UNIVERSITY OF SOUTHERN CALIFORNIA

DEPARTMENT OF CIVIL ENGINEERING

PROGRAM EQRISK: A COMPUTER PROGRAM FOR FINDING UNIFORM RISK SPECTRA OF STRONG EARTHQUAKE GROUND MOTION

by

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PREFACE TO THE READERS

Program EQRISK has been written as a portion of the on-going effort at the University of Southern California to accurately describe the hazard posed by earthquakes. The complete effort includes many aspects of strong motion seismology: installation and maintenance of strong motion accelerographs to expand the present data base, processing of strong motion accelerograms, interpretation of strong ground motion to understand the earthquake mechanism, scaling of strong motion characteristics in terms of simplified parameters which describe the earthquake source, detailed studies on the distribution of seismic events, seismic risk analysis, interaction of seismic waves with man-made structures and natural topography, and earthquake resistant design.

Program EQRISK deals with the portion of our effort to estimate the seismic risk. It was written when we realized that the output of our effort to describe the scaling of strong ground motion in terms of earthquake source parameters allowed significant improvement in the state of the art of seismic risk analysis. This is accomplished by independent scaling of spectral amplitudes in several frequency bands, rather than scaling in terms of a single parameter (e.g., peak acceleration). McGuire (1974) had previously suggested this improvement, and with our development of the frequency dependent scaling relations, it became possible to implement the improved method.

The fundamental procedure for the seismic risk analysis has been described by Cornell (1968). Anderson and Trifunac (1977a, 1978) developed a number of improvements and generalizations, and the computer code EQRISK is based on their formulation. This formulation is equally adaptable to regions where the seismicity is based on magnitude or on Modified Mercalli Intensity statistics. Anderson (1978a) presents the details of the formulation when intensities must be used to describe the seismic activity rates.

The program requires certain "input," or data supplied by the user before computations can begin, and in the course of computations produces certain "output," or results. Part of the input, which describes the scaling of strong ground motion with earthquake source parameters, is provided as a part of this program package. The user must furnish a description of the seismicity, which is defined as a description of the geometry of seismic source zones and the occurrence rate of events of different sizes [magnitude (M) or epicentral Modified Mercalli Intensity (I_0)] within each source zone. A source zone is a fault or region with the property that when an earthquake occurs, the epicenter has an equal probability of occurring anyplace in the zone.

From the first cases which we ran (Anderson and Trifunac, 1977), it became evident that the output of this program is sensitive to the input seismicity. The program accepts the usual method of describing seismicity by a $\log N = a - bM$ or $\log N = a - b\ I_o$ relationship, where N is the occurrence rate of events with size M or I_o. The program also accepts a table of occurrence rates per year. Finally, it allows the seismicity to be input from a parameter which describes the slip rates on a fault, using the procedure suggested by Anderson (1978b). Before any single risk estimate output is accepted, for whatever method of input of the seismicity, a thorough sensitivity study should be undertaken to see how the risk depends on the entire range of possible seismicity models.

The output of this program is spectral amplitudes at eleven different periods which all have the same probability of being exceeded in strong earthquake shaking. These constitute an estimate for the uniform risk spectrum appropriate to the site.

It is worth reiterating the comments of Anderson and Trifunac (1978), that a uniform risk spectrum is a physically (probabilistically) well defined functional. A seismic risk analysis hopes to estimate this functional as accurately as possible, from information that is always less complete and less accurate than what is needed.

We hope that this computer code will be a useful tool for those who are faced with the problems of defining the seismic risk. We believe that it will be, allowing the user to concentrate on the definition of the seismicity, and eliminating considerable bother with the details of procedure in going from the seismicity estimate to the risk estimate.

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Introduction

Most of this report consists of a listing of the computer program EQRISK for computing uniform risk spectra (URS) of strong ground motion. As described by Anderson and Trifunac (1977a, 1978), URS are found by computing the probability functions independently in several frequency bands. From these functions, then, a complete spectrum may be found for which the probability of it being exceeded in the selected time interval is independent of frequency.

The computer listing contains a thorough description of the input parameters. This section follows that listing, and expands on the theory behind some of the options where needed, or describes which reference gives further details.

Explanation of Options: Input Part 1

MTY, MRS, MAL:

The correlation functions are described in the references in Table I. Additional references to these correlations are found in Trifunac (1977a,b) and Trifunac and Anderson (1978c). The attenuation functions of Modified Mercalli Intensity in the eastern and western United States are from Anderson (1978a). Basic procedures for use of the magnitude correlations are given in Anderson and Trifunac (1977a, 1978a), while these are expanded to the intensity correlations by Anderson (1978b).

ILTL:

The program generally assumes that the seismicity rates which are input are the mean rates of a Poisson distribution function. However, the program can also treat these rates as certain future events, as one may wish in

TABLE I

Spectrum	Units[1]	Earthquake Size Description	Site Condition Description	Reference
Fourier Spectrum (FS)	cm/sec	M	s[2]	Trifunac (1976)
FS	cm/sec	MMI	s	Trifunac (1978a)
FS	cm/sec	M,MMI	h[3]	Trifunac & Lee (1978)
Absolute Acceleration (SA)	g	M,MMI	s	Trifunac & Anderson (1977a)
Pseudo Relative Velocity (PSV)	cm/sec	M,MMI	s	Trifunac & Anderson (1978a)
PSV	cm/sec	M,MMI	h	Trifunac & Lee (1979)
Relative Velocity (SV)	cm/sec	M,MMI	s	Trifunac & Anderson (1978b)

[1] Units used in output of computer program. These may differ from units used by the reference.

[2] s Represents simplified geologic site characterization into s=0, 1 or 2 (Trifunac & Brady 1975)

[3] h Represents the depth of sedimentary deposits beneath the station

the case of an earthquake prediction. This procedure is described by Anderson and Trifunac (1977a), and controlled by parameter ILTL.

MRL:

Relationships between the magnitude and rupture length of an earthquake have proliferated rapidly in recent years, but is is not clear how reliable any of them are since there is a large scatter in the data. I often use the option MRL = 6, but do not pretend that it is better than any of the others. The program treats earthquakes occurring at a point source or in the diffuse zone (described in detail below) as having the rupture length according to the selected relationship and as being unilateral straight ruptures (epicenter is at one end of the rupture) with any direction equally probable.

IPPC:

After the seismic source regions are read into the computer and broken down to a set of small elements for integration, these elements are grouped according to distance. By various procedures which depend on the source region, each integration element is assigned an expected number of earthquakes at each magnitude or intensity in which faulting occurs in the element and is closest to the site. When these elements are grouped according to distance, the result is a table giving the expected number of earthquakes with each combination of distance and magnitude (or intensity) that may occur.

INPUT Part 2:

This section deals with the scaling laws for strong ground motion. References for these have been given in Table I. The user does not normally need to modify this section at all. If changes should ever be needed, the documentation within the program should be adequate.

Note, however, that since the program is organized for a time sharing computer with input from disk, it does not generally read all the data in this input section. Thus, some minor modification would be needed to run this program using cards for input.

Note also that all of these scaling laws are derived from data in California, which has primarily shallow focus events (<15 km) and fairly high attenuation. Thus, application outside of California always involves some extrapolation.

INPUT Part 3:

This section deals with the seismicity model. The model consists of point, line, diffuse, and dipping planar faults. Added sophistication could be implemented in the future, but for calculations which we have done to date the present setup is adequate. Each source zone requires (1) a description of the geometry of the zone, and (2) a description of the rate of earthquake occurrence within the zone.

The point source allows the epicenters to occur at only one spot, as described by input. When an extended rupture is used, one end of the earthquake occurs at the point, and the fault is allowed to propagate for one rupture length with all directions being equally probable. For the diffuse zone, the epicenter is assumed to occur anyplace within the region defined by the geometry of input. When extended ruptures are allowed, each elemental area of the diffuse zone is treated like a point source. Rupture is allowed to extend outside of the diffuse region.

For a dipping planar source, epicenters are allowed to occur anyplace on the plane, but extended rupture is not treated. The scaling relationships do not account for earthquakes with depth of focus greater than about 15 km, since they were developed from California data. As a result, the greater depth is handled in an arbitrary manner. The distance from the site to the hypocenter is used in place of the distance from the site to the epicenter or nearest point on the extended fault rupture.

Line sources automatically use extended ruptures (although the choice

MRL = 1 effectively makes that rupture length negligible for all events). In this case, since the geometrical relationships are simple, it is possible to eliminate any assumption about the rupture being either "unilateral," "bilateral," or otherwise. Rather, the program automatically considers all the ways that a rupture with length specified (by MRL and the magnitude) can be fit onto the fault.

The occurrence rates of earthquakes can be input in any of four ways. The first two (ISI = 1,2) apply when a relationship

$$N(M) = 10^{a-bM}, \quad \text{or}$$

$$N(I) = 10^{a-bI}$$

is known. In the first case (ISI = 1), N(M) [or N(I)] is treated as the number of earthquakes which occur with magnitude, M [or intensity, I] greater than or equal to M [or I]. The input includes the maximum size of earthquakes which may occur, as well as the numerical coefficients a,b. The second case (ISI = 2) uses the same relationships, but N(M) or N(I) is interpreted to give the number of earthquakes in the incremental range [M - 0.25, M + 0.24] or [I - 0.5, I + 0.49].

The option ISI = 3 for input of seismicity uses a procedure suggested by Anderson (1978c). This procedure finds an occurrence rate of earthquakes which is consistent with the geological slip rate on the fault. As for the two previous methods, the user is required to specify the b-value and the maximum magnitude. In addition, the user specifies $\dot{M}_o$, the geological average rate at which seismic moment is accumulated and released. $\dot{M}_o$ is easily found from the slip rate s by

$$\dot{M}_o = \mu A s \quad .$$

A is the cross-sectional area of the fault; in California, a reasonable procedure to find it is to multiply the length of the fault by 15 km width. The term μ is the shear modulus of the region; in California, it is reasonable to assign $\mu = 3 \times 10^{11}$ dyne/cm^2. $\dot{M}_o$ should have units of dyne-cm/yr. For example, if the Garlock Fault (length 255 km) is assumed to have a slip rate of 8 mm/year, $\dot{M}_o = 9.2 \times 10^{24}$ dyne-cm/year. This information is input by setting AZTM = 9.2 and AZTP = 24.0. The minimum magnitude is used to avoid calculations based on smaller earthquakes, but does not affect the rate of larger events.

The final procedure (ISI = 4) for seismicity input is to input the rates directly. This can be used for checking, or when rates are desired which differ from the exponential relationship of other options.

The program is written assuming input is from disk data files, and the OPEN statements are appropriate for a PDP system. The internal documentation is extensive, and thus understanding the program or modifying it to other computers does not require more detailed explanations here.

Following the listing of the program is a listing of the file SPEC.DAT which contains the numerical constants for the scaling relationships (Input Part 2). These are followed by a sample input and output.

