2
VAR=S/(N-1)
RETURN
END

```

```

FUNCTION AMEAN(X,N)
DIMENSION X(N)
R=FLOAT(N)
S=0.
DO 10 I=1,N
10 S=S+X(I)
AMFAN=S/R
RETURN
END

```

```

SUBROUTINE F2MOM(X,N,A,S,AX,AN)
DIMENSION X(N),Y(100)
DO 10 I=1,N
Y(I)=X(I)
10 CONTINUE
A=AMEAN(Y,N)
V=VAR(Y,A,N)
S=SQRT(V)
CALL DKRSRT(Y,N)
AX=Y(I)
AN=Y(I)
RETURN
END

```

```

SUBROUTINE CONUSE
COMMON/CU1/CK, TM, PC, PR, CU, AC, EFF
DIMENSION CK(5), TM(5), PC(5), PR(5), CU(5)
DO 10 I=1,5
CU(I)=(,0173*TM(I)-,314)*CK(I)*TM(I)*PC(I)
CU(I)=CU(I)-PR(I)
IF(CU(I).LT.,0.,0)CU(I)=0.0
10 CONTINUE
WRITE(6,900)(CU(I),I=1,5)
900 FORMAT(1H , 'CONSUMPTIVE USE',5F10.2)
RETURN
END

```


Table B.4. Continued.

```

SUBROUTINE DIVERT(U,N,ETA)
DIMENSION Q(100,12),ETA(100,12)
DO 50 I=1,N
DO 30 J=8,12
IF (Q(I,J).GT.17510.)GOTO 20
IF (Q(I,J).GT.16905.)ETA(I,J)=3592.
ETA(I,J)=.221*Q(I,J)-107.836
GOTO 30
20 IF (Q(I,J).GT.24150.)GOTO 25
ETA(I,J)=.453*Q(I,J)-3934.38
GOTO 30
25 ETA(I,J)=7010.
30 CONTINUE
50 CONTINUE
RETURN
END

SUBROUTINE DEMAND(ETP)
COMMON/CU1/CK,TH,PC,PR,CU,AC,EFF
DIMENSION CK(5),TH(5),PC(5),PR(5),CU(5),ETP(12)
DO 10 I=1,5
I7=I+7
ETP(I7)=CU(I)/12.
ETP(I7)=ETP(I7)*AC/EFF
10 CONTINUE
900 FORMAT(1H ,10DEMAND ACFT=1,5F10,2)
WRITE(6,900)(ETP(I),I=8,12)
RETURN
END

SUBROUTINE CROPY(ETP,ETA,N,TOTY,TOTB,YACT,BEN,AC)
COMMON/CY1/PRICE,ALV,ALP,ALM,CONST,YPOT
DIMENSION ETP(12),ETA(100,12),YACT(100),BEN(100)
TOTY=0.0
TOTB=0.0
DO 10 I=1,N
RV=(ETA(I,8)+ETA(I,9))/(ETP(8)+ETP(9))
RP=ETA(I,10)/ETP(10)
RM=(ETA(I,11)+ETA(I,12))/(ETP(11)+ETP(12))
YACT(I)=CONST*YPOT*RV**ALV*RP**ALP*RM**ALM*AC
BEN(I)=YACT(I)*PRICE
TOTY=TOTY+YACT(I)
TOTB=TOTB+BEN(I)
10 CONTINUE
RETURN
END

```

Table B.4. Continued.

```

SUBROUTINE SEQPEK(QX,NY,DEM,SIZE)
DIMENSION QX(100,12),DEM(12),D(1850)
DEV=0,0
DO 10 J=1,12
IF(J,GE,8)GOTO 10
DEM(J)=0,0
10 CONTINUE
WRITE(6,900)(DEM(J),J=1,12)
900 FORMAT(1H,'DEMAND=',12F10,2)
PEAK=1,E15
TROUGH=1,E15
SIZE=PEAK
IP=0
K=0
N2=NY*2
NP=NY*24
DO 200 I=1,N2
IF(I,LE,NY)GOTO 20
L=I-NY
GOTO 30
20 L=I
30 CONTINUE
DO 150 J=1,12
DIF=QX(L,J)-DEM(J)
DEV=DEV+DIF
K=K+1
D(K)=DEV
IF(DEV,GE,PEAK)GOTO 40
IP=1
IF(DEV,LE,TROUGH)TROUGH=DEV
GOTO 150
40 IF(IP,EQ,0)GOTO 45
SIZE=PEAK-TROUGH
IF(SIZE,GT,SIZE1)SIZE1=SIZE
SIZE=SIZE1
IP=0
TROUGH=1,E15
45 PEAK=DEV
150 CONTINUE
200 CONTINUE
WRITE(6,950)SIZE
950 FORMAT(1H,'RESERVOIR SIZE=',E15,9)
RETURN
END