Listing of the Computer Program EQRISK
and all of its Subroutines

```
C
C         PROGRAM EQRISK
C
C         THIS PROGRAM IS TO DETERMINE THE RISK AT AN ARBITRARY POINT.
C         THE METHOD IS ONE DEVELOPED BY J.G.ANDERSON AND M.D.TRIFUNAC
C
C****************************************************************
C        REVISION HISTORY
C        DATE              CHANGE
C        AUG. 01,1978      VERSION PUBLISHED IN REPORT C.E.78-11.
C*****EQRISK*****************************************************
C
      DIMENSION WS(12)
C        WS    IS THE TOTAL SEISMICITY OF A REGION, BEFORE IT IS DIVIDED
C              AMONG SEVERAL POINTS IN THE ARRAY  SA.
C              WS  IS THE NUMBER OF EARTHQUAKES EXPECTED TO OCCUR
C              IN THE REGION IN THE TIME PERIOD OF INTEREST.
      DIMENSION NSITE(20),NSATE(9),NSBTE(20)
C        NSITE    IS THE NAME OF THE POINT WHERE RISK IS CALCULATED.
C              THIS POINT HAS LATITUDE  SLAT  AND LONGITUDE  SLONG
C              NORTH LONGITUDE AND WEST LATITUDE IS TREATED AS
C              POSATIVE
      DIMENSION XL(100),YL(100),XR(100)
C        XL,YL   IS A SEQUENCE OF LONGITUDES AND LATITUDES ON A FAULT.
C        CONNECTING THEM IN ORDER WILL GIVE A GOOD APPROXIMATION TO THE
C        TRACE OF THE FAULT.
C        FOR A DIFFUSE SOURCE, YL IS A LATITUDE THROUGH THE SOURCE
C        REGION.  XL AND XR ARE THE LONGITUDES WHERE YL INTERSECTS THE
C        LEFT (WEST) AND RIGHT (EAST) BOUNDARIES OF THE REGION.
      DIMENSION PDPL(7)
C        PDPL GIVES INFORMATION TO CHARACTERIZE A DIPPING PLANAR SOURCE.
C        THE SEVEN MEMBERS ARE (X1,Y1),(X2,Y2),(X3,Y3,H).  THESE POINTS
C        DETERMINE THE PLANE.   (X1,Y1) AND (X2,Y2) ARE ON THE SURFACE
C        TRACE.   (X3,Y3,H) GIVES THE DEPTH OF ONE POINT.
C        (XI,YI) ARE INPUT AS (LONGITUDE,LATITUDE) AND
C        LATER CONVERTED TO KILOMETERS.
      DIMENSION RC(10),AC(10)
C        RC,AC  GIVE A SERIES OF DISTANCE-AREA CRITERIA FOR INTEGRATION
C        OVER THE REGIONS OF DIFFUSE SEISMIC ACTIVITY.   SPECIFICALLY,
C        IF PART OF A RECTANGULAR ELEMENT OF INTEGRATION IS AT DISTANCE
C        LESS THAN RC FROM THE CENTRAL POINT. THE AREA OF THAT ELEMENT
C        MUST BE LESS THAN AC.
      DIMENSION SL(100),PL(100),EL(100),PS(11,100),ES(11,100)
      DIMENSION PLD(100),PP(11,100)
C        SL IS A TRIAL SPECTRAL LEVEL
C        PL  IS THE PROBABILITY THAT  SL WILL NOT BE EXCEEDED
C        EL  IS THE EXPECTED NUMBER OF TIMES THAT SL WILL BE EXCEEDED.
C        PS,ES  JUST STORE PL,EL
C       PP STORES THE POISSON PROBABILITY OF EXCEEDANCE.
      DIMENSION A(11),B(11),C(11),D(11),E(11),F(11),G(11),PER(11)
      DIMENSION AMN(11) SDEV(11),ALP(11),BET(11),NXPN(11)
C        A TO G  ARE THE PARAMETERS  MDT HAS DERIVED.  THEY ARE FOR THE
C        PERIODS GIVEN IN PER.   AMN AND SDEV GIVE THE PROBABILITY OF A
C        SPECTRAL LEVEL RELATIVE TO THE LINEAR PROBABILITY GIVEN BY MDT.
      DIMENSION PE(24)
C        THESE ARE UP TO TWENTY-FOUR PROBABILITIES OF EXCEEDANCE
C        FOR CALCULATING SPECTRA FROM THE
C        AMPLITUDE - PROBABILITY CURVE.
      DIMENSION SPL(11)
C        SPL  IS A UNIFORM RISK  SPECTRAL AMPLITUDE.
      COMMON/AMPLT/ALAR(200)
C        ALAR  IS THE DISTANCE CORRECTION FACTOR ADDED TO LOG(AMPLITUDE)
C        TO OBTAIN MAGNITUDE.   IT GIVES THE FALLOFF OF AMPLITUDE WITH
C        DISTANCE.    RATHER THAN REPEATEDLY CALCULATE IT (OLD METHOD)
C        IT IS CALCULATED JUST ONCE AND STORED.
      COMMON/WP/PT,AA,BB,CC,DD,EE,FF,GG,AU,SD,ALPH,BETA,NEXP,AMIN,AMAX
      COMMON/SITE/SLONG,SLAT,HIS,IV
      COMMON/B1/ NXO,XO(100),YO(100)
C        XO, YO GOVE THE AMPLITUDE - DISTANCE CURVE FOR A REGION.
      COMMON/SEISM/NA,SA(1000,12),RA(1000)
C        SA    IS THE SEISMICITY AT POINT  I   , AT 12 MAGNITUDE LEVELS
C        RA    IS THE DISTANCE FROM POINT  I  TO THE POINT WHERE RISK IS
C                DETERMINED.
C        NA    IS THE LENGTH OF THE ARRAYS  SA, RA.
      COMMON/CSEIS/NRC,RX(200),PC(200,12),EC(200,12),IFC(200)
C        FOR A DESCRIPTION OF THIS BLOCK /CSEIS/, SEE SRT. COMPR
      COMMON/RINGS/ NRB,RB(200)
C        FOR A DESCRIPTION OF THIS BLOCK /RINGS/  SEE SRT. CSEIS
      COMMON/MAGS/AM(12),ML,MX
      COMMON/MMPRM/RMU(12),RSIG(12),PKS(200,12)
C       RMU,RSIG ARE THE MEAN AND STANDARD DEVIATION FOR
C       LOCATION (LOG R) OF ISOSEISMAL LINE I1.  RMU(J) APPLIES
C       TO J=IO-I1+1.
C       IT WOULD BE MORE APPROPRIATE TO READ IN RMU(IO,I1)
C       AND RSIG(IO,I1), BUT THE DATA ARE NOT GOOD ENOUGH
C       TO DEFINE THESE PARAMETERS.
C       PKS(200,12) GIVES PROBABILITIES  FOR EACH OF
C       THE DISTANCES IN CSEIS AND THE 12 ISOSEISMAL DIFFERENCES.
C
      COMMON/IONUM/MIS,MIN,MOUT,MPUN,LSSUP,YRS
C       THIS BLOCK CONTAINS THOSE CONTROL PARAMETERS WHICH MAY BE
C       NEEDED BY SUBROUTINES.
C       MIS,MIN,MOUT,MPUN ARE INPUT*2,OUTPUT,AND PUNCH UNITS.
C       LSSUP IS OCCASIONALLY USED TO SUPPRESS OUTPUT FROM SUBROUTINES.
C
  901 FORMAT ('1THE FREQUENCY DEPENDENT SEISMIC RISK')
  902 FORMAT(/,5X,'THIS PROGRAM USES A METHOD DEVELOPED BY J.G.ANDERSON
     1 AND M.D.TRIFUNAC')
  903 FORMAT(/,5X,'THE RISK IS FOUND FOR THE SITE',/,5X,20A2,
     1   5X,'SITE NO.',I5,/,
     2 F15.5,'  DEG WEST LONGITUDE',/,F15.5,'  DEG NORTH LATITUDE')
  904 FORMAT(2F10.5,I5,F5.0,2I5,20A2)
  905 FORMAT(4I5,10X,I10)
  906 FORMAT(/,5X,'THE SEISMICITY IS REGARDED AS A SUPERPOSITION OF',/,
     1   I10,'  POINT SOURCES',/,I10,'  LINE SOURCES (FAULTS)',/,
     2  I10,'  REGIONS OF DIFFUSE SEISMICITY',
     3  /,I10,'  DIPPING PLANES')
  907 FORMAT (//,5X,'THE DISTANCE AND SEISMICITY ARRAYS FOLLOW')
  908 FORMAT (I5,F8.1,12F8.4)
  910 FORMAT(I1,F9.1,7F10.1)
  911 FORMAT(I5,9A1,11F6.3)
  912 FORMAT(10F8.3)
  913 FORMAT(I5,10A2)
  914 FORMAT(5X,'AMPLITUDE - DISTANCE CURVE FOR ',10A2,' GIVEN AT',
     1  I5,   '  POINTS')
  915 FORMAT(5(F8.1,F7.3))
  916 FORMAT(/.5X,'PROBABILITIES FOR LOG(PER) = ',F9.3,'  IV = ',I3,'  I
     1S = ',I3,/,5X,'LOG(SPECTRAL VALUE),PROBABILITY, AND EXPECTED NUMBE
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    2R OF OCCURENCES')
 917 FORMAT(3(F12.3,F9.5,F12.5))
 918 FORMAT(/,5X,'LOG PERIOD AND LOG SPECTRUM FOR',F10.5,'  PROBABILITY
    1 OF EXCEEDANCE',/,11F8.3)
 919 FORMAT(//,5X,'ML,MX',2I5)
 920 FORMAT(//,5X,'FOLLOWING SPECTRA ASSUME NUMBER OF EARTHQUAKES EXACT
    1LY AS INPUT')
 921 FORMAT(//,5X,'FOLLOWING SPECTRA ASSUME EARTHQUAKES ARE POISSON, WI
    1TH MEAN AS INPUT')
 922 FORMAT(4A1,I3,I4,I2,1X,11F6.3)
 923 FORMAT('          MODEL OF SEISMICITY NO. (MOSN)...',I5,5X,20A2)
 924 FORMAT(//,5X,'MOSN=',I5,5X,'SITE NO.=',I5,5X,'SPECTRUM NO.',I5)
 925 FORMAT('1   LITERAL PROBABILITY OF EXCEEDANCE --- IV =',I3,'   HIS
    1 =',F6.3,/)
 926 FORMAT('1   LOG10(EXPECTED NUMBER OF EXCEEDANCES) --- IV =',I3,
    1  '       HIS =', F6.3,/)
 927 FORMAT(' LOG(SL)',40X,'LOG(PER)')
 928 FORMAT(10X,11F9.5)
 929 FORMAT(F8.2,2X,11F9.5)
 930 FORMAT(I5,9A1,11I6)
 931 FORMAT(11F8.4)
 932 FORMAT(5X,'IV = ',I5,/ ,4X,'HIS = ',F6.3)
 933 FORMAT(5X,'RISK FOUND FOR',I5,'    PROBABILITIES OF EXCEEDANCE
    1 --',6(/,5F10.5))
 934 FORMAT(16F5.4)
 935 FORMAT('   INTENSITY ATTENUATION MODEL FOR ',10A2,/,
    1    5X,'I0-I1',6X,'MEAN',4X,'ST DEV')
 936 FORMAT(I10,2F10.3)
 937 FORMAT(/,5X,'CALCULATIONS ARE BASED ON INTENSITY STATISTICS')
 938 FORMAT(8F10.3)
 939 FORMAT(16I5)
 940 FORMAT(I8,' = TOO MANY PROBABILITIES - ERROR EXIT')
 941 FORMAT('   ATTENUATION MODEL PARAMETERS NOT FOUND FOR
    1    MTY,MRS,MAL =',3I5,/,'   ERROR EXIT')
 942 FORMAT(1X)
 943 FORMAT(' DEBUG - LOCATION NUMBER ',I5)
 944 FORMAT(12I2,F6.2)
 945 FORMAT('1    PROB. DENSITY FUNCTION FOR LOG(T) =',F9.5)
 946 FORMAT(1H1,5X,'THE FOLLOWING SOURCES TREATED AS POISSON')
 947 FORMAT(1H1,5X,'THE FOLLOWING SOURCES TREATED AS LITERAL')
 948 FORMAT('1    POISSON PROBABILITY OF EXCEEDANCE --- IV=',
    1    I3,'     HIS=',F6.3)
 949 FORMAT(//,5X,'FOLLOWING SPECTRA USE BOTH LITERAL AND ',
    1    'POISSON EARTHQUAKES')
 950 FORMAT(/,5X,'CONTROL PARAMETERS',/,'    MTY   MRS   MAL',
    1    '  ILTL  IPPL IMRAC   MRL  IPPC LSSUP  IDL1  IDL2  IDL3')
 951 FORMAT (12I6)
 952 FORMAT(5X,'SEE PROGRAM LISTING FOR EXPLANATION',/)
 953 FORMAT(1H1,5X,'THE FOLLOWING SOURCES TREATED AS BOTH ',
    1    'POISSON AND LITERAL')
 954 FORMAT(5X,'YRS =',F10.3,/,5X,'INPUT SEISMICITY RATES ARE ',
    1    'MULTIPLIED BY YRS FOR RISK CALCULATIONS',/)
C
C
C        INITIALIZATIONS
      MIS=4
      MIN=5
      MOUT=6
      MPUN=7
      OPEN(UNIT=MOUT,FILE='FSOUT.DAT',ACCESS='SEQOUT',
     1    DEVICE='DSK',DIRECTORY='3000,560')
      OPEN(UNIT=MPUN,FILE='FSPUN.DAT',ACCESS='SEQOUT',
     1    DEVICE='DSK',DIRECTORY='3000,560')
      ALTEN=ALOG(10.0)
      NA=0
      ML=12
      MX=1
      WRITE(MOUT,901)
      WRITE(MOUT,902)
C
C
C     INPUT   PART 1          MODEL IDENTIFICATION, SITE PARAMETERS
C
C     CARD 1  944(12I2,F6.2) MTY,MRS,MAL,ILTL,IPPL,IMRAC,MRL,IPPC,
C     ******                 LSSUP,IDL1,IDL2,IDL3,YRS
C        MTY = 0       TERMINATE PROGRAM
C              1       FOURIER SPECTRUM; SEISMICITY MODEL USES
C                      MAGNITUDE STATISTICS, S=0,1,2 SITE CONDITIONS
C              2       ALL RESPONSE SPECTRA; SEISMICITY MODEL USES
C                      MAGNITUDE STATISTICS; S=0,1,2 SITE CONDITIONS
C              3       FOURIER SPECTRUM; SEISMICITY MODEL USES
C                      INTENSITY STATISTICS; S=0,1,2 SITE CONDITIONS
C              4       ALL RESPONSE SPECTRA; SEISMICITY MODEL USES
C                      INTENSITY STATISTICS; S=0,1,2 SITE CONDITIONS
C              5       FOURIER SPECTRUM; MAGNITUDE STATISTICS;
C                      SITE CONDITION IS DEPTH TO BASEMENT H
C              6       RESPONSE SPECTRUM,PSV ONLY; MAGNITUDE STATISTICS
C                      SITE CONDITION IS DEPTH TO BASEMENT H
C              7       FOURIER SPECTRUM; INTENSITY STATISTICS;
C                      SITE CONDITION IS DEPTH TO BASEMENT H
C              8       RESPONSE SPECTRUM,PSV ONLY; INTENSITY STATISTICS
C                      SITE CONDITION IS DEPTH TO BASEMENT H.
C        MRS = 0  FOURIER SPECTRUM
C              1  SA   0 PERCENT DAMPING
C              2  SA   2 PERCENT
C              3  SA   5 PERCENT
C              4  SA  10 PERCENT
C              5  SA  20 PERCENT
C              6  PSV  0 PERCENT
C              7  PSV  2 PERCENT
C              8  PSV  5 PERCENT
C              9  PSV 10 PERCENT
C             10  PSV 20 PERCENT
C             11  SV   0 PERCENT
C             12  SV   2 PERCENT
C             13  SV   5 PERCENT
C             14  SV  10 PERCENT
C             15  SV  20 PERCENT
C       MAL - IDENTIFIES THE ATTENUATION LAW
C              FOR MTY=1,2
C              MAL=1   RICHTER CURVE FOR SO. CALIFORNIA (ONLY OPTION)
C              FOR MTY=3,4
C              MAL=1   ANDERSON PARAMETERS FOR WEST USA INTENSITY DECAY
C                  2   ANDERSON PARAMETERS FOR EAST USA INTENSITY DECAY
C       ILTL =  0  SUPPRESSES ALL 'LITERAL' CALCULATIONS.
C               1  INCLUDES BOTH 'LITERAL' AND 'POISSON' OUTPUT
C               2  SOME SOURCES ARE 'LITERAL', OTHERS ARE 'POISSON'
C                       IN THIS CASE, THE ENTIRE PART 3 OF THE INPUT
C                       IS REPEATED TWICE.  THE FIRST TIME THROUGH,
C                       IT READS THE POISSON SOURCES.  THE SECOND
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C                    TIME IT READS THE LITERAL SOURCES.  COMPUTE
C                    TIME MAY BE DOUBLED.
C      IPPL =  0  NORMAL VALUE
C             -1  PRODUCES PRINTER PLOT OF DERIVATIVE OF P(S(T))
C                    AT ALL PERIODS CALCULATED IN THE SPECTRUM
C            1-11  PRODUCES PRINTER PLOT OF DERIVATIVE OF P(S(T))
C                    AT THE PERIOD 1-11 CORRESPONDING TO INPUT.
C      IMRAC = 0  NORMAL VALUE
C              1  READS ADDITIONAL CARD TO MODIFY DEFAULT DISTANCE-
C                    AREA CRITERIA FOR DIFFUSE SEISMICITY ZONES.
C      MRL   =  0 OR 1  DIFFUSE SOURCES ARE TREATED AS POINT SOURCES.
C              2-10  MAGNITUDE - RUPTURE LENGTH RELATION AS FOLLOWS
C                    FLNG= 10**(A*M-B)
C              MRL     A       B        SOURCE
C              1       0.0     0.4
C              2       0.6     2.7      APPROX. PRESS
C              3       0.67    2.23     THATCHER & HANKS 1.7 BARS
C              4       0.67    1.41     THATCHER & HANKS 0.1 BARS
C              5       0.67    3.41     THATCHER & HANKS 100 BARS
C              6       0.53    1.47     WYSS & BRUNE
C              7       1.02    5.77     TOCHER
C              8       1.32    7.99     OKAMOTO
C              9       0.395   1.454    HOUSNER  M.LT.6.4
C                      0.900   4.673    HOUSNER M.GE.6.4
C              10      1.596   7.56     DER-KIUREGHIAN
C                                       USES EXP(.),NOT 10**(.)
C      IPPC =  0  NORMAL VALUE
C              1  PRINTS FINAL DISTANCE AND SEISMICITY ARRAY.  THIS
C                   CAN BE HELPFUL IN LEARNING THE SOURCE DISTRIBUTION,
C                   AND THUS IN UNDERSTANDING THE RESULTS.
C      LSSUP = 0  NORMAL VALUE
C              1  SUPPRESSES LISTING OF SEISMICITY MODEL.
C      IDL1  = STTARTING PERIOD NUMBER FOR DO LOOPS OVER PERIODS
C                DEFAULT IDL1=1.
C      IDL2  = ENDING PERIOD NUMBER FOR DO LOOPS OVER PERIODS
C                DEFAULT IDL2=11.
C      IDL3  = SKIP PARAMETER FOR DO LOOPS OVER PERIODS.
C                DEFAULT IDL3=1.
C              BY DEFAULT, THE PROGRAM FINDS SPECTRA AT 11 PERIODS.
C              IF THESE ARE NOT ALL NEEDED, THEN IDL1,IDL2,IDL3 ALLOW
C              A FLEXIBLE WAY TO SELECT JUST THOSE THAT ARE NEEDED.
C      YRS   = MULTIPLICATION FACTOR FOR SEISMICITY - DEFAULT = 1.0
C
C
C   CARD 2 904(2F10.5,I5,F5.0,2I5,20A2) SLONG,SLAT,IV,HIS,NPEX,NUST,
C   ******                                (NSITE(20))
C     SLONG = WEST LONGITUDE OF SITE
C     SLAT  = NORTH LATITUDE OF SITE
C     IV    = 0 HORIZONTAL
C             1 VERTICAL
C     HIS   = 0 SOFT,ALLUVIAL SITE, FOR MTY=1,2,3,4
C             1 INTERMIDIATE SITE, FOR MTY=1,2,3,4
C             2 HARD SITE, FFOR MTY=1,2,3,4
C           = DEPTH TO GEOLOGIC BASEMENT (KM.) FOR MTY=5,6,7,8
C     NPEX  = NUMBER OF PROBABILITIES OF EXCEEDANCE FOR WHICH SPECTRA
C             WILL BE CALCULATED (LIMIT 24)
C     NUST  = SITE NUMBER
C     NSITE = ALPHANUMERIC SITE NAME
C   CARD 3 938(8F10.3) (PE(I),I=1,NPEX)
C   ******
C      PE(I) = EXCEEDANCE PROBABILITIES FOR THE SPECTRA.  USE ONLY AS
C                MANY CARDS AS NEEDED.
C   CARD 4 (WHEN IMRAC=1) CONTROLS THE INTEGRATION OF DIFFUSE SOURCES.
C   ******
C   CARD 4  910(I1,F9.1,7F10.1)  NC,(RC(I),AC(I),I=1,NC)
C      NC = 1 TO 4
C      RC, AC ... NC PAIRS OF DISTANCE - AREA CRITERIA.  MUST HAVE
C              RC(I) LESS THAN RC(I-1) AND AC(I) LT AC(I-1).
C              WITH A DIFFUSE SOURCE, NONE OF THE ELEMENTS OF
C              AREA WITH A DISTANCE LESS THAN RC(I) FROM THE SITE
C              WILL HAVE AN AREA GREATER THAN AC(I) IN THE
C              INTEGRATION.
C              THIS CARD IS READ ONLY WHEN IMRAC=1.
C              OTHERWISE, REASONABLE DEFAULT VALUES ARE ASSIGNED.
C
      OPEN(UNIT=MIS,FILE='SITES.DAT',ACCESS='SEQIN',
     1   DEVICE='DSK',DIRECTORY='3000,560')
  701 READ(MIS,944) MTY,MRS,MAL,ILTL,IPPL,IMRAC,MRL,IPPC
     1   ,LSSUP,IDL1,IDL2,IDL3,YRS
      WRITE(MOUT,950)
      WRITE(MOUT,951) MTY,MRS,MAL,ILTL,IPPL,IMRAC,MRL,IPPC,
     1   LSSUP,IDL1,IDL2,IDL3
      WRITE(MOUT,952)
      IF(IDL1.LE.0) IDL1=1
      IF(IDL2.LE.0) IDL2=11
      IF(IDL3.LE.0) IDL3=1
      IF(YRS.LE.0.0) YRS=1.0
      IF(MTY.LE.0) GO TO 999
      IF(MRL.EQ.0) MRL=1
      READ(MIS,904) SLONG,SLAT,IV,HIS,NPEX,NUST,(NSBTE(I),I=1,20)
      IF(NPEX.GT.24)WRITE(MOUT,940) NPEX
      IF(NPEX.GT.24) GO TO 999
      READ(MIS,938) (PE(I),I=1,NPEX)
      IF(IMRAC.EQ.1) READ(MIS,910)NC,(RC(I),AC(I),I=1,NC)
      WRITE(MOUT,954) YRS
C
C
C
C       INPUT    PART 2            MODEL PARAMETERS
C
C     THE REGRESSION PARAMETERS FOR ALL THE SCALING RELATIONS
C     ARE STORED IN THE DATA BLOCK 'SPEC.DAT'.  THE INPUT
C     PARAMETERS 'MTY,MRS,MAL' TELL THE PROGRAM WHICH PARTS
C     OF THIS BLOCK TO READ.
C
C     THE USER DOES NOT NORMALLY NEED TO DO ANYTHING WITH THIS
C     DATA BLOCK, EXCEPT TO MAKE IS AVAILABLE TO THE COMPUTER.
C     BUT ITS ORGANIZATION IS LISTED BELOW.
C
C     ATTENUATION CURVES
C             RICHTER DATA FOR CALIFORNIA (SMOOTHED BY MDT)
C             ANDERSON PARAMETERS FOR WESTERN U.S.
C             ANDERSON PARAMETERS FOR EASTERN U.S.
C     SCALING PARAMETERS
C             FOURIER SPECTRUM FROM M,R,S
C             RESPONSE SPECTRUM FROM M,R,S (15 CHOICES)
C             FOURIER SPECTRUM FROM I,S
C             RESPONSE SPECTRUM FROM I,S (15 CHOICES)
C             FOURIER SPECTRUM FROM M,R,H
C             RESPONSE SPECTRUM FROM M,R,H (5 CHOICES)
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C              FOURIER SPECTRUM FROM I,H
C              RESPONSE SPECTRUM FROM I,H (5 CHOICES)
C
C      COMMENTS FOLLOW ON SPECIFIC PARTS.
C  RICHTER    AMPLITUDE - DISTANCE CURVE.
C   CARD 1  913(I5,10A2)   NXO,NAME(10)
C      NXO = NUMBER OF DISTANCES WHERE AMPLITUDE IS DESIGNATED.
C      NAME(10)  IDENTIFICATION OF AMPLITUDE - DISTANCE CURVE.
C   CARDS 2  912(10F8.3)    (XO(I),YO(I),I=1,NXO)
C      XO(I) = RADIAL DISTANCE FROM EPICENTER.
C      YO(I) = LOG(AMPLITUDE) AT XO(I).
C        THIS CAN BE REPLACED BY CURVES FOR OTHER REGIONS.
C        YO SHOULD BE NORMALIZED LIKE THE LOCAL MAGNITUDE - ATTENUATION
C        CURVE FOR CALIFORNIA.   AT XO=0.0, YO=-1.4
C  SCALING PARAMETERS
C             911(I5,9A1,11F6.3)  NX,ID,X(11)
C     A BLOCK OF RELATED CARDS, ALL ON THE SAME FORMAT.
C      NX = NUMBER OF POINTS IN ARRAY X.   SAME ON ALL CARDS.
C      ID  IDENTIFICATION OF ARRAY..     FOR USER CHECKING.
C      X   ONE OF TEN ARRAYS.
C        PER - LOG(PERIODS) WHOSE SPECTRUM IS CALCULATED.
C        A,B,C,D,E,F,G   SEE PAPER BY TRIFUNAC ' PRELIMINARY EMPIRICAL
C        MODEL FOR SCALING FOURIER AMPLITUDE SPECTRA ...'
C        AMN,SDEV  MEAN AND STANDARD DEVIATION OF GAUSSIAN CURVE FIT TO
C        FIG. 11 OF ABOVE PAPER.
C
      OPEN(UNIT=MIN,FILE='SPEC.DAT',ACCESS='SEQIN',
     1   DEVICE='DSK',DIRECTORY='3000,571')
C
C       PART 2, BLOCK 1
C
      MTYA=MTY
      IF(MTYA.GT.4) MTYA=MTYA-4
      GO TO (610,610,620,620), MTYA
  605 WRITE(MOUT,941) MTY,MRS,MAL
      GO TO 999
  610 READ(MIN,939) MTYM,MRSM,MALM,NCDS
      READ(MIN,913) NXO,(NSITE(I),I=1,10)
      READ(MIN,912) (XO(I),YO(I),I=1,NXO)
      WRITE(MOUT,914) (NSITE(I),I=1,10), NXO
      WRITE(MOUT,915) (XO(I),YO(I),I=1,NXO)
      DO 612 J=1,2
      READ(MIN,939) MTYM,MRSM,MALM,NCDS
      DO 611 I=1,NCDS
  611 READ(MIN,942)
  612 CONTINUE
      GO TO 635
  620 READ(MIN,939)MTYM,MRSM,MALM,NCDS
      DO 621 I=1,NCDS
  621 READ(MIN,942)
      DO 630 IJ=1,2
      READ(MIN,939)MTYM,MRSM,MALM,NCDS
      IF(MALM.EQ.MAL)GO TO 625
      DO 622 II=1,NCDS
  622 READ(MIN,942)
      GO TO 630
  625 READ(MIN,913)NXO,(NSITE(I),I=1,9)
      READ(MIN,934)(RMU(I),I=1,NXO)
      READ(MIN,934)(RSIG(I),I=1,NXO)
      WRITE(MOUT,935)(NSITE(I),I=1,10)
      DO 627 I=1,NXO
      J=I-1
  627 WRITE(MOUT,936)J,RMU(I),RSIG(I)
  630 CONTINUE
C
C       PART 2, BLOCK 2
C
  635 DO 699 J=1,44
C       THE USER HAS A CHOICE OF 44 SCALING RELATIONS,
C       DEPENDING ON THE APPLICATION AND THE SEISMICITY
C       MODEL.
      READ(MIN,939)MTYM,MRSM,MALM,NCDS
      IF(MTYM.NE.MTY)GO TO 640
      IF(MRSM.NE.MRS)GO TO 640
      GO TO 650
  640 DO 641 I=1,NCDS
  641 READ(MIN,942)
      GO TO 699
  650 READ(MIN,911) NPER,(NSITE(I),I=1,9),( PER(I),I=1,NPER)
      WRITE(MOUT,911) NPER,(NSITE(I),I=1,9),( PER(I),I=1,NPER)
      READ(MIN,911) NWX ,(NSATE(I),I=1,9),(   A(I),I=1,NPER)
      WRITE(MOUT,911) NWX ,(NSATE(I),I=1,9),(   A(I),I=1,NPER)
      READ(MIN,911) NWX ,(NSITE(I),I=1,9),(   B(I),I=1,NPER)
      WRITE(MOUT,911) NWX ,(NSITE(I),I=1,9),(   B(I),I=1,NPER)
      READ(MIN,911) NWX ,(NSITE(I),I=1,9),(   C(I),I=1,NPER)
      WRITE(MOUT,911) NWX ,(NSITE(I),I=1,9),(   C(I),I=1,NPER)
      READ(MIN,911) NWX ,(NSITE(I),I=1,9),(   D(I),I=1,NPER)
      WRITE(MOUT,911) NWX ,(NSITE(I),I=1,9),(   D(I),I=1,NPER)
      READ(MIN,911) NWX ,(NSITE(I),I=1,9),(   E(I),I=1,NPER)
      WRITE(MOUT,911) NWX ,(NSITE(I),I=1,9),(   E(I),I=1,NPER)
      IF(MTYA.EQ.3)GO TO 660
      IF(MTYA.EQ.4)GO TO 660
      READ(MIN,911) NWX ,(NSITE(I),I=1,9),(   F(I),I=1,NPER)
      WRITE(MOUT,911) NWX ,(NSITE(I),I=1,9),(   F(I),I=1,NPER)
      READ(MIN,911) NWX ,(NSITE(I),I=1,9),(   G(I),I=1,NPER)
      WRITE(MOUT,911) NWX ,(NSITE(I),I=1,9),(   G(I),I=1,NPER)
  660 GO TO (670,680,670,680), MTYA
  670 READ(MIN,911) NWX ,(NSITE(I),I=1,9),( AMN(I),I=1,NPER)
      WRITE(MOUT,911) NWX ,(NSITE(I),I=1,9),( AMN(I),I=1,NPER)
      READ(MIN,911) NWX ,(NSITE(I),I=1,9),(SDEV(I),I=1,NPER)
      WRITE(MOUT,911) NWX ,(NSITE(I),I=1,9),(SDEV(I),I=1,NPER)
      GO TO 700
  680 READ(MIN,911) NWX,(NSITE(I),I=1,9),(ALP(I),I=1,NPER)
      WRITE(MOUT,911)NWX,(NSITE(I),I=1,9),(ALP(I),I=1,NPER)
      READ(MIN,911) NWX,(NSITE(I),I=1,9),(BET(I),I=1,NPER)
      WRITE(MOUT,911)NWX,(NSITE(I),I=1,9),(BET(I),I=1,NPER)
      READ(MIN,930) NWX,(NSITE(I),I=1,9),(NXPN(I),I=1,NPER)
      WRITE(MOUT,930)NWX,(NSITE(I),I=1,9),(NXPN(I),I=1,NPER)
      GO TO 700
  699 CONTINUE
      WRITE(MOUT,941) MTY,MRS,MAL
      GO TO 999
  700 CLOSE(UNIT=MIN,FILE='SPEC.DAT',ACCESS='SEQIN',
     1   DEVICE='DSK',DIRECTORY='3000,571')
C
C  INPUT       PART  3          MODEL OF SEISMICITY
C
C       NOTE: FOR ILTL=2, THIS BLOCK IS REPEATED TWICE.
C
C    CARD 1    905(4I5,10X,I10)  NPONT,NLINE,NDFUS,NPLNE,MOSN
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C     ******
C              THE SEISMICITY IS INPUT AS THE SUPERPOSITION OF FOUR KINDS
C              OF SOURCES -- POINT, LINE, DIFFUSE, AND DIPPING PLANE.
C        NPONT = NUMBER OF POINT SOURCES (SEISMIC HOT SPOTS)
C        NLINE = NUMBER OF LINE SOURCES (MAJOR FAULTS)
C        NDFUS = NUMBER OF REGIONS OF DIFFUSE SEISMICITY.  THE EPICENTER
C                   HAS UNIFORM PROBABILITY OF OCCURING ANYPLACE IN THE
C                   REGION.
C
C        NPLNE = NUMBER OF DIPPING PLANAR SOURCES.  THE EPICENTER
C                   HAS UNIFORM PROBABILITY OF OCCURING ANYPLACE ON
C                   THE DIPPING PLANE.
C        MOSN  = MODEL OF SEISMICITY NUMBER
C
C  NEXT THERE ARE BLOCKS OF CARDS FOR EACH POINT, LINE,
C  DIFFUSE, AND DIPPING PLANE  SOURCE.   INPUT IS BY SUBROUTINE.
C
C  POINT SOURCE.   SUBROUTINE PSIN.
C    CARD P1  S901(3I2,F2.0,I2,35A2) ISI,IPOL,JST,SL,NL,NAME
C    *******
C        ISI   = SAME AS L1 FOR LINE SOURCE - EXPLAINED BELOW.
C        IPOL  = SAME AS L1 (NOT USED).
C        JST   = 1   SOURCE IS A POINT
C                2   EQ'S ARE UNILATERAL RUPTURE, RANDOM DIRECTION.
C                      RUPTURE LENGTH GIVEN BY MRL IN BLOCK 1,CARD 1.
C        SL    = NOT USED
C        NL    = NOT USED
C        NAME  = ALPHANUMERIC IDENTIFICATION OF THE SOURCE.
C    CARD P2A OR P2B  --  SAME AS L2A OR L2B FOR LINE SOURCE - SEE BELOW
C    ***************
C    CARD P3  S903(2F10.5) XS,YS
C    *******
C        XS    = WEST LONGITUDE OF SOURCE (IN DECIMAL DEGREES).
C        YS    = NORTH LATITUDE OF SOURCE (IN DECIMAL DEGREES).
C LINE SOURCE.    SUBROUTINE LSIN.
C    CARD L1    S901(3I2,F2.0,I2,35A2)  ISI,IPOL,JST,SL,NL,NAME(35)
C    *******
C        ISI   =  GIVES THE MEANS OF INPUTTING THE SEISMICITY.
C              = 1  USES LOG N=A-BM, MMIN.LE.M.LE.MMAX (CUMULATIVE)
C                     N = NO. OF EVENTS GREATER THAN OR EQUAL TO M.
C              = 2  USES LOG N=A-B*M, MMIN.LE.M.LE.MMAX (INCREMENTAL)
C                     N = NO OF EVENTS WITH MAGNITUDE OF M+-DM.
C                     DM=0.25 FOR MAG. STATISTICS
C                     DM=0.5 FOR INTENSITY STATISTICS.
C              = 3  USES ANNUAL MOMENT, B, MMAX TO DERIVE LOG N
C                     RELATIONSHIP.
C              = 4  N(M) IS INPUT DIRECTLY.
C        IPOL  = 0  POISSON
C                1  LITERAL
C        JST   = 0-10  DESCRIBES THE MAGNITUDE - RUPTURE LENGTH RELATION.
C                        SAME CHOICE AS FOR 'MRS' IN INPUT PART 1.
C        SL    = STEP LENGTH (KM) FOR REPRESENTING THE LINE SOURCE.
C                  DEFAULT = 5.0.
C        NL    = NUMBER OF CARDS TO INPUT SOURCE.
C        NAME  = ALPHANUMERIC IDENTIFICATION OF FAULT.
C    CARD L2A (IF ISI=1,2,OR 3) (8F10.2) AAL,BBL,AMM,AMX,AZTM,AZTP
C    ********
C        AAL   = COEFFICIENT 'A' IN LOG(N)=A-B*M  (ISI=1,2)
C        BBL   = COEFFICIENT 'B' IN LOG(N)=A-B*M (ISI=1,2,3)
C        AMM   = MINIMUM MAGNITUDE (ISI=1,2,3; DEFAULT ALWAYS AVAILABLE)
C        AMX   = MAXIMUM MAGNITUDE (ISI=1,2,3; DEFAULT ALWAYS AVAILABLE)
C        AZTM  = USED TO DEFINE MOMENT RATE. (ISI=3)
C        AZTP  = USED TO DEFINE MOMENT RATE. (ISI=3)
C                   MOMENT RATE = AZTM * 10.0**AZTP
C    CARD L2B (IF ISI=4) (8F10.2)  WS(12)
C    ********
C        WS(12)= SEISMICITY RATE ON THE FAULT.
C                 REQUIRES TWO CARDS WITH 12 VALUES.
C                 BOTH MUST BE PRESENT EVEN IF ONE IS BLANK.
C                 IF MAGNITUDE, RATE IS FOR M=3.0,3.5,4.0,...,8.0,8.5
C                 IF INTENSITY, RATE IS FOR I=I,II,III,IV,...,X,XI,XII
C    CARDS L3   S902 (2F10.5)  XL(I),YL(I)    --NL CARDS--
C    ********
C        XL(I) = WEST LONGITUDE (DECIMAL DEGREES)
C        YL(I) = NORTH LATITUDE (DECIMAL DEGREES)
C                 XL(I),YL(I), FOR I FROM 1 TO NL, GIVE THE COORDINATES
C                 OF SUCCESSIVE POINTS ON THE FAULT.
C
C  DIFFUSE SOURCE.   SUBROUTINE DSIN.
C    CARD D1 - SAME FORMAT AND VARIABLE NAMES AS L1 FOR LINE SOURCE.
C    *******
C              - USAGE OF FOLLOWING VARIABLES DIFFERS:
C        JST   = 1 THE SOURCE RUPTURE LENGTHS ARE ZERO
C              = 2 THE SOURCES ARE ASSUMED TO BE UNILATERAL RUPTURE,
C                     WITH THE EPICENTER HAVING EQUAL PROBABILITY TO BE
C                     ANYPLACE IN THE ZONE. THE DIRECTION OF RUPTURE
C                     IS RANDOM.  THIS IS THE DEFAULT VALUE.
C                     RUPTURE LENGTH GIVEN BY MRL IN BLOCK 1, CARD 1.
C        SL    = NOT USED.
C        NL    = NUMBER OF LONGITUDES USED TO DEFINE REGION.
C    CARD D2A OR D2B  --  SAME AS L2A OR L2B FOR LINE SOURCE
C    ***************
C    CARDS D3   S902(3F10.5)   YC(I),XL(I),XR(I)  --NL CARDS--
C    ********
C        ON EACH CARD, A NORTH LATITUDE 'YC(I)', AND THE
C        LONGITUDE AT WHICH IT INTERSECTS THE WEST 'XL(I)' AND
C        EAST 'XR(I)' BOUNDARY OF THE REGION.
C        'YC(I)' MUST INCREASE WITH SUCCESSIVE CARDS.
C        THE FIRST VALUE OF 'YC(I)' IS THE SOUTHERN BOUNDARY OF THE
C        REGION, AND THE LAST VALUE IS THE NOUTHERN BOUNDARY.
C
C  DIPPING PLANAR SOURCE.   SUBROUTINE DSIN.
C    AT PRESENT, EXTENDED SOURCES CANNOT BE USED (ISI=1,ONLY)
C    THE ROUTINE DOES NOT WORK FOR A VERTICAL FAULT.
C    THE SCALING RELATIONS ARE FOR EPICENTRAL DISTANCE.  FOR
C     THIS SOURCE, EPICENTRAL DISTANCE IS ARBITRARILY REPLACED
C     WITH HYPOCENTRAL DISTANCE.
C     THERE IS NO WAY TO JUDGE THE QUALITY OF THIS APPROXIMATION.
C    CARD DP1 - SAME AS CARD D1
C    ********
C    CARD DP2 - SAME AS CARD D2
C    ********
C    CARD DP3   S907(7F10.5)  PDPL(I),I=1,7
C    ********
C       PDPL(1),PDPL(2)  LONGITUDE AND LATITUDE OF A SURFACE POINT
C                 TRACE OF THE DIPPING FAULT.
C       PDPL(3),PDPL(4)  LONGITUDE AND LATITUDE OF SECOND SURFACE POINT
C                 ON THE SURFACE TRACE OF THE DIPPING PLANE.
C       PDPL(5),PDPL(6),PDPL(7)   LONGITUDE, LATITUDE, AND DEPTH(KM) OF
C                 THIRD POINT ON THE DIPPING FAULT.
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C     CARDS DP4  --  SAME AS CARDS D3
C     *********
C
C
      OPEN(UNIT=MIN,FILE='FSIN.DAT',ACCESS='SEQIN',
     1   DEVICE='DSK',DIRECTORY='3000,560')
    5 WRITE( MOUT,901)