SUBROUTINE MONCOR(Q,AVE,N,B,R,LAG)
DIMENSION Q(100,12),AVE(12),S(12),R(12),P1(12),A2(12),A1(12)
,S1(12)
NL=N-LAG
DO 20 J=1,12
A1(J)=0,0
A2(J)=0,0
P1(J)=0,0
20 CONTINUE
DO 40 I=1,NL
IL=I+LAG
DO 40 J=1,12
D1=Q(IL,J)-AVE(J)
A2(J)=A2(J)+D1*D1
IF(J,EQ,1)GO TO 30
K=J-1
D2=Q(IL,K)-AVE(K)
GO TO 35
30 IF(I,EQ,1)GO TO 35
K=12
D2=Q(IL-1,K)-AVE(K)
35 P1(J)=P1(J)+D1*D2
A1(J)=A1(J)+D2*D2
40 CONTINUE
EN1=N-1
DO 42 J=1,12
S1(J)=SQRT(A1(J)/EN1)
S(J)=SQRT(A2(J)/EN1)
42 CONTINUE
DO 47 J=1,12
IF(J,EQ,1)GO TO 43
K=J-1
GO TO 44
43 K=12
44 R(J)=P1(J)/(S(J)*S(K)+(N-1))
IF(LAG,NE,0)R(J)=P1(J)/(S(J)*S1(K)+NL)
47 CONTINUE
RETURN
END

```

Table B.5. Definition of program variables.

Name	Description
A	average
ABEN	average annual crop benefits
AC	acres of irrigated area
AL(10)	transformation exponents
ALM	maturation stage crop coefficient for predicting crop yield
ALP	pollination stage crop coefficient for crop yield equation
ALV	vegetative stage crop coefficient for predicting crop yield
AT(1,12)	A^T matrix in disaggregation model
AX(12,12)	A coefficient matrix for seasonal disaggregation model
AYACT	average annual crop yield
B(12,12)	B coefficient matrix for seasonal disaggregation model
BEMN	minimum annual crop benefits
BEN(N)	N annual crop benefits
BEX	maximum annual crop benefits
BT(12,12)	D^T matrix in disaggregation model
C(12,12)	C coefficient matrix for seasonal disaggregation model
CCT(12,12)	BB^T matrix for disaggregation model
CK(5)	monthly crop coefficient in Blaney-Criddle consumptive use equation for the growing season
CONST	constant for crop yield prediction equation
CU(5)	monthly consumptive use derived from Blaney-Criddle consumptive use equation

Table B.5. Continued.

Name	Description
D(12)	eigen values for BB^T matrix
DELM	summation variable in lower triangular matrix decomposition routine
DEV	summation of DIF in SPA
DIF	difference between streamflow and demand in sequent peak algorithm (SPA)
DLAM	transformation statistic for computing goodness of fit for the transformation used
DMAX	maximum cumulative departure from the mean for range computation
DMIN	minimum cumulative departure from the mean for range computation
DUM(1,1)	temporary array for disaggregation parameter estimation
DUMC(12,12)	temporary array in disaggregation parameter estimation
DUM2(1,12)	temporary array for disaggregation parameter estimation
DUM3(12,12)	temporary array for disaggregation parameter estimation
DUMZ(12,12)	temporary array in disaggregation parameter estimation
DZX	maximum monthly negative run sum
EFF	efficiency of the irrigation canal system
EJZ	average monthly negative run lengths
EM	median
ESZ	average monthly negative run sums
ETA(N,12)	N actual irrigation diversions determined by diversion schedule

Table B.5. Continued.

Name	Description
ETP(12)	potential monthly evapotranspiration computed from Blaney-Criddle equation
H	Hurst coefficient
HY1(12)	historic monthly lag-one serial correlations
HYX(12,1)	historic untransformed annual-monthly correlations
HYY(12,12)	historic untransformed monthly cross-correlations
HYZ(12,12)	historic untransformed monthly-previous months correlations
ICYR	option for solution technique for BB^T matrix
IDF	option to read different input format
IDIS	option to write out transformed data
IHO	option historic statistics computations only
INV	option to inverse transform
IREAD	option to read time series from cards or files
ISTART	Option to change starting year of time series
ISTAT	option to write out statistics computed
IVS	option for type of disaggregation model to build
IWR	option to write out certain computation steps
IS13	optional new starting year
IY	beginning month or season counter
IYEAR	year of each annual streamflow
IZ	beginning previous season counter
JZN	minimum monthly negative run length
JZX	maximum monthly negative run length
MONANN	option to only aggregate from months to years

Table B.5. Continued.

Name	Description
MX	ending counter for annual or higher level dis- aggregation
MY	ending month or season counter
N	number of years of streamflows in time series
NCL	number of crossing levels
NDY	monthly or seasonal dimension
NDZ	dimension for previous season array
NOT	option for no transform
NSEA	number of seasons for aggregation routine