C        INITIALIZATIONS
      NA=0
      ML=12
      MX=1
      KST=0
      DO 6 I=1,200
      IFC(I)=0
      DO 6 J=1,12
      PC(I,J)=0.0
    6 EC(I,J)=0.0
      GO TO (7,7,8,8), MTYA
    7 AMMM=3.0
      DMMM=0.5
      GO TO 9
    8 AMMM=1.0
      DMMM=1.0
      WRITE(MOUT,937)
    9 DO 11 I=1,12
   11 AM(I)=AMMM+(FLOAT(I)-1.0)*DMMM
      WRITE(MOUT,903) (NSBTE(I),I=1,20),NUST,SLONG,SLAT
      WRITE(MOUT,932)IV,HIS
      WRITE(MOUT,933)NPEX,(PE(I),I=1,NPEX)
C
C        FLAG 'ILTLF' = 0  BOTH POISSON AND LITERAL FOR SAME SEISMICITY
C                       1  POISSON,LITERAL SEISMICITY ARE SEP. PROG IS
C                            DOING THE POISSON PART.
C                       2  AS FOR 1, BUT PROG IS DOING LITERAL PART.
      IF(ILTL.EQ.0) WRITE(MOUT,946)
      IF(ILTL.EQ.1) WRITE(MOUT,953)
      IF(ILTL.EQ.2) WRITE(MOUT,946)
      ILTLF=0
      IF(ILTL.EQ.2)ILTLF=1
      GO TO 13
   12 ILTLF=2
      ML=12
      MX=1
      KST=0
      WRITE(MOUT,947)
   13 DO 14 I=1,200
      IFC(I)=0
      DO 14 J=1,12
      PC(I,J)=0.0
   14 EC(I,J)=0.0
C
C**************************************************************
C       INPUT OF THE SEISMICITY
C**************************************************************
      READ(MIN,905) NPONT,NLINE,NDFUS,NPLNE,MOSN
      WRITE(MOUT,923)MOSN
      WRITE(MOUT,906) NPONT,NLINE,NDFUS,NPLNE
   10 IF(NPONT .EQ. 0) GO TO 30
      DO 20 I=1,NPONT
      CALL PSIN (XS,YS,WS,JST)
C      CALL PSIAR(XS,YS,WS)
      IF(JST.EQ.2) KST=1
      CALL COMPR(JST)
   20 CONTINUE
   30 IF(NLINE.EQ.0) GO TO 50
      DO 40 I=1,NLINE
      CALL LSIN(XL,YL,NL,WS,SL)
C      CALL LSIAR(XL,YL,NL,WS,SL)
      CALL COMPR(1)
   40 CONTINUE
   50 IF(NDFUS.EQ.0 .AND. NPLNE.EQ.0) GO TO 100
      IF(IMRAC.EQ.1) GO TO 55
      NC=4
      RC(1)=220.
      AC(1)=10000.
      RC(2)=75.
      AC(2)=1140.
      RC(3)=25.
      AC(3)=130.
      RC(4)=9.
      AC(4)=15.
   55 IF(NDFUS .EQ. 0) GO TO 70
      IDPL=0
      DO 60 I=1,NDFUS
      CALL DSIN(NL,YL,XL,XR,WS,JST,PDPL,IDPL)
      CALL DSIAR(NL,YL,XL,XR,WS,RC,AC,NC,PDPL,IDPL)
      IF(JST.EQ.2) KST=1
      CALL COMPR(JST)
   60 CONTINUE
   70 IF(NPLNE.EQ.0) GO TO 100
      IDPL=1
      DO <0!I=1,NPLNE
      CALL DSIN(NL,YL,XL,XR,WS,JST,PDPL,IDPL)
      CALL DSIAR(NL,YL,XL,XR,WS,RC,AC,NC,PDPL,IDPL)
      CALL COMPR(1)
   80 CONTINUE
  100 CONTINUE
      IF(ILTLF.EQ.1) GO TO 101
      CLOSE(UNIT=MIN,FILE='FSIN.DAT',ACCESS='SEQIN',
     1   DEVICE='DSK',DIRECTORY='3000,560')
  101 WRITE(MOUT,919) ML,MX
      IF(KST.EQ.1) CALL LTP(MRL)
      CALL COMP2
      GO TO (102,102,103,103),MTY
  102 CALL FALOF
      GO TO 104
  103 CALL MMIPR
  104 CONTINUE
C
C        OPTIONAL OUTPUT OF SEISMICITY ARRAYS
      IF(IPPC.EQ.1)WRITE(MOUT,907)
      IF(IPPC.EQ.1)WRITE(MOUT,908) (I,RX(I),(PC(I,J),J=1,12),I=1,NRC)
C
C**************************************************************
C        CHOOSE A SET OF SPECTRAL AMPLITUDES.  EVALUATE THE PROBABILITY
C        THAT EACH WILL BE EXCEEDED.   THIS IS DONE MAINLY IN  SUMMER.
C**************************************************************
      DO 300 J=IDL1,IDL2,IDL3
      SMUMP=-5.0
      DNUMP=0.2
```

```
      NUMP=51
      EPSL=0.1E-7
      MFLG=0
      PT=PER(J)
      AA=A(J)
      BB=B(J)
      DD=D(J)
      IF(MTY.GE.5) DD=DD/100.0
      EE=E(J)
      GO TO (105,105,115,120),MTYA
  105 FF=F(J)/10.0
      GG=G(J)/1000.0
      AMAX=(1.0-BB)/(2.0*FF)
      AMIN=-BB/(2.0*FF)
      GO TO (106,108),MTYA
  106 AU=AMN(J)
      SD=SDEV(J)
  107 CC=C(J)-ALOG(2.54)/ALTEN
      GO TO 130
  108 ALPH=ALP(J)
      BETA=BET(J)
      NEXP=NXPN(J)
      MRSF=1+(MRS-1)/5
      GO TO (110,107,107),MRSF
  110 CC=C(J)
      GO TO 130
  115 AU=AMN(J)
      SD=SDEV(J)
  117 CC=C(J)+ALOG(2.54)/ALTEN
      GO TO 130
  120 ALPH=ALP(J)
      BETA=BET(J)
      NEXP=NXPN(J)
      MRSF=1+(MRS-1)/5
      GO TO (110,117,117),MRSF
  130 CONTINUE
      DO 200 I=1,NUMP
      SL(I)=SMUMP+(I-1)*DNUMP
      PL(I)=0.0
      EL(I)=0.0
      IF(MFLG.EQ.1) GO TO 200
      GO TO (140,150,160,170), MTYA
  140 CALL SUM1(SL(I),PL(I),EL(I))
      GO TO 180
  150 CALL SUM2(SL(I),PL(I),EL(I))
      GO TO 180
  160 CALL SUM3(SL(I),PL(I),EL(I))
      GO TO 180
  170 CALL SUM4(SL(I),PL(I),EL(I))
      GO TO 180
  180 CONTINUE
C        PL    IS THE PROBABILITY THAT SL WILL BE EXCEEDED ASSUMING THE
C        SEISMICITY IS EXACTLY AS INPUT.  (ASSUMPTION 1).
C        EL    IS THE EXPECTED NUMBER OF TIMES  SL  WILL BE EXCEEDED.
      IF(PL(I).LT.EPSL  .AND.  EL(I).LT.EPSL) MFLG=1
C        THE REASON FOR THIS TEST IS THAT IF  PL  AND  EL   ARE ZERO
C        FOR ONE SPECTRAL LEVEL, THEY WILL BE FOR ALL HIGHER SPECTRAL
C        LEVELS TOO.   SO  THIS SHOULD CUT COMPUTING TIME.
C        THE CUTOFF  EPSL=0.1E-7  IS QUITE ARBITRARY.  BUT I THINK IT IS
C        SO SMALL THAT PROBABILITY SMALLER THAN EPSL IS NOT MEANINGFUL.
  200 CONTINUE
      DO 250 I=1,NUMP
C        PL    AND  EL    ARE SAVED FOR LATER USE.
      PS(J,I)=PL(I)
  250 ES(J,I)=EL(I)
      IF(ILTLF-1) 260,260,300
  260 DO 270 I=1,NUMP
  270 PP(J,I)=1.0-EXP(-EL(I))
  300 CONTINUE
C*********************************************************************
C        GENERATE PRINTOUT OF NE(S(T)) AND P(S(T)).
C*********************************************************************
      IF(ILTL.EQ.0) GO TO 320
      WRITE(MOUT,925) IV,HIS
      WRITE(MOUT,927)
      WRITE(MOUT,928) (PER(J),J=IDL1,IDL2,IDL3)
      DO 310 I=1,NUMP
  310 WRITE(MOUT,929) SL(I),(PS(J,I),J=IDL1,IDL2,IDL3)
  320 CONTINUE
      WRITE(MOUT,926) IV,HIS
      WRITE(MOUT,927)
      WRITE(MOUT,928) (PER(J),J=IDL1,IDL2,IDL3)
      DO 330 I=1,NUMP
      DO 325 J=IDL1,IDL2,IDL3
      EL(J)=ALOG10(EPSL)
      IF(ES(J,I).GT.EPSL) EL(J)=ALOG10(ES(J,I))
  325 CONTINUE
  330 WRITE(MOUT,929) SL(I),(EL(J),J=IDL1,IDL2,IDL3)
  340 CONTINUE
      IF(ILTLF.EQ.2) GO TO 360
      WRITE(MOUT,948) IV,HIS
      WRITE(MOUT,927)
      WRITE(MOUT,928) (PER(J),J=IDL1,IDL2,IDL3)
      DO 350 I=1,NUMP
  350 WRITE(MOUT,929) SL(I),(PP(J,I),J=IDL1,IDL2,IDL3)
  360 CONTINUE
      IF(ILTLF.EQ.1) GO TO 12
C
C***************************************************************
C        INVERT P(S(T)) TO OBTAIN THE UNIFORM RISK SPECTRA
C***************************************************************
C        WE CALCULATED THE PROBABILITY OF EXCEEDANCE ASSUMING THE
C        SEISMICITY IS A POISSON PROCESS WITH A MEAN VALUE EQUAL TO THE
C        INPUT SEISMICITY (ASSUMPTION 2), AND UNDER THE ASSUMPTION THAT
C        THE SEISMICITY IS EXACTLY AS INPUT (ASSUMPTION 1).
C        UNDER ASSUMPTION 2, THE
C        EXPECTED NUMBER OF EXCEEDANCES THE SAME AS UNDER ASSUMPTION 1.
C        HOWEVER, THE PROBABILITY OF EXCEEDANCE OF A GIVEN SPECTRAL
C        LEVEL IS SMALLER (LESS CONSERVATIVE) THAN BY ASSUMPTION 1.
C        NOW INVERT PL (ASSUMPTION 1) FOR A SPRCTRUM WITH CONSTANT
C        PROBABILITY OF EXCEEDANCE.
      NPCH=0
      WRITE(MPUN,922) (NSATE(I),I=1,3),NSATE(9),
     1  MOSN,NUST,NPCH,(PER(I),I=IDL1,IDL2,IDL3)
      IF(ILTL-1) 500,400,710
  400 WRITE(MOUT,920)
      DO 490 J=1,NPEX
      PZ=PE(J)
      NPCH=NPCH+1
      DO 430 K=IDL1,IDL2,IDL3
```

```
      DO 410 I=1,NUMP
  410 PL(I)=PS(K,I)
  430 CALL SOFP(PL,SL,NUMP,PZ,SPL(K))
      WRITE(MOUT,924) MOSN,NUST,NPCH
      WRITE(MOUT,918) PZ,(PER(I),I=IDL1,IDL2,IDL3)
      WRITE(MOUT,931) (SPL(I),I=IDL1,IDL2,IDL3)
      WRITE(MPUN,922)(NSATE(I),I=1,3),NSATE(9),
     1   MOSN,NUST,NPCH,(SPL(I),I=IDL1,IDL2,IDL3)
  490 CONTINUE
  500 CONTINUE
C        NOW INVERT PL (ASSUMPTION 2) FOR A SPRCTRUM WITH CONSTANT
C        PROBABILITY OF EXCEEDANCE.
      WRITE(MOUT,921)
      JSET=0
      DO 590 J=1,NPEX
      ISYM=ISYM+1
      PZ=PE(J)
      NPCH=NPCH+1
      DO 530 K=IDL1,IDL2,IDL3
      DO 510 I=1,NUMP
  510 PL(I)=1.0-EXP(-ES(K,I))
      IF(IPPL.LT.0) GO TO 515
      IF(K-IPPL) 525,515,525
  515 IF(JSET.EQ.1) GO TO 525
      WRITE(MOUT,945) PER(K)
      CALL DUONE(PL,PLD,DNUMP,NUMP)
      DO 520 MMM=1,NUMP
  520 PLD(MMM)=-PLD(MMM)
      CALL PPL1(SL,PLD,NUMP)
  525 IF(PZ.GE.PL(1)) GO TO 590
  530 CALL SOFP(PL,SL,NUMP,PZ,SPL(K))
      JSET=1
      WRITE(MOUT,924) MOSN,NUST,NPCH
      WRITE(MOUT,918) PZ,(PER(I),I=IDL1,IDL2,IDL3)
      WRITE(MOUT,931) (SPL(I),I=IDL1,IDL2,IDL3)
      WRITE(MPUN,922)(NSATE(I),I=1,3),NSATE(9),
     1   MOSN,NUST,NPCH,(SPL(I),I=IDL1,IDL2,IDL3)
  590 CONTINUE
      IF(ILTL-1) 600,600,710
  710 CONTINUE
C       THIS SECTION FINDS THE PROBABILITIES OF EXCEEDANCE
C       UNDER THE JOINT CONDITION OF SOME LITERAL (ASS. 1)
C       SOURCES AND SOME POISSON (ASSUMPTION 2) SOURCES.
      WRITE(MOUT,949)
      DO 770 J=1,NPEX
      PZ=PE(J)
      NPCH=NPCH+1
      DO 750 K=IDL1,IDL2,IDL3
      DO 720 I=1,NUMP
  720 PL(I)=1.0-(1.0-PP(K,I))*(1.0-PS(K,I))
  750 CALL SOFP (PL,SL,NUMP,PZ,SPL(K))
      WRITE(MOUT,924) MOSN,NUST,NPCH
      WRITE(MOUT,918) PZ,(PER(I),I=IDL1,IDL2,IDL3)
      WRITE(MOUT,931) (SPL(I),I=IDL1,IDL2,IDL3)
      WRITE(MPUN,922) (NSATE(I),I=1,3),NSATE(9),
     1   MOSN,NUST,NPCH,(SPL(I),I=IDL1,IDL2,IDL3)
  770 CONTINUE
  600 CONTINUE
      GO TO 701
  999 CONTINUE
      CLOSE(UNIT=MIS,FILE='SITES.DAT',ACCESS='SEQIN',
     1   DEVICE='DSK',DIRECTORY='3000,560')
      CLOSE(UNIT=MOUT,FILE='FSOUT.DAT',ACCESS='SEQOUT',
     1   DEVICE='DSK',DIRECTORY='3000,560')
      CLOSE(UNIT=MPUN,FILE='FSPUN.DAT',ACCESS='SEQOUT',
     1   DEVICE='DSK',DIRECTORY='3000,560')
      END
```

```
      FUNCTION ACOS2(X)
C         THIS GIVES THE ARC-COSINE OF X   :: -1.0 .LE. X..LE.0.
C         THE VALUE RETURNED IS IN RADIANS AND IN THE SECOND QUADRANT
C         ( PI/2 .LT. ACOS2 .LE. PI)
C
C*****************************************************************
C       REVISION HISTORY
C       DATE              CHANGE
C       AUG. 1,1978       AS IN REPORT CE 78-11.
C*****ACOS2*******************************************************
C
      DATA PI,PI2/3.14159,1.5707963/
      IF(X.GT. -0.1) GO TO 30
      Y=SQRT(1.0-X*X) / X
      Z=ATAN(Y)
      GO TO 50
   30 Z=X-PI2
   50 ACOS2=Z+PI
      RETURN
      END
```

```
      FUNCTION ASIN2(X)
C         THIS GIVES THE ARC-SIN OF X.  NO PROTECTION IF X MORE THAN 1.0
C         IF X POSATIVE, RESULT IS IN THE 2-ND QUADRANT (PI/2.LT.X.LT.PI)
C         IT IS WRITTEN FOR A USE WHICH NEVER HAS NEGATIVE VALUES OF X.
C
C*****************************************************************
C       REVISION HISTORY
C       DATE              CHANGE
C       AUG. 1,1978       AS IN REPORT CE 78-11.
C*****ASIN2*******************************************************
C
      DATA PI,PI2/3.14159,1.5707963/
      IF(X.GT.0.99) GO TO 30
      Y=X/SQRT(1.0-X*X)
      Z=ATAN(Y)
      GO TO 50
   30 Y=SQRT(2.0*(1.0-X))
      Z=PI2-Y
   50 ASIN2=PI-Z
      RETURN
      END
```

```
      SUBROUTINE COMPR(JC)
C         THIS SUBROUTINE COMPRESSES ARRAYS SA, RA INTO AN ARRAY WHERE
C         ALL THE POINTS OF EQUAL DISTANCE ARE CONSOLIDATED.
C
C********************************************************************
C       REVISION HISTORY
C       DATE              CHANGE
C       AUG. 1,1978       AS IN REPORT CE 78-11.
C*****COMPR**********************************************************
C
      COMMON/RINGS/ NRB,RB(200)
C         COMMON BLOCK /RINGS/ IS INITIALIZED IN A BLOCK DATA STATEMENT
      COMMON/CSEIS/NRC,RC(200),PC(200,12),EC(200,12),IFC(200)
C        RB  GIVES THE BOUNDARIES OF THE COMPRESSED SEISMICITY RADII,
C        RC GIVES THE CENTRAL DISTANCES.
C         PC  GIVES THE SEISMICITY AT DISTANCES RC THAT IS TO BE
C        TREATED AS A POINT SOURCE.
C        EC  GIVES THE SEISMICITY THAT IS TO BE TREATED AS A LINE SOURCE
C        THE RUPTURE MAY BE UNILATERAL IN A RANDOM DIRECTION.
      COMMON/SEISM/NA,SA(1000,12),RA(1000)
C
C        IF  JC=1,  THE SEISMICITY IS ADDED TO PC.  (POINT)
C        IF  JC=2,  THE SEISMICITY GOES TO EC  (EXTENDED)
C
C        AFTER ADDING THE SEISMICITY TO PC OR EC, THE PROGRAM RESETS NA
C        SO THAT SA, NA, AND RA CAN BE USED AGAIN.
C
C        PC AND EC ARE ZEROED IN THE MAIN PROGRAM
      NRC=NRB-1
      DO 10 I=1,NRC
   10 RC(I)=(RB(I)+RB(I+1))/2.0
      DO 100 K=1,NA
      RW=RA(K)
      DO 20 J=2,NRB
      IF(RW.LE.RB(J))  GO TO 30
   20 CONTINUE
C        TO REACH THE NEXT STATEMENT, DISTANCE IS HUGE, SO SEISMICITY
C        THERE WILL NOT BE INCLUDED IN THE RISK CALCULATION.
      GO TO 100
   30 IF(JC.EQ.1) GO TO 60
      DO 50 I=1,12
   50 EC(J-1,I) = EC(J-1,I) + SA(K,I)
      GO TO 90
   60 DO 70 I=1,12
   70 PC(J-1,I) = PC(J-1,I) + SA(K,I)
   90 IFC(J-1) = IFC(J-1) + 1
  100 CONTINUE
      NA=0
      RETURN
      END
```

```
      SUBROUTINE COMP2
C         THIS SUBROUTINE COMPRESSES THE ARRAYS PC, EC TO ELIMINATE ANY
C         DISTANCES THAT ARE NOT IN USE AT ALL
C
C*****************************************************************
C       REVISION HISTORY
C       DATE                CHANGE
C       AUG. 1,1978       AS IN REPORT CE 78-11.
C*****COMP2*******************************************************
C
      COMMON/CSEIS/NRC,RC(200),PC(200,12),EC(200,12),IFC(200)
      DATA MOUT/6/
  901 FORMAT(5X,'DATA COMPRESSED TO',I5,'   DISTANCES FOR INTEGRATION')
      J=0
      DO 100 K=1,NRC
      IF(IFC(K).LE.0) GO TO 100
      J=J+1
C         NOTE THAT J IS .LE. K
      RC(J)=RC(K)
      DO 20 I=1,12
      PC(J,I) = PC(K,I)
   20 EC(J,I)=EC(K,I)
  100 CONTINUE
      NRC=J
      WRITE(MOUT,901) NRC
      RETURN
      END
```

```
      SUBROUTINE DEGKM(XDEG,YDEG,XKM,YKM)
CC        THIS SUBROUTINE CONVERTS A LOCATION IN DEGREES TO
C         ONE IN KM.   THE KM.  COORDINATES HAVE ORIGIN (SLONG,SLAT).
C         SLONG IS WEST LONGITUDE,  SLAT IS NORTH LATITUDE.
C         XKM,YKM MAY BE THE SAME AS XDEG,YDEG IN THE CALLING ROUTINE
C
C*******************************************************************
C       REVISION HISTORY
C       DATE                CHANGE
C       AUG.01,1978       AS IN REPORT CE 78-11.
C*****DEGKM*********************************************************
C
      COMMON /SITE/ SLONG,SLAT
      DATA DR/0.017453293/
C         DR  GIVES THE NUMBER OF RADIANS IN ONE DEGREE
      DATA A,F/6378.388,0.003367/
C         A   IS THE RADIUS OF THE EARTH (GEOID) AT THE EQUATOR
C         F    IS 1./297., THE FLATTENING OF THE EARTH.
C         YDEG, THE LATITUDE, IS  DETERMINED BY THE LOCAL PERPENDICULAR
C           TO THE EARTH.  FIRST FIND THE GEOCENTRIC LATITUDE.
      XX=TAN(YDEG*DR)/(1.0+2.0*F)
      THETA=ATAN(XX)
C         NOW FIND THE DISTANCE FROM TNE CENTER OF THE EARTH.
      R=A*(1.0-F*SIN(THETA)**2)
C         FIND THE DISTANCE ALONG THE LATITUDE YDEG FROM XDEG TO SLONG.
      XKM=R*DR*(SLONG-XDEG)*COS(THETA)
C         FIND THE AVERAGE LATITUDE.
      PHIB=(YDEG+SLAT)/2.0
C         ... AND THE CORRESPONDING GEOCENTRIC LATITUDE.
      YY=TAN(PHIB*DR)/(1.0+2.0*F)
      THB=ATAN(YY)
C         FINALLY  ..
      YKM=A*(1.0-2.0*F+3.0*F*SIN(THB)**2)*(YDEG-SLAT)*DR
C     WRITE(6,901) SLONG,SLAT,DR,A,F,XDEG,YDEG,XX,THETA,R,XKM,PHIB,YY,
C    1  THB,YKM
C 901 FORMAT (5F15.6)
      RETURN
      END
```

```
      SUBROUTINE DSIAR(NL,YC,XL,XR,WS,RC,AC,NC,PDPL,IDPL)
      DIMENSION YC(1),XL(1),XR(1),WS(12),RC(1),AC(1)
      DIMENSION BIGWK(4,1000),XX(5),YY(5),PDPL(7)
      COMMON/SEISM/NA,SA(1000,12),RA(1000)
      COMMON/IONUM/MIS,MIN,MOUT,MPUN,LSSUP,YRS
C
C        THIS TAKES THE INFORMATION OF THE AREA BOUNDARY, AND GENERATES
C        A SET OF ROUGHLY SQUARE RECTANGLES.  THESE ARE DIVIDED SO
C        THAT THEY ARE SMALL ENOUGH ACCORDING TO THE CRITERIA CONTAINED
C        IN THE ARRAYS  RC,AC.   THEN THE SEISMICITY IS DIVIDED AMONG
C        THESE AREAS IN PROPORTION TO THE AREA OF EACH ELEMENT.
C*****************************************************************
C       REVISION HISTORY
C       DATE               CHANGE
C       AUG. 1,1978        AS IN REPORT CE 78-11.
C*****DSIAR********************************************************
C
C        FIRST CONVERT THE LOCATIONS IN DEGREES TO KILOMETERS.
  901 FORMAT(5X,' INPUT GIVES LONGITUDE OF EAST AND WEST BOUN
     1DARY AT',I3,'  LATITUDES')
  902 FORMAT(5X,'ARRAY BIGWK - CX,CY,XL,YL,AREA,DISTANCE')
  903 FORMAT(I5,6F15.5)
  904 FORMAT(5X,'INITIALLY ',I5,'  RECTANGLES')
  905 FORMAT(5X,'AREA, CORNER DISTANCE, CENTER DISTANCE',/,3F15.3)
  906 FORMAT(5X,'NOW ', I5,'  RECTANGLES')
  907 FORMAT(5X,'REGION HAS AREA ',F15.1)
  908 FORMAT(5X,'INSERTED INTO RA,SA  ARRAYS IN ELEMENTS ',I5,'  TO',I5,
     1 /)
  909 FORMAT (5X,'*****PROGRAM EXCEEDING LIMITS OF ARRAY BIGWK. ADDITION
     1AL SPACE NEEDED AT LEAST',I5,/,5X,'WORKING ON RC,AC ELEMENT',I5)
  910 FORMAT(5X,'*****PROGRAM EXCEEDING LIMITS OF ARRAYS SA,RA.  ADDITIO
     1NAL SPACE NEEDED AT LEAST',I5)
  911 FORMAT(5X,'BEGINNING AREA-DISTANCE CHECKS')
      IF(LSSUP.EQ.0) WRITE(MOUT,901) NL
      DO 10 I=1,NL
      YSTO=YC(I)
      CALL DEGKM(XL(I),YSTO,XL(I),YSTO)
   10 CALL DEGKM(XR(I),YC(I),XR(I),YC(I))
C
C       NOW FIND THE BASIC RECTANGLES.   THE DATA IS STORED IN  BIGWK
C         BIGWK(1,N)     CENTER IN X DIRECTION
C               2        CENTER IN Y DIRECTION
C               3        LENGTH IN X DIRECTION
C               4        LENGTH IN Y DIRECTION
C
C         K IS THE ELEMENT IN THE ARRAYS XL,XR,YC
C         L IS THE ELEMENT IN BIGWK
      L=0
      DO 100 K=1,NL
      BL=XR(K)-XL(K)
      IF(K.EQ.1) GO TO 40
      IF(K.EQ.NL) GO TO 50
      BW=(YC(K+1)-YC(K-1))/2.0
      CY=YC(K+1)/4.0+YC(K)/2.0+YC(K-1)/4.0
      GO TO 60
   40 BW=(YC(2)-YC(1))/2.0
      CY=YC(1)+0.5*BW
      GO TO 60
   50 BW=(YC(NL)-YC(NL-1))/2.0
      CY=YC(NL)-0.5*BW
   60 NB=BL/BW
      DL=BL/FLOAT(NB)
      DO 90 J=1,NB
      L=L+1
      BIGWK(1,L)=XL(K)+(FLOAT(J)-0.5)*DL
      BIGWK(2,L)=CY
      BIGWK(3,L)=DL
      BIGWK(4,L)=BW
   90 CONTINUE
  100 CONTINUE
      NREC=L
      IF(LSSUP.EQ.0) WRITE(MOUT,904) NREC
C        NOW SEE IF ALL THE ELEMENTS SATISIFY THE DISTANCE -
C        AREA CRITERIA.   IF NOT - SUBDIVIDE.
C        FIRST, FIND THE LARGEST AREA.
      AMAX=BIGWK(3,1)*BIGWK(4,1)
      AREA=AMAX
      DO 120 I=2,NREC
      AREL=BIGWK(3,I)*BIGWK(4,I)
      AREA=AREA+AREL
      IF(AREL.GT.AMAX) AMAX=AREL
  120 CONTINUE
      IF(LSSUP.EQ.0) WRITE(MOUT,907) AREA
C        THE RECTANGLES WERE CREATED SO THAT THE LENGTH TO
C        BE AT MOST TWICE THE WIDTH, BUT AT LEAST EQUAL TO THE WIDTH.
C        THIS, AND THE MAXIMUM AREA, IS USED TO ESTIMATE THE MAXIMUM
C        DISTANCE FROM CENTER TO CORNER OF ALL THE RECTANGLES.
C
      IF(NC.EQ.0) GO TO 310
      IF(LSSUP.EQ.0) WRITE(MOUT,911)
      DO 300 MNC=1,NC
      RCC=SQRT(0.625*AMAX)
      RCT=RC(MNC)+RCC
      ACT=AC(MNC)
      AMAX=ACT
      IF(LSSUP.EQ.0) WRITE(MOUT,905) ACT,RC(MNC),RCT
      NNREC=NREC
      DO 250 L=1,NREC
      DEL=SQRT(BIGWK(1,L)**2+BIGWK(2,L)**2)
      IF(DEL.GT.RCT) GO TO 250
      AREL=BIGWK(3,L)*BIGWK(4,L)
      IF(AREL.LT.ACT) GO TO 250
C        REACHING THIS POINT, THE AREA OF ELEMENT L MUST BE DECREASED.
      AN=AREL/ACT
      MM=SQRT(AN) + 1.0
      NTEST=NNREC+MM*MM-1000
      IF(NTEST.GT.0)WRITE(MOUT,909)NTEST,MNC
      XZ=BIGWK(1,L)-BIGWK(3,L)/2.0
      YZ=BIGWK(2,L)-BIGWK(4,L)/2.0
      DXH=BIGWK(3,L)/(2.0*FLOAT(MM))
      DYH=BIGWK(4,L)/(2.0*FLOAT(MM))
      DO 200 J=1,MM
      DO 200 K=1,MM
      NNREC=NNREC+1
      BIGWK(1,NNREC)=XZ+(2.0*FLOAT(K)-1.0)*DXH
      BIGWK(2,NNREC)=YZ+(2.0*FLOAT(J)-1.0)*DYH
      BIGWK(3,NNREC)=2.0*DXH
      BIGWK(4,NNREC)=2.0*DYH
  200 CONTINUE
      DO 220 I=1,4
```

```
  220 BIGWK(I,L)=BIGWK(I,NNREC)
      NNREC=NNREC-1
  250 CONTINUE
      NREC=NNREC
      IF(LSSUP.EQ.0) WRITE(MOUT,906) NREC
      AREA=0.0
      DO 260 I=1,NREC
  260 AREA=AREA+BIGWK(3,I)*BIGWK(4,I)
      IF(LSSUP.EQ.0) WRITE(MOUT,907) AREA
  300 CONTINUE
C        NOW ALL THE RECTANGLES ARE SMALL ENOUGH FOR THE INTEGRATION.
  310 CONTINUE
  350 CONTINUE
C        SEISMICITY IS DIVIDED, AND THE INFORMATION IS STORED IN SA,RA
      NA1=NA+1
      NAR=NA+NREC
      IF(LSSUP.EQ.0) WRITE(MOUT,908) NA1,NAR
      NTEST=NAR-1000
      IF(NTEST.GT.0)WRITE(MOUT,910)NTEST
      DO 400 I=1,NREC
      NA=NA+1
      RA(NA)=SQRT(BIGWK(1,I)**2+BIGWK(2,I)**2)
      DO 380 J=1,12
  380 SA(NA,J)=WS(J)*BIGWK(3,I)*BIGWK(4,I)/AREA
  400 CONTINUE
C
C        THE FOLLOWING IS AN OPTION USED FOR A DIPPING PLANE SOURCE.
C        WHEN USED, EPICENTRAL DISTANCE IS REPLACED BY THE HYPOCENTRAL
C        DISTANCE.  THIS IS A CRUDE FIX UP JOB, NOT JUSTIFIED BY DATA.
      IF(IDPL.NE.1) GO TO 500
C        CONVERT THE POINTS IS PDPL TO KM.
      CALL DEGKM(PDPL(1),PDPL(2),X1,Y1)
      CALL DEGKM(PDPL(3),PDPL(4),X2,Y2)
      CALL DEGKM(PDPL(5),PDPL(6),X3,Y3)
C        FIND A VECTOR ALONG THE SURFACE TRACE - UNIT LENGTH.
      SX=X2-X1
      SY=Y2-Y1
      SM=SQRT(SX*SX+SY*SY)
      SX=SX/SM
      SY=SY/SM
      PX=-SY
      PY=SX
C        NOW FIND THE PERPENDICULAR DISTANCE  TDP FROM THE SURFACE TRACE
C        TO THE POINT WHICH HAS DEPTH.
      TDP=(X3-X1)*PX + (Y3-Y1)*PY
      IF(TDP.LT.0.0) PX=-PX
      IF(TDP.LT.0.0) PY=-PY
C        FINALLY FIND THE TANGENT OF THE DIP ANGLE.
      TANDP=PDPL(7)/ABS(TDP)
C        NOW FIND THE DEPTH OF THE CENTER POINT OF EACH ELEMENT IN THE
C        ARRAY BIGWK, AND MAKE THE CRUDE ADJUSTMENT.
      DO 450 I=1,NREC
      J=NA1-1+I
      Z=(BIGWK(1,I)-X1)*PX + (BIGWK(2,I)-Y1)*PY
      IF(Z.LT.0.0) Z=0.0
      H=Z*TANDP
      RA(J)=SQRT(RA(J)*RA(J)+H*H)
  450 CONTINUE
  500 CONTINUE
      RETURN
      END
```

```
      SUBROUTINE DSIN(NL,YL,XL,XR,WS,JST,PDPL,IDPL)
      DIMENSION YL(1),XL(1),XR(1)
C        IN THIS SUBROUTINE  YL  BECOMES THE LATITUDE OF A LINE RUNNING
C        EAST-WEST THROUGH A DIFFUSE REGION .  XL IS THE
C        LONGITUDE OF THE LEFT BOUNDARY OF THE REGION, AND XR IS THE
C        LONGITUDE OF THE RIGHT BOUNDARY AT LATITUDE YL.
C        NL  IS NOW THE NUMBER OF EAST-WEST LINES TO DEFINE THE REGION.
C
C       IDPL=0 FOR A DIFFUSE ZONE WITH NO DEPTH
C            1 FOR A DIPPING PLANAR SOURCE
C
C***************************************************************
C       REVISION HISTORY
C       DATE            CHANGE
C       AUG. 1,1978     AS IN REPORT CE 78-11.
C********DSIN****************************************************
      DIMENSION WS(12),NAME(35),PDPL(7)
      COMMON/MAGS/AM(12),ML,MX
      COMMON/IONUM/MIS,MIN,MOUT,MPUN,LSSUP,YRS
  901 FORMAT(3I2,F2.0,I2,35A2)
  902 FORMAT(3F10.5)
  903 FORMAT(//,5X,'DIFFUSE SEISMICITY REGION  ',35A2)
  904 FORMAT(5X,'SEISMICITY - MAGNITUDE AND NUMBER OF EARTHQUAKES',
     1   12(/,F10.1,F13.7))
  905 FORMAT(5X,'EVENTS ARE ASSUMED TO BE POINT SOURCES')
  906 FORMAT(5X,'EVENTS ARE ASSUMED TO BE UNILATERAL RUPTURES')
  907 FORMAT(7F10.5)
  908 FORMAT(5X,'DIPPING PLANE SOURCE  ',9A2)
  909 FORMAT(5X,'FOLLOWING THREE POINTS DEFINE THE PLANE',/,10X,'LONGITU
     1DE,LATITUDE,DEPTH',3(/,3F15.5))
      READ(MIN,901)ISI,IPOL,JST,SL,NL,(NAME(I),I=1,35)
      IF(IDPL.EQ.0) WRITE(MOUT,903) (NAME(I),I=1,35)
      IF(IDPL.EQ.1) WRITE(MOUT,908) (NAME(I),I=1,35)
      CALL WSIN (WS,ISI)
      IF(LSSUP.EQ.0) WRITE(MOUT,904) (AM(I),WS(I),I=1,12)
      IF(IDPL.EQ.0) GO TO 10
      READ(MIN,907) (PDPL(I),I=1,7)
      X=0.0
      IF(LSSUP.EQ.0) WRITE(MOUT,909) PDPL(1),PDPL(2),X,PDPL(3),PDPL(4),
     1   X,(PDPL(I),I=5,7)
   10 READ(MIN,902) (YL(I),XL(I),XR(I),I=1,NL)
      IF(JST.NE.1) JST=2
      IF(LSSUP) 40,20,40
   20 IF(JST.EQ.1) WRITE(MOUT,905)
      IF(JST.EQ.2) WRITE(MOUT,906)
C        THIS AVOIDS LOOPING OVER SOME MAGNITUDES WITH NO EVENTS
   40 DO 50 I=1,12
      ML1=I
      IF(WS(I).GT.0.0) GO TO 60
   50 CONTINUE
   60 DO 70 I=1,12
      J=13-I
      MX1=J
      IF(WS(J).GT.0.0) GO TO 80
   70 CONTINUE
   80 IF(ML.GT.ML1) ML=ML1
      IF(MX.LT.MX1) MX=MX1
      RETURN
      END
```

```
      SUBROUTINE DUONE (U, V, DT, N)
C
C***********************************************************************
C       REVISION HISTORY
C       DATE              CHANGE
C       AUG. 1,1978       AS IN REPORT CE 78-11.
C*****DUONE*************************************************************
C
C        THIS TAKES THE FIRST DERIVATIVE OF EQUALLY SPACED DATA POINTS.
C        U  --  ARRAY TO BE DIFFERENTIATED
C        V  --  THE FIRST DERIVATIVE OF  --  UU  --..  MAY BE THE SAME
C             ARRAY AS  --  U  -- IN THE CALLING PROGRAM.
C        DT  --  TIME SPACING OF   --  U  --.
C        N  --  NUMBER OF POINTS IN  --  U  --.
C
C        ...  LIMITATIONS  ...
C        THIS ROUTINE INTRODUCES A TIME SHIFT OF 0.5*DT, SINCE IT WORKS
C        BY FORWARD DIFFERENCES.  THE HIGHER TIME RESOLUTION OF THIS
C        METHOD IS HERE REGARDED MORE IMPORTANT.
C        THUS  ..  V(T) = (U(T+DT) - U(T)) / DT
C
C        TO PREVENT ANY IRREGULARITIES, V(N) = V(N - 1)
C
      DIMENSION U(2), V(2)
      A = U(1)
      N1 = N - 1
      DO 10 I = 1, N1
      B = U(I+1)
      V(I) = (B - A) / DT
   10 A = B
      V(N) = V(N1)
      RETURN
      END
```

```
      SUBROUTINE FALOF
C
C***********************************************************************
C       REVISION HISTORY
C       DATE              CHANGE
C       AUG. 1,1978       AS IN REPORT CE 78-11.
C*****FALOF*************************************************************
C
      COMMON/CSEIS/NRC,RC(200),PC(200,12),EC(200,12),IFC(200)
      COMMON/AMPLT/ALAR(200)
      COMMON/B1/NXO,XO(100),YO(100)
C        THIS SUBROUTINE FINDS THE FACTOR  LOG10(A(R)) = ALAR  FOR EACH
C        INTEGRATION POINT.   ALAR  IS THE CORRECTION FOR DISTANCE USED
C        IN STANDARD MAGNITUDE FORMULAE.
      NXO1=NXO-1
      DO 100 K=1,NRC
      R=RC(K)
      DO 10 I=1,NXO1
      IF(R.LT.XO(I+1) .AND. R.GE.XO(I))  GO TO 20
   10 CONTINUE
   20 ALO=YO(I)+((YO(I+1)-YO(I))/(XO(I+1)-XO(I)))*(R-XO(I))
   30 IF(R.LE.XO(1)) ALO=YO(1)
  100 ALAR(K)=ALO
C 901 FORMAT(4(I5,2F10.3))
C     MOUT=6
C     WRITE(MOUT,901) (I,RA(I),ALAR(I),I=1,NA)
      RETURN
      END
```

```
      FUNCTION FLNG(AM,MRL)
C        THIS FUNCTION GIVES THE FAULT LENGTH FOR A GIVEN MAGNITUDE.
C        THERE IS TREMENDOUS UNCERTAINTY.    IT WOULD NOT BE WISE TO
C        DELUDE ONESELF BY BELIEVING THE RESULT.
C        IN ALL CASES,  L IS IN KILOMETERS
C**************************************************************
C       REVISION HISTORY
C       DATE              CHANGE
C       AUG. 1,1978      AS IN REPORT CE 78-11.
C*****FLNG*****************************************************
C
       GO TO (10,20,30,40,50,60,70,80,90,100),MRL
   10  FLNG=0.4
       RETURN
C        THIS RESEMBLES THE PRESS RELATIONSHIP.   I DIDN'T HAVE HIS
C        REFERENCE HANDY WHEN WRITING THIS ROUTINE.   THUS THE CONSTANTS
C        WERE PICKED OFF A GRAPH.
   20 FLNG=10.0**(0.6*AM-2.7)
       RETURN
C
C        THATCHER AND HANKS  --  1.7 BARS
   30  FLNG=10.0**(2.0*AM/3.0 - 2.23)
       RETURN
C
C        THATCHER AND HANKS  --  0.1 BAR
   40  FLNG=10.0**(2.0*AM/3.0 - 1.41)
       RETURN
C
C        THATCHER AND HANKS  --  100 BARS
   50  FLNG=10.0**(2.0*AM/3.0 - 3.41)
       RETURN
C
C        WYSS AND BRUNE
   60  FLNG=10.0**(0.53*AM-1.47)
       RETURN
C
C        TOCHER
   70  FLNG=10.0**(1.02*AM-5.77)
       RETURN
C
C        OKAMOTO
   80  FLNG=10.0**(1.32*AM-7.99)
       RETURN
C
C        HOUSNER
   90  IF(AM.GE.6.4) GO TO 91
       FLNG=10.0**(0.395*AM-1.454)
       RETURN
   91  FLNG=10.0**(0.900*AM-4.673)
       RETURN
C
C       AS USED BY DER-KIUREGHIAN
  100  FLNG=EXP(1.596*AM-7.56)
      RETURN
      END
```

```
      SUBROUTINE LSIN(XL,YL,NL,WS,SL)
      DIMENSION XL(100),YL(100),WS(12),NAME(35),FL(12)
      DIMENSION RWORK(500),ZX(500),ZY(500),PWORK(500)
      COMMON/SEISM/NA,SA(1000,12),RA(1000)
      COMMON/MAGS/AM(12),ML,MX
      COMMON/IONUM/MIS,MIN,MOUT,MPUN,LSSUP,YRS
C        THIS SUBROUTINE READS IN DATA ON A LINE SEISMIC SOURCE.
C        IT FIRST READS IN THE FAULT NAME, THE CONTROL PARAMETERS,
C        AND THE SEISMICITY.
C        FOLLOWING CARDS DESCRIBE THE FAULT BY A SEQUENCE OF POINTS.
C
C**************************************************************
C       REVISION HISTORY