NTR	number of transformations
NX	average number of monthly downcrossings
NY	ending counter for months
NZ	ending counter for previous sesons
PC(5)	monthly percent of the annual solar radiation for the growing season for the Blaney-Criddle equation
PEAK	maximum DEV for SPA
PR(5)	average monthly precipitation for growing season
PRICE	crop price per unit quantity in dollars
Q(N,12)	N monthly streamflow values inputed to the program
QA(N,1)	N aggregated annual streamflows
QB(N,1)	N annual streamflows with the mean subtracted from
QQ(N,4)	N aggregated quarterly streamflows
QS(N,2)	N aggregated semiannual streamflows
R	range of cumulative departures from the mean

Table B.5. Continued.

Name	Description
R(12,12)	eigen vectors for BB^T matrix
RLRSX	monthly run length for the maximum negative monthly run sum
RM	ratio of actual to potential evapotranspiration during the maturation stage
RP	ratio of actual to potential evapotranspiration during the pollination stage
RSRLX	monthly run sum for the maximum negative monthly run length
RV	ratio of actual to potential evapotranspiration during vegetative crop stage
S	skew
S(12,1)	temporary array in disaggregation parameter estimation
SAM(12)	monthly mean streamflows
SBEN	standard deviation of annual crop benefits
SD	standard deviation
SDX(1)	lag zero annual standard deviation
SDX1(1)	transformed lag-zero annual standard deviation
SDX2	transformed lag-one annual standard deviation
SDX2(1)	lag-one annual standard deviation
SDY(12)	transformed monthly standard deviations
SDY1(12)	transformed lag zero monthly standard deviations
SDY2(12)	transformed lag-one monthly standard deviations
SIZE	reservoir size from the sequent peak algorithm
SJZ	standard deviations of monthly run lengths
SS(12)	monthly streamflow skews

Table B.5. Continued.

Name	Description
SSD(12)	monthly streamflow standard deviations
SSZ	standard deviation of monthly negative run sums
SVM(12)	monthly streamflow variances
SXX(1,1)	annual lag-zero correlation
SXZ(1,12)	transpose of SZX(12,1)
SYACT	standard deviation of annual crop field
SYX(12,1)	monthly annual cross-correlation vector
SYZ(12,12)	monthly cross-correlation matrix
SYZ(12,12)	monthly-previous months cross-correlation matrix
SZN	minimum monthly negative run sum
SZX(12,1)	previous months-annual cross-correlation vector
SZZ(12,12)	previous year's months cross-correlation matrix
T(1,1)	temporary array for disaggregation parameter estimation
TAM(12)	monthly transformed mean streamflows
TAQ(4)	quarterly transformed mean streamflows
TAS(2)	semiannual transformed mean streamflows
TITLE(20)	title of the time series inputted to the program
TL	transformation exponent
TM(5)	average monthly temperatures for Blaney-Criddle consumptive use equation for the growing season
TOTB	total crop benefits
TOTY	total crop yield over period of record
TROUGH	minimum DEV for SPA
TSM(12)	monthly transformed standard deviations

Table B.5. Continued.

Name	Description
TSXY(12,12)	covariance matrix of seasonal values
V	variance
X(N,m)	streamflows to be aggregated, N by M
XBAR	mean annual streamflow
Y(N,NSEA)	aggregated streamflows, N by NSEA
YACT(N)	N annual crop yields
YAN	minimum annual crop yield
YAX	maximum annual crop yield
YPOT	potential crop yield with water not limiting
YQ(N,12)	N transformed monthly streamflows
YQA(n,1)	N transformed annual streamflows
YQQ(N,4)	N transformed quarterly streamflows
YQS(N,2)	N transformed semiannual streamflows
YQ1(N,12)	N transformed monthly streamflows
Z(12,1)	previous year's months used in disaggregation model

APPENDIX C

User Manual for Program to Calculate a_1
for Broken Line Model (IMP)

Table C.1. Description of input formats.

Data Segment	Card No. in data segment	Format	Symbol	Description
Program IMP	1	Free	NBRL	Number of Broken Lines in the Broken Line Model (i.e. 4, 5, 8)
	1	Free	B	Quality parameter (use 3)
	1	Free	HH	Hurst coefficient, K
	1	Free	RO3	Lag-one autocorrelation coefficient
	1	Free	A1	Initial estimate for the a_1 parameter pick a larger number than 1 and less than 5.

Table C.2. Sample input.

5, 3, 0.766, 0.491, 0.8

Table C.3. Sample output.

NBRL = 5, B = 3, HH = 0.766, RO3 = 0.491, A1 = 0.8

NCOUNT = 5, A1 = 1.151

Table C.4. Program listing.