C       DATE           CHANGE
C       AUG. 1,1978     VERSION IN REPORT CE 78-11.
C*****LSIN*****************************************************
C
  901 FORMAT(3I2,F2.0,I2,35A2)
  902 FORMAT (2F10.5)
  903 FORMAT (//,5X,'LINE SOURCE   ',35A2)
  907 FORMAT(5X,'  LOCATIONS OF ENDS ARE',
     1  2(/,F15.5,'  WEST LONGITUDE',F15.5,'  NORTH LATITUDE'))
  904 FORMAT(5X,'SEISMICITY - MAGNITUDE AND NUMBER OF EARTHQUAKES,  ASSU
     1MED FAULT LENGTH', 12(/,F10.1,F13.7,F10.4))
  905 FORMAT(5X,'FAULT IS REPRESENTED BY',I5,' - 1  STRAIGHT LINE SEGMEN
     1TS')
  906 FORMAT(5X,'ISI=',I3)
C  907  FORMAT IS OUT OF ORDER.
      READ(MIN,901) ISI,IPOL,JST,SL,NL,(NAME(I),I=1,35)
      IF(JST.EQ.0) JST=2
      WRITE(MOUT,903) (NAME(I),I=1,35)
      DO 1 I=1,12
    1 FL(I)=FLNG(AM(I),JST)
      CALL WSIN(WS,ISI)
      READ(MIN,902) (XL(I),YL(I),I=1,NL)
      IF(LSSUP)4,3,4
    3 WRITE(MOUT,907) XL(1),YL(1),XL(NL),YL(NL)
      WRITE(MOUT,905) NL
      WRITE(MOUT,906) ISI
      WRITE(MOUT,904) (AM(I),WS(I),FL(I),I=1,12)
C        THIS AVOIDS LOOPING OVER SOME MAGNITUDES WITH NO EVENTS
    4 DO 5 I=1,12
      ML1=I
      IF(WS(I).GT.0.0) GO TO 6
    5 CONTINUE
    6 DO 7 I=1,12
      J=13-I
      MX1=J
      IF(WS(J).GT.0.0) GO TO 8
    7 CONTINUE
    8 IF(ML.GT.ML1) ML=ML1
      IF(MX.LT.MX1) MX=MX1
C
C       THIS SECTION TAKES THE DESCRIPTION OF A LINEAR FAULT AS INPUT,
C       AND CONVERTS IT TO A SERIES OF EQUALLY SPACED POINTS ON THE
C       FAULT.  THE DISTANCE FROM THESE POINTS TO THE OBSERVATION POINT
C       (SLONG,SLAT) IS CALCULATED.  THE RISK IS ASSIGNED TO EACH POINT
C       ACCORDING TO THE PROBABILITY OF BEING THE CLOSEST POINT THAT
C       RUPTURES FOR EACH MAGNITUDE.
  911 FORMAT (5X,'THE FAULT IS REPRESENTED BY',I5,'  POINTS AT SPACING O
```

```
     1F',    F6.2, '  KILOMETER')
 912 FORMAT (5X,'THIS GIVES A LENGTH OF',F8.2, '  KILOMETER')
 913 FORMAT (5X,'X-Y LOCATIONS AND DISTANCES FOLLOW')
 914 FORMAT (I5,3F15.5)
 915 FORMAT(8F15.5)
 916 FORMAT(5X,'INSERTED IN DISTANCE AND SEISMICITY ARRAYS IN POSITIONS
    1  ',I5,'   TO',I7,/)
C
C         FIRST CONVERT LONGITUDE AND LATITUDE TO KILOMETERS.
      DO 10 I=1,NL
  10  CALL DEGKM(XL(I),YL(I),XL(I),YL(I))
C
C         NOW FIND EQUALLY SPACED POINTS.  THE SPACING IS SL KILOMETERS.
      I=1
      K=1
      AXK=XL(K+1)-XL(K)
      AYK=YL(K+1)-YL(K)
      ALK=SQRT(AXK*AXK+AYK*AYK)
      AXK=SL*AXK/ALK
      AYK=SL*AYK/ALK
      ZXC=XL(1)
      ZYC=YL(1)
      ZX(1)=ZXC
      ZY(1)=ZYC
      RWORK(1)=SQRT(ZXC*ZXC+ZYC*ZYC)
  20  RTP=SQRT((ZXC-XL(K+1))**2+(ZYC-YL(K+1))**2)
      IF(RTP.LT.SL) GO TO 50
  30  ZXC=ZXC+AXK
      ZYC=ZYC+AYK
      ZX(I+1)=ZXC
      ZY(I+1)=ZYC
  40  RWORK(I+1)=SQRT(ZXC*ZXC+ZYC*ZYC)
      I=I+1
      GO TO 20
  50  K1=K+1
      IF(K1.EQ.NL) GO TO 90
  60  AXKP=XL(K1+1)-XL(K1)
      AYKP=YL(K1+1)-YL(K1)
C     WRITE(MOUT,915)XL(K1),YL(K1),AXKP,AYKP
      ALK=SQRT(AXKP*AXKP+AYKP*AYKP)
      AXKP=SL*AXKP/ALK
      AYKP=SL*AYKP/ALK
      RP=RTP+ALK
       IF(RP.LE.SL) GO TO 80
  70  ZXC=XL(K1)+(1.0-RTP/SL)*AXKP
      ZYC=YL(K1)+(1.0-RTP/SL)*AYKP
      ZX(I+1)=ZXC
      ZY(I+1)=ZYC
      K=K1
      AXK=AXKP
      AYK=AYKP
      GO TO 40
  80  RTP=RP
      K=K1
      GO TO 50
  90  SLH=SL/2.0
      IF(RTP.LT.SLH) GO TO 110
 100  ZXC=ZXC+AXK
      ZYC=ZYC+AYK
      I=I+1
      ZX(I)=ZXC
      ZY(I)=ZYC
      RWORK(I)=SQRT(ZXC*ZXC+ZYC*ZYC)
 110  LF=I
C         THE FAULT IS REPRESENTED BY LF POINTS.  IT HAS LENGTH SL*(LF-1)
      IF(LSSUP)105,102,105
 102  WRITE(MOUT,911) LF,SL
      FLTH=SL*(FLOAT(LF)-1.0)
      WRITE(MOUT,912) FLTH
C         INSERT RWORK  INTO RA.   BUT WE'LL STILL NEED RWORK.
 105  NA1=NA+1
      NAM=NA+LF
      DO 120 I=NA1,NAM
 120  RA(I)=RWORK(I-NA)
C         NOW CALCULATE PROBABILITIES.
      DO 300 M=1,12
      DO 200 I=1,LF
 200  PWORK(I)=0.0
      IF(WS(M).LE.0.0) GO TO 260
 210  RUP=FLNG(AM(M),JST)
      KK=RUP/SL
      KK1=KK+1
      IF(KK1.GT.LF) KK=LF-1
 230  PEG=WS(M)/(FLOAT(LF)-FLOAT(KK))
      KK1=KK+1
      DO 250 L=KK1,LF
      LR=L
      LL=L-KK
      JLO=LL
      RLO=RWORK(LL)
      DO 240 J=LL,LR
      IF(RWORK(J).GT.RLO) GO TO 240
      RLO=RWORK(J)
      JLO=J
 240  CONTINUE
 250  PWORK(JLO)=PWORK(JLO)+PEG
 260  DO 280 I=NA1,NAM
 280  SA(I,M)=PWORK(I-NA)
 300  CONTINUE
      IF(LSSUP.EQ.0)WRITE(MOUT,916) NA1,NAM
      NA=NAM
      RETURN
      END
```

```
      SUBROUTINE LTP(MRL)
C        THIS TAKES A SET OF POINTS WHERE EPICENTERS OCCUR, AND
C        FINDS THE FRACTIONAL EXPECTED NUMBER OF EARTHQUAKES WHICH OCCUR
C        WITH CLOSEST POINT IN EACH DISTANCE RANGE DEFINED BY ARRAY
C        -- RB  --.
C        THIS SUBROUTINE IS CALLED ONLY IF IT IS ASSUMED THAT THE EVENTS
C        IN THE DIFFUSE REGIONS HAVE A SPATIAL EXTENT.
C***************************************************************
C       REVISION HISTORY
C       DATE                CHANGE
C       AUG. 1,1978         AS IN REPORT CE 78-11.
C******LTP******************************************************
      DIMENSION RL(12)
      COMMON/CSEIS/NRC,RC(200),PC(200,12),EC(200,12),IFC(200)
      COMMON/RINGS/ NRB,RB(200)
      COMMON/MAGS/ AM(12),ML,MX
      DATA MOUT/6/
  901 FORMAT(' RC',10F10.2)
  902 FORMAT(' RB',10F10.2)
  903 FORMAT(' PC',12F8.4)
  904 FORMAT(' EC',12F8.4)
  905 FORMAT(5X,'MAGNITUDE-RUPTURE LENGTH NO...',I4,12(/,F10.1,F10.4))
      DO 10 I=1,12
   10 RL(I)=FLNG(AM(I),MRL)
      WRITE(MOUT,905) MRL,(AM(I),RL(I),I=1,12)
      DO 300 KR=1,NRC
      IF(IFC(KR).LE.0) GO TO 300
C        THE ABOVE TEST IS OK BECAUSE ONLY SHORTER DISTANCES ARE ADDED
C        TO THE SEISMICITY ARRAYS , AND THE ROUTINE WORKS FROM
C        THE SHORTEST DISTANCES TO THE LONGEST.
C
C        SET UP THE LOOP OVER MAGNITUDE.
      DO 290 M=ML,MX
      FL=FLNG(AM(M),MRL)
C        FIND THE CLQSEST POSSIBLE APPROACH OF THE FAULT TO THE STATION.
      RMIN=RC(KR)-FL
      IF(RMIN.LT.0.0) RMIN=0.0
C        FIND WHAT DISSTANCE INTERVAL RMIN IS IN.
      DO 20 KZ=1,KR
      IF(RB(KZ+1) .GT. RMIN) GO TO 30
   20 CONTINUE
C        IN THE SPECIAL CASE OF KZ=KR, THE FAULT IS TOO SHORT TO RUPTURE
C        OUT OF THE RING CONTAINING THE EPICENTER.
   30 IF(KZ.LT.KR) GO TO 40
      PC(KR,M) = PC(KR,M) + EC(KR,M)
      GO TO 290
C        WHAT REMAINS IS THE POSSIBILITY THAT THE FAULT RUPTURES INTO A
C        CLOSER RING TO THE EPICENTER.   NOW CONSIDER EACH RING,
C        AND FIND THE PROBABILITY THAT THE FAULT HAS ITS CLOSEST POINT
C        THERE.
   40 CONTINUE
      PHI1=3.1415927
      RZ=RC(KR)
      DO 100 K=KZ,KR
      R2=RB(K+1)
      PHI2=PHI(R2,RZ,FL)
      PRK=(PHI1-PHI2)/3.1415927
      PC(K,M) = PC(K,M)+PRK*EC(KR,M)
      PHI1=PHI2
      IFC(K)=IFC(K)+1
  100 CONTINUE
  290 CONTINUE
  300 CONTINUE
      DO 350 J=1,12
      DO 350 K=1,200
  350 EC(K,J)=0.0
      RETURN
      END
```

```
      FUNCTION PHI(R,RZ,FL)
C        FINDS THE ANGLE  PHI  DEFINED ON P.68 OF MY NOTES IN NOTEBOOK
C        'RISK ANALYSIS II'
C
C******************************************************************
C       REVISION HSITORY
C       DATE                CHANGE
C       AUG. 1,1978         AS IN REPORT CE 78-11.
C*****PHI**********************************************************
      DATA PI,PI2/3.1415927,1.5707963/
      PHI=0.0
      IF(R.GE.RZ) RETURN
      IF(FL.GE.RZ) GO TO 100
      X=SQRT(RZ*RZ-FL*FL)
      IF(X.LE.R) GO TO 100
      X=(R*R-RZ*RZ-FL*FL)/(2.0*FL*RZ)
      PHI=ACOS2(X)
      RETURN
  100 X=R/RZ
      PHI=ASIN2(X)
      RETURN
      END
```

```
      SUBROUTINE MMIPR
C
C       THIS SUBROUTINE ADDED  TO CAUSE FASTER EXECUTION FOR
C       MMI CASES.  IT DOES THIS AT THE EXPENSE OF THE ADDITIONAL
C       STORAGE REQUIRED IN ARRAY PKS.  THE TIME SAVED IS BECAUSE
C       PKS IS COMPUTED ONLY ONCE, RATHER THAN 11(FOR EACH PERIOD)*
C       50(FOR EACH SPECTRAL LEVEL) TIMES.  MY INITIAL PREDITION IS
C       THAT EXECUTION TIME WILL BE ABOUT HALF THE SPEED WITHOUT
C       THIS ROUTINE.
C
C*************************************************************
C       REVISION HISTORY
C       DATE            CHANGE
C       AUG.01,1978     VERSION IN REPORT CE 78-11
C*****MMIPR*******************************************************
C
C
      COMMON/CSEIS/NRC,RC(200),PC(200,12),EX(200,12),IFC(200)
      COMMON/MMPRM/RMU(12),RSIG(12),PKS(200,12)
      ALTEN=ALOG(10.0)
      DO 200 J=1,NRC
      R=RC(J)
      DO 200 KK=1,12
      RNORM=(ALOG(R)/ALTEN-RMU(KK))/RSIG(KK)
  200 PKS(J,KK)=1.0-QOFX(RNORM)
      RETURN
      END


      FUNCTION PACALR(PLIN,ALPHA,BETA,N)
C         PACALR = P-ACTUAL, CALCULATED  RAYLEIGH DISTRIBUTION FUNCTION
C********************************************************
C       REVISION HISTORY
C       DATE            CHANGE
C       AUG.11,1978     VERSION IN REPORT CE 78-11.
C*****PACALR*********************************************
      Q=-1.0*EXP(ALPHA*PLIN + BETA)
      AN=FLOAT(N)
      R=1.0-EXP(Q)
      Y=AN*ALOG(R)
      PACALR=0.0
      IF(Y.GT.-75.0)PACALR=EXP(Y)
C       THE DIRECT EXPONENTIAL IN THE FOLLOWING STATEMENT IS
C       THEORETICALLY EQUIVALENT TO THE PREVIOUS THREE STEPS.
C       BUT IT LEADS TO NUMEROUS UNDERFLOW ERRORS.
C       NUMERICALLY, FOR LARGE N (AN), THE ABOVE THREE STEPS
C       GIVE A SLIGHTLY DIFFERENT ANSWER (0.01 PERCENT DIFFERENCE
C       OR LESS) THAN THE STATEMENT BELOW.
C       PACALR=R**AN
      RETURN
      END
```

```
      SUBROUTINE PSIN(XS,YS,WS,JST)
C*****************************************************************************
C       REVISION HISTORY
C       DATE            CHANGE
C       AUG.01,1978     VERSION IN REPORT CE 78-11.
C****PSIN*********************************************************************
      DIMENSION WS(12),NAME(35)
      COMMON/MAGS/AM(12),ML,MX
      COMMON/IONUM/MIS,MIN,MOUT,MPUN,LSSUP,YRS
      COMMON/SEISM/NA,SA(1000,12),RA(1000)
C        THIS SUBROUTINE READS IN THE DATA ON A POINT SEISMIC SOURCE.
  901 FORMAT(3I2,F2.0,I2,35A2)
  902 FORMAT(//,5X,'POINT SOURCE   ', 35A2)
  903 FORMAT (2F10.5)
  904 FORMAT (5X,'SEISMICITY - MAGNITUDE AND NUMBER OF EARTHQUAKES',
     1  12(/,F10.1,F13.7))
  907 FORMAT(8X,'LOCATION',F10.5,'  WEST LONGITUDE',/,
     1    16X,F10.5,'  NORTH LATITUDE')
      READ(MIN,901) ISI,IPOL,JST,SL,NL,(NAME(I),I=1,35)
      WRITE(MOUT,902) (NAME(I),I=1,35)
      CALL WSIN(WS,ISI)
      READ(MIN,903) XS,YS
      IF(LSSUP.EQ.0) WRITE(MOUT,907) XS,YS
      IF(LSSUP.EQ.0) WRITE(MOUT,904) (AM(I),WS(I),I=1,12)
      IF(JST.NE.1) JST=2
C        THIS AVOIDS LOOPING OVER SOME MAGNITUDES WITH NO EVENTS
      DO 50 I=1,12
      ML1=I
      IF(WS(I).GT.0.0) GO TO 60
   50 CONTINUE
   60 DO 70 I=1,12
      J=13-I
      MX1=J
      IF(WS(J).GT.0.0) GO TO 80
   70 CONTINUE
   80 IF(ML.GT.ML1) ML=ML1
      IF(MX.LT.MX1) MX=MX1
C        THIS  SECTION INSERTS THE INFORMATION ON A POINT SOURCE INTO
C        THE ARRAYS SA,RA.
  905 FORMAT ('      INSERTED IN ARRAYS  SA,RA  IN ELEMENT',I5)
  906 FORMAT (5X,'X-Y COORIDINATES ARE ', 2F12.6,/)
      NA=NA+1
      DO 100 I=1,12
  100 SA(NA,I)=WS(I)
      CALL DEGKM(XS,YS,XKM,YKM)
      R=SQRT(XKM*XKM+YKM*YKM)
      RA(NA)=R
      IF(LSSUP.EQ.0) WRITE(MOUT,905) NA
      IF(LSSUP.EQ.0) WRITE(MOUT,906) XKM,YKM
      RETURN
      END
```

```
      SUBROUTINE PPL1(T,U,N)
C      MAKES A PRINTER PLOT
C*****************************************************
C     REVISION HISTORY
C     DATE             CHANGE
C     AUG. 1,1978      AS IN REPORT CE 78-11.
C*****PPL1*************************************************
      DIMENSION T(1),U(1),IARY(101)
      DATA MOUT/6/
      DATA IPW,IZ/60,4/
      DATA IB,II,IS/1H ,1HI,1H*/
  901 FORMAT('     PEAK VALUE IS ',E15.5)
  902 FORMAT(F10.3,F10.4,60A1)
      CALL S1(U,N,AMAX)
      WRITE(MOUT,901) AMAX
      DO 10 I=1,IPW
   10 IARY(I)=IB
C     F=1.0
C     IF(AMAX.GT.0.0) F=33.0/AMAX
      AM1=1.4
      F=FLOAT(IPW-IZ)/AM1
      DO 20 I=1,N
      IARY(IZ)=II
      K=F*U(I)+IZ
      IF(K.GT.IPW)K=1
      IF(K.LE.0) K=1
      IARY(K)=IS
      WRITE(MOUT,902)T(I),U(I),(IARY(J),J=1,IPW)
   20 IARY(K)=IB
      RETURN
      END

      SUBROUTINE S1(UI,NP,AMAX)
C
C*****************************************************************
C     REVISION HISTORY
C     DATE             CHANGE
C     AUG. 1,1978      AS IN REPORT CE 78-11.
C*****S1**********************************************************
C
      DIMENSION UI(NP)
C        S1 FINDS THE ABSOLUTE VALUE OF THE LARGEST NUMBER IN AN ARRAY.
C        UI  --  THE ARRAY,  DIMENSION  --  NP  --
C        AMAX  --  ABSOLUTE VALUE OF MAX
      AMAX = 0.0
      DO 40 I = 1, NP
      B=ABS(UI(I))
   20 IF (B - AMAX) 40, 40, 30
   30 AMAX = B
   40 CONTINUE
      RETURN
      END

      FUNCTION QOFX(X)
C
C*****************************************************************
C     REVISION HSITORY
C     DATE             CHANGE
C     AUG. 1,1978      AS IN REPORT CE 78-11.
C*****QOFX********************************************************
C
      DATA P,B1,B2/0.2316419,0.319381530,-0.356563782/
      DATA B3,B4,B5/1.781477937,-1.821255978,1.330274429/
      DATA AN/0.398942280/
C        THIS SUBROUTINE EVALUATES EQUATION 26.2.17 IN ABRAMOWITZ
C             & STEGUN (P 932). IT GIVES THE PROBABILITY THAT A NORMALLY
C             DISTRIBUTED RANDOM VARIABLE, WITH MEAN = ZERO AND STANDARD
C             DEVIATION = ONE, IS GREATER THAN  --  X  --.  THIS ROUTINE
C             GIVES A RESULT WITH ERROR LESS THAN 7.5E-8.
C             EQUATION 26.2.17 IS RESTRICTED TO X POSATIVE OR ZERO.
C             FOR NEGATIVE X,  Q(-X) = 1. - Q(X)
      Y=ABS(X)
      T=1.0/(1.0+P*Y)
      Z=AN*EXP(-X*X/2.0)
      Q=T*(B1+T*(B2+T*(B3+T*(B4+T*B5))))
      QOFX=Z*Q
      IF(X.LT.0.0) QOFX=1.0-QOFX
      RETURN
      END

      FUNCTION TAN(X)
      TAN=SIN(X)/COS(X)
      RETURN
      END
```

```
      SUBROUTINE SOFP(P,S,N,PZ,SZ)
      DIMENSION P(N),S(N)
      DATA EPS/0.00001/
C        P  IS A DECREASING ARRAY, AND  S  IS A FUNCTION OF P.
C        GIVEN ANY VALUE FOR P (PZ), FIND THE CORRESPONDING  S (SZ).
C*****************************************************************
C       REVISION HISTORY
C       DATE                 CHANGE
C       AUG. 1,1978          AS IN REPORT CE 78-11.
C**********************************************************************
      I=1
      N2=N-2
      IF(PZ.GT.P(1)) GO TO 20
      DO 10 I=1,N2
      IF(PZ.LT.P(I) .AND. PZ.GT.P(I+1)) GO TO 30
   10 CONTINUE
C       THIS NEXT STATEMENT IS THE LINEAR INTERPOLATION
   20 SZ=S(I)+(PZ-P(I))*(S(I+1)-S(I))/(P(I+1)-P(I))
      RETURN
C       FOR THIS USUAL CASE, THE ROUTINE FITS A THIRD ORDER POLYNOMIAL
C       THROUGH FOUR POINTS - TWO ON EITHER SIDE OF THE POINT TO BE
C       INTERPOLATED.  THEN IT FINDS THE ROOT BY NEWTON'S METHOD.
   30 A0=P(I)
      A1=-P(I-1)/3.0-P(I)/2.0+P(I+1)-P(I+2)/6.0
      A2=P(I-1)/2.0-P(I)+P(I+1)/2.0
      A3=-P(I-1)/6.0+P(I)/2.0-P(I+1)/2.0+P(I+2)/6.0
      PP=0.5
C       CHECK FOR A RELATIVE MAXIMUM OR MINIMUM INSIDE THE RANGE
C       OF THE INTERPOLATION.  IF SO, USE THE LINEAR METHOD.
C       ALTHOUGH I BELIEVE THIS CHECK IS CORRECT, I HAVE NOT
C       YET SEEN ANY CASES WHERE IT HAS BEEN NEEDED.
      DET=A2*A2-3.0*A3*A1
      IF(DET.LT.0.0)GO TO 40
C       WHEN DET IS POSATIVE, THERE IS A REAL MAXIMA AND MINIMA.
      X1=(-A2+SQRT(DET))/(3.0*A3)
      X2=(-A2-SQRT(DET))/(3.0*A3)
      IF(X1.LT.0.0)GO TO 35
      IF(X1.LT.1.0)GO TO 20
   35 IF(X2.LT.0.0)GO TO 40
      IF(X2.LT.1.0)GO TO 20
   40 PSZPP=A0+PP*(A1+PP*(A2+PP*A3))
      YTEST=ABS((PZ-PSZPP)/PZ)
      IF(YTEST.LT.EPS) GO TO 100
      SSZPP=A1+PP*(2.0*A2+3.0*A3*PP)
      PSZ=PP+(PZ-PSZPP)/SSZPP
      PP=PSZ
      GO TO 40
  100 SZ=S(I)+PSZ*(S(I+1)-S(I))
      RETURN
      END
```

```
      BLOCK DATA
C
C*****************************************************************
C       REVISION HSITORY
C       DATE                 CHANGE
C       AUG. 1,1978          AS IN REPORT CE 78-11.
C*****BLOCK*DATA**************************************************
C
      COMMON/RINGS/ NRB,RB(200)
      DATA RB/0.0,1.0,2.0,3.0,4.0,5.0,6.0,7.0,8.0,9.0,10.0,11.0,12.0,
     1  13.0,14.0,15.0,16.0,17.0,18.0,19.0,20.0,21.0,22.0,23.0,24.0,
     1 25.,26.,27.,28.,29.,30.,31.,32.,33.,34.,35.,36.,37.,38.,39.,
     2 40.,41.,42.,43.,44.,45.,46.,47.,48.,49.,50.,51.,52.,53.,54.,
     3 55.,56.,57.,58.,59.,60.,61.,62.,63.,64.,65.,66.,67.,68.,
     3 69.,70.,71.,72.,73.,74.,75.,76.,77.,78.,79.,80.,81.,82.,83.,
     4 84.,85.,86.,87.,88.,89.,90.,91.,92.,93.,94.,95.,96.,97.,98.,
     4 99.,100.,102.,104.,106.,108.,110.,115.,120.,125.,130.,135.,
     5  140.0,145.0,150.0,155.0,160.0,165.0,170.0,175.0,180.0,185.0,
     6  190.0,195.0,200.0,205.0,210.0,215.0,220.0,225.0,230.0,235.0,
     7  240.0,245.0,250.0,260.0,270.0,280.0,290.0,300.0,325.0,350.0,
     8  375.0,400.0,425.0,450.0,475.0,500.0,525.0,550.0,575.0,600.0,
     9  625.0,650.0,675.0,700.0,750.0,800.0,850.0,900.0,1000.0/
      DATA NRB/160/
      END
```

```
      SUBROUTINE SUM1(SP,P,E)
C
C        GIVEN A VALUE OF PERIOD AND A SPECTRAL AMPLITUDE, THIS
C        SUBROUTINE PERFORMS THE BIG SUM OVER PROBABILITIES.
C        MANY PARAMETERS ARE PASSED THROUGH COMMON BLOCKS  WP AND SEISM.
C        THIS ROUTINE ASSUMES  SA  IS LOG(SPECTRAL AMPLITUDE)
C
C       P AND E MUST BE SET TO ZERO BEFORE THE ROUTINE IS CALLED.
C       IF THEY ARE SET IN THE MAIN PROGRAM, AND ARE NOT SET
C       AGAIN HERE TO SAVE TIME.
C
C*****************************************************************
C       REVISION HISTORY
C       DATE            CHANGE
C       AUG. 01,1978    VERSION AS PUBLISHED IN REPORT C.E.78-11
C*****SUM1********************************************************
      COMMON/WP/PT,AA,BB,CC,DD,EE,FF,GG,AU,SD,ALPH,BETA,NEXP,AMIN,AMAX
      COMMON/MAGS/AM(12),ML,MX
      COMMON/CSEIS/NRC,RC(200),PC(200,12),EC(200,12),IFC(200)
      COMMON/AMPLT/ALAR(200)
      COMMON/SITE/SLONG,SLAT,HIS,IV
      DO 200 M=ML,MX
      AMAG=AM(M)
      AM1=AMAG
      IF(AM1.LE.AMIN) AM1=AMIN
      IF(AMAG-AMAX)20,20,10
   10 AM1=AMAX
      AMAG=AMAX
   20 PSUM=SP-AMAG+BB*AM1+CC+DD*HIS+EE*IV+FF*AM1*AM1
      DO 200 J=1,NRC
      ZIT=PSUM-ALAR(J)+GG*RC(J)
C         PLIN IS P-LINEAR = LINEAR APPROXIMATION TO PROBABILITY
C           OF NOT EXCEEDING SP.
C        PG IS P-ACTUAL = ACTUAL PROBABILITY OF NOT EXCEEDING SP.
C        QG IS PROBABILITY OF EXCEEDING SP = Q(.), AS USED
C           BY ANDERSON AND TRIFUNAC (1977,1978), AND ANDERSON (1978)
      PLIN=-ZIT/AA
      PNORM=(PLIN-AU)/SD
      QG=QOFX(PNORM)
C        AS PLIN INCREASES, QG DECREASES.
C        THE PROBABILITY  P  CALCULATED HERE IS THE PROBABILITY THAT THE
C        SPECTRAL AMPLITUDE LEVEL  SA  WILL NOT  BE EXCEEDED.
      PG=1.0-QG
      QL=-200.
      IF(PG.GT.0.0)QL=ALOG(PG)
      P=P+PC(J,M)*QL
  200 E=E+QG*PC(J,M)
      PB=1.0
      IF(P.GT.-25.0) PB=1.0-EXP(P)
      P=PB
      RETURN
      END
```

```
      SUBROUTINE SUM2(SP,P,E)
C        GIVEN A VALUE OF PERIOD AND A SPECTRAL AMPLITUDE, THIS
C        SUBROUTINE PERFORMS THE BIG SUM OVER PROBABILITIES.
C        MANY PARAMETERS ARE PASSED THROUGH COMMON BLOCKS  WP AND SEISM.
C        THIS ROUTINE ASSUMES  SA  IS LOG(SPECTRAL AMPLITUDE)
C
C       P AND E MUST BE ZEROED BY THE PROGRAM THAT CALLS SUM2.
C
C*****************************************************************
C       REVISION HISTORY
C       DATE            CHANGE
C       AUG.01,1978     VERSION AS PUBLISHED IN REPORT C.E. 78-11.
C*****SUM2********************************************************
      COMMON/WP/PT,AA,BB,CC,DD,EE,FF,GG,AU,SD,ALPH,BETA,NEXP,AMIN,AMAX
      COMMON/MAGS/AM(12),ML,MX
      COMMON/CSEIS/NRC,RC(200),PC(200,12),EC(200,12),IFC(200)
      COMMON/AMPLT/ALAR(200)
      COMMON/SITE/SLONG,SLAT,HIS,IV
      DO 200 M=ML,MX
      AMAG=AM(M)
      AM1=AMAG
      IF(AM1.LE.AMIN) AM1=AMIN
      IF(AMAG-AMAX)20,20,10
   10 AM1=AMAX
      AMAG=AMAX
   20 PSUM=SP-AMAG+BB*AM1+CC+DD*HIS+EE*IV+FF*AM1*AM1
      DO 200 J=1,NRC
      ZIT=PSUM-ALAR(J)+GG*RC(J)
      PLIN=-ZIT/AA
      PG=PACALR(PLIN,ALPH,BETA,NEXP)
      QG=1.0-PG
C        AS PLIN INCREASES, QG DECREASES.
C        THE PROBABILITY  P  CALCULATED HERE IS THE PROBABILITY THAT THE
C        SPECTRAL AMPLITUDE LEVEL  SA  WILL NOT  BE EXCEEDED.
      QL=-200.
      IF(PG.GT.0.0)QL=ALOG(PG)
      P=P+PC(J,M)*QL
  200 E=E+QG*PC(J,M)
      PB=1.0
      IF(P.GT.-25.0) PB=1.0-EXP(P)
      P=PB
      RETURN
      END
```

```
      SUBROUTINE SUM3(SP,P,E)
C        GIVEN A VALUE OF PERIOD AND A SPECTRAL AMPLITUDE, THIS
C        SUBROUTINE PERFORMS THE BIG SUM OVER PROBABILITIES.
C        MANY PARAMETERS ARE PASSED THROUGH COMMON BLOCKS  WP AND SEISM.
C        THIS ROUTINE ASSUMES  SA  IS LOG(SPECTRAL AMPLITUDE)
C
C       THIS SUBROUTINE, AS ADAPTED FOR MMI, IMPLICITLY USES
C       THE FACT THAT MMI LEVELS ARE QUANTIZED TO INTEGERS, AND THUS
C       THE DO LOOPS OVER M AND KK USE THE DO INDEX RATHER THAN THE
C       SUBSTITUTION FOR MMI=(AM(INDEX)), AS THE PROGRAM FOR MAGNITUDE
C       DOES.
CC
C       P AND E MUST BE SET TO ZERO BY THE PROGRAM THAT CALLS SUM3.
C
C**********************************************************
C       REVISION HISTORY
C       DATE            CHANGE
C       AUG.01,1978     VERSION IN REPORT CE 78-11.
C*****SUM3*********************************************
      COMMON /WP/PT,AA,BB,CC,DD,EE,FF,GG,AU,SD,ALPH,BETA,NEXP
      COMMON/MAGS/AM(12),ML,MX
      COMMON/CSEIS/NRC,RC(200),PC(200,12),EC(200,12),IFC(200)
      COMMON/MMPRM/RMU(12),RSIG(12),PKS(200,12)
      COMMON/SITE/SLONG,SLAT,HIS,IV
      DO 200 M=ML,MX
      PSUM=SP-CC-DD*HIS-EE*FLOAT(IV)
      DO 200 J=1,NRC
C       FIND QG.  THIS IS THE TERM Q(I,J) IN THE REPORT
C       AND THE PAPER BY ANDERSON & TRIFUNAC ON 'UNIFORM RISK
C       FUNCTIONALS...'.   IT IS THE PROBABILITY THAT THE
C       SPECTRAL AMPLITUDE --SP-- WILL BE EXCEEDED BY AN
C       EVENT WITH EPICENTRAL INTENSITY M AT DISTANCE RC(J).
C
      PK1=1.0
      QG=0.0
      DO 150 KK=1,M
      K=M-KK+1
C        KK IS THE SUBSCRIPT IO-I1+1 FOR RMU,RSIG
      PK=PKS(J,KK)
C        FIND PLIN = P(LINEAR) ... THE TERM WHOSE
C        COEFFICIENT IS  A  IN THE PAPER BY TRIFUNAC 'A PRELIMINARY
C        EMPIRICAL MODEL ...'
      PLIN=(PSUM-BB*FLOAT(K))/AA
      PNORM=(PLIN-AU)/SD
      QG=QG+QOFX(PNORM)*(PK1-PK)
  150 PK1=PK
C        AS PLIN INCREASES, QG DECREASES.
C        THE PROBABILITY  P  CALCULATED HERE IS THE PROBABILITY THAT THE
C        SPECTRAL AMPLITUDE LEVEL  SA  WILL NOT  BE EXCEEDED.
      PG=1.0-QG
      QL=-200.
      IF(PG.GT.0.0)QL=ALOG(PG)
      P=P+PC(J,M)*QL
  200 E=E+QG*PC(J,M)
      PB=1.0
      IF(P.GT.-25.0) PB=1.0-EXP(P)
      P=PB
      RETURN
      END
```

```
      SUBROUTINE SUM4(SP,P,E)
C        GIVEN A VALUE OF PERIOD AND A SPECTRAL AMPLITUDE, THIS
C        SUBROUTINE PERFORMS THE BIG SUM OVER PROBABILITIES.
C        MANY PARAMETERS ARE PASSED THROUGH COMMON BLOCKS  WP AND SEISM.
C        THIS ROUTINE ASSUMES  SA  IS LOG(SPECTRAL AMPLITUDE)
C
C       THIS SUBROUTINE, AS ADAPTED FOR MMI, IMPLICITLY USES
C       THE FACT THAT MMI LEVELS ARE QUANTIZED TO INTEGERS, AND THUS
C       THE DO LOOPS OVER M AND KK USE THE DO INDEX RATHER THAN THE
C       SUBSTITUTION FOR MMI=(AM(INDEX)), AS THE PROGRAM FOR MAGNITUDE
C       DOES.
CC
C       P AND E MUST BE SET TO ZERO BY THE PROGRAM THAT CALLS SUM4.
C
C**********************************************************
C       REVISION HISTORY
C       DATE            CHANGE
C       AUG.01,1978     VERSION IN REPORT CE 78-11.
C*********SUM4*****************************************
      COMMON /WP/PT,AA,BB,CC,DD,EE,FF,GG,AU,SD,ALPH,BETA,NEXP
      COMMON/MAGS/AM(12),ML,MX
      COMMON/CSEIS/NRC,RC(200),PC(200,12),EC(200,12),IFC(200)
      COMMON/MMPRM/RMU(12),RSIG(12),PKS(200,12)
      COMMON/SITE/SLONG,SLAT,HIS,IV
      DO 200 M=ML,MX
      PSUM=SP-CC-DD*HIS-EE*FLOAT(IV)
      DO 200 J=1,NRC
C       FIND QG.  THIS IS THE TERM Q(I,J) IN THE REPORT
C       AND THE PAPER BY ANDERSON & TRIFUNAC ON 'UNIFORM RISK
C       FUNCTIONALS...'.   IT IS THE PROBABILITY THAT THE
C       SPECTRAL AMPLITUDE --SP-- WILL BE EXCEEDED BY AN
C       EVENT WITH EPICENTRAL INTENSITY M AT DISTANCE RC(J).
C
      PK1=1.0
      QG=0.0
      DO 150 KK=1,M
      K=M-KK+1
C        KK IS THE SUBSCRIPT IO-I1+1 FOR RMU,RSIG
      PK=PKS(J,KK)
C        FIND PLIN = P(LINEAR) ... THE TERM WHOSE
C        COEFFICIENT IS  A  IN THE PAPER BY TRIFUNAC 'A PRELIMINARY
C        EMPIRICAL MODEL ...'
      PLIN=(PSUM-BB*FLOAT(K))/AA
      QG=QG+(1.0-PACALR(PLIN,ALPH,BETA,NEXP))*(PK1-PK)
  150 PK1=PK
C        AS PLIN INCREASES, QG DECREASES.
C        THE PROBABILITY  P  CALCULATED HERE IS THE PROBABILITY THAT THE
C        SPECTRAL AMPLITUDE LEVEL  SA  WILL NOT  BE EXCEEDEI.
      PG=1.0-QG
      QL=-200.
      IF(PG.GT.0.0)QL=ALOG(PG)
      P=P+PC(J,M)*QL
  200 E=E+QG*PC(J,M)
      PB=1.0
      IF(P.GT.-25.0) PB=1.0-EXP(P)
      P=PB
      RETURN
      END
```

```
      SUBROUTINE WSIN(WS,ISI)
C
C     THIS SUBROUTINE READS IN THE SEISMICITY FOR ALL OF THE
C     SOURCE REGIONS.
C
C*****************************************************************
C     REVISION HISTORY
C     DATE              CHANGE
C     AUG. 1,1978       AS IN REPORT CE 78-11.
C******WSIN*******************************************************
      DIMENSION WS(12)
      COMMON/MAGS/AM(12),ML,MX
      COMMON/IONUM/MIS,MIN,MOUT,MPUN,LSSUP,YRS
  901 FORMAT(5X,'SEISMICITY INPUT BY CUMULATIVE N(M) RELATION')
  902 FORMAT(5X,'SESIMICITY INPUT BY INCREMENTAL N(M) RELATION')
  903 FORMAT(5X,'SEISMICITY INPUT BY MOMENT RATE (PER YEAR),B, MMAX')
  904 FORMAT(5X,'N(M) READ DIRECTLY')
  905 FORMAT(5X,'A,B,M-MIN,M-MAX,MO/YR',/,4F10.3,E15.5)
  906 FORMAT(8F10.2)
  907 FORMAT(5X,'SEISMICITY SCALED UP BY FACTOR OF',F10.3)
      GO TO (20,20,20,60),ISI
   20 READ(MIN,906) AAL,BBL,AMM,AMX,AZTM,AZTP
      DMH=(AM(2)-AM(1))/2.0
      IF(AMM.LE.0.0)AMM=AM(1)-DMH
      IF(AMX.LE.0.0) AMX=AM(12)+DMH
      AMZY=AZTM*10.0**AZTP
      GO TO (30,40,50),ISI
   30 DMH=(AM(2)-AM(1))/2.0
      IF(LSSUP.EQ.0) WRITE(MOUT,901)
      AMR=AM(12)+DMH
      IF(AMR.GT.AMX) AMR=AMX
      ANUM=10.0**(AAL-BBL*AMR)
      DO 35 J=1,12
      I=13-J
      BMR=AM(I)-DMH
      IF(BMR.GT.AMX)BMR=AMX
      IF(BMR.LT.AMM) BMR=AMM
      BNUM=10.0**(AAL-BBL*BMR)
      WS(I)=BNUM-ANUM
   35 ANUM=BNUM
      GO TO 70
   40 DO 45 I=1,12
      WS(I)=10.0**(AAL-BBL*AM(I))
      IF(AM(I).LT.AMM)WS(I)=0.0
      IF(AM(I).GT.AMX) WS(I)=0.0
   45 CONTINUE
      IF(LSSUP.EQ.0) WRITE(MOUT,902)
      GO TO 70
   50 CONTINUE
C     THIS SECTION OF PROGRAMMING MODIFIED FROM PROGRAM JGA60.
C     THIS TAKES A FILE WITH MO/YR, MMAX FOR EACH FAULT
C     TOGETHER WITH A B-VALUE AND NUMBER OF YEARS COMMON
C     TO ALL FAULTS, AND FINDS 1.THE A-VALUE AND 2. THE NUMBER OF
C     EVENTS/YR IN SDVERAL MAGNITUDE RANGES.
C
      IF(LSSUP.EQ.0) WRITE(MOUT,903)
      DM=AM(2)-AM(1)
      D=BBL*2./3.
      UMAX=16.0+1.5*AMX
      C=0.0
      IF(AMZY-1.0) 53,53,52
   52 C=ALOG(AMZY)/ALOG(10.)-UMAX*(1.-D)+ALOG(2.30258*(1.-D))/
     1 ALOG(10.)
   53 AAL=C-16.*D+0.176091
      DO 55 I=1,12
      AMIN=AM(I)-0.5*DM
      AMAX=AM(I)+0.5*DM
      IF(AMIN.GT.AMX)AMIN=AMX
      IF(AMAX.GT.AMX)AMAX=AMX
      IF(AMIN.LT.AMM) AMIN=AMM
      IF(AMAX.LT.AMM) AMAX=AMM
   55 WS(I)=RCINT(AAL,BBL,AMIN,AMAX)
      GO TO 70
   60 READ(MIN,906) (WS(I),I=1,12)
      IF(LSSUP.EQ.0) WRITE(MOUT,904)
      GO TO 80
   70 IF(LSSUP.EQ.0) WRITE(MOUT,905) AAL,BBL,AMM,AMX,AMZY
   80 DO 90 I=1,12
   90 WS(I)=WS(I)*YRS
      IF(LSSUP.EQ.0) WRITE(MOUT,907) YRS
      RETURN
      END


      FUNCTION RCINT(A,B,AM,AX)
C
C*****************************************************************
C     REVISION HSITORY
C     DATE              CHANGE
C     AUG. 1,1978       AS IN REPORT CE 78-11.
C*****RCINT*******************************************************
C
      CF=10.0**A/(2.302585*B)
      CM=10.0**(-B*AM)
      CX=10.0**(-B*AX)
      RCINT=CF*(CM-CX)
      RETURN
      END
```