```

HEAD(5,/)NBRL,B,HH,RO3,A1
WRITE(6,/)NBRL,B,HH,RO3,A1
ABCD=(HH*(2,HH=1,)*(2,HH=2,)*(2,HH=3,)*(2,HH=4,)*
*(2,HH=5,))/(6,*(2,*(3,=2,HH)=1,))
NSIG=1
N1=NBRL-2
NCCOUNT=0
10  CC=0,
   NCCOUNT=NCCOUNT+1
   DD=0,
   DO 30 I=1,N1
   AI=I-1
   A3=AI*B**AI
   DD=DD+B***(2,*(HH=1,)*AI)
   IF(A3.LT.0.5)GOTO 100
   IF(A3.LT.1)GOTO 20
   CC=CC+(1,=3,*(2,=1,/A3)/(4,=A3**2))*B***(2,*(HH=1,)*AI)
   GOTO 30
20  CC=CC+(2,=1,/A3)**3*B***(2,*(HH=1,)*AI)/4,
30  CONTINUE
   GGG=AI***(2,HH=2,)*ABCD*(B***(HH=1,)*B***(1,HH))/((2,*(HH=1,))
   DD1=DD
   DD=DD*GGG
   IF(NSIG.EQ.1)GOTO 40
   GOTO 50
40  A2=(RO3=GGG*(CC-DD1))/(GGG*DD1/AI***(2,HH=2,))
   A2=A2***(1,/(2,HH=2,))
   IF(A2.LT.0.5)GOTO 90
   GOTO 80
50  IF(A1.LT.1)GOTO 60
   DD=(1,=DD)*(1,=3,*(2,=1,/A1)/(4,=A1*A1))
   GOTO 70
60  DD=(1,=DD)*(2,=1,/A1)**3/4,
70  A2=SQRT((GGG*CC+DD=1,)*A1*A1/(RO3=1,))
80  ER=ABS(A1=A2)
   A1=A2
   IF(ER.GE.,01)GOTO 10
   GOTO 100
90  NSIG=0
   A1=1,
   GOTO 10
100 CONTINUE
   WRITE(6,/)NCCOUNT,A1
   STOP
   END

```

Table C.5. Definition of program variables.

Name	Description
A1	Interval parameter for Broken Line model
A2	Term in the parameter estimation routine
A3	parameter in estimation equation, function of B and A1
ABCD	a constant, function of the Hurst parameter
B	quality parameter for Broken Line model
CC	summation of the various elements in parameter estimation
DD	summation of various parameter estimation components
ER	difference between successive values for the estimate for A1
GGG	term in the parameter estimation routine
HH	Hurst coefficient input to estimate the parameter A1
NBRL	number of broken lines in the model
NCOUNT	counter for the number of iterations in the estimation routine
RO3	autocorrelation coefficient input to estimate the parameter A1