Listing of Part 2 of the Input
for Computer Program EQRISK

This section contains the regression parameters, and is not normally altered by the user.

```
   0     0     1    16
  71   CALIFORNIA
  0.001  -1.400    5.000  -1.500   10.000  -1.605   15.000  -1.716   20.000  -1.833
 25.000  -1.955   30.000  -2.078   35.000  -2.199   40.000  -2.314   45.000  -2.421
 50.000  -2.517   55.000  -2.603   60.000  -2.679   65.000  -2.746   70.000  -2.805
 80.000  -2.920   85.000  -2.958   90.000  -2.989   95.000  -3.020  100.000  -3.044
110.000  -3.089  120.000  -3.135  130.000  -3.182  140.000  -3.230  150.000  -3.279
160.000  -3.328  170.000  -3.378  180.000  -3.429  190.000  -3.480  200.000  -3.530
210.000  -3.581  220.000  -3.631  230.000  -3.680  240.000  -3.729  250.000  -3.779
260.000  -3.828  270.000  -3.877  280.000  -3.926  290.000  -3.975  300.000  -4.024
310.000  -4.072  320.000  -4.119  330.000  -4.164  340.000  -4.209  350.000  -4.253
360.000  -4.295  370.000  -4.336  380.000  -4.376  390.000  -4.414  400.000  -4.451
410.000  -4.485  420.000  -4.518  430.000  -4.549  440.000  -4.579  450.000  -4.607
460.000  -4.634  470.000  -4.660  480.000  -4.685  490.000  -4.709  500.000  -4.732
510.000  -4.755  520.000  -4.776  530.000  -4.797  540.000  -4.817  550.000  -4.835
560.000  -4.853  570.000  -4.869  580.000  -4.885  590.000  -4.900  600.000  -4.900
1000.000  -5.700
   0     0     1     3
  12   WESTERN USA
1.15 1.48 1.78 2.04 2.25 2.42 2.56 2.67 2.77 2.85 2.92 2.99
 0.3  0.3  0.3  0.3  0.3  0.3  0.3  0.3  0.3  0.3  0.3  0.3
   0     0     2     3
  12   EASTERN USA
1.18 1.54 1.90 2.23 2.53 2.79 3.01 3.18 3.32 3.44 3.54 3.62
 0.3  0.3  0.3  0.3  0.3  0.3  0.3  0.3  0.3  0.3  0.3  0.3
   1     0     0    10
  11    PERIOD-1.398-1.150-0.903-0.655-0.407-0.159 0.088 0.336 0.584 0.831 1.079
  11FS A M   1-1.688-1.620-1.517-1.445-1.460-1.514-1.549-1.570-1.601-1.630-1.633
  11FS B M   1-1.086-1.380-1.418-1.216-1.053-1.129-1.499-2.592-4.042-4.699-4.872
  11FS C M   1 7.615 7.892 7.344 6.249 5.587 5.913 7.32811.23016.38118.87519.715
  11FS D M   1-0.018-0.080-0.068 0.011 0.102 0.163 0.189 0.197 0.200 0.204 0.203
  11FS E M   1-0.098-0.026 0.094 0.229 0.304 0.319 0.309 0.288 0.281 0.292 0.297
  11FS F M   1 1.320 1.527 1.542 1.364 1.206 1.227 1.469 2.250 3.300 3.775 3.900
  11     G   1-0.441-0.869-1.052-0.940-0.709-0.610-0.753-1.033-1.258-1.352-1.375
  11FS    MEAN 0.492 0.502 0.500 0.488 0.479 0.479 0.488 0.511 0.532 0.522 0.492
  11FS    ST D 0.301 0.300 0.299 0.289 0.281 0.280 0.287 0.301 0.312 0.302 0.289
   2     1     0    11
  11SA PERIOD-1.398-1.171-0.943-0.716-0.489-0.261-0.034 0.193 0.420 0.648 0.875
  11SA A     1-1.230-1.284-1.276-1.229-1.243-1.312-1.358-1.405-1.501-1.617-1.714
  11SA B     1-0.904-1.146-1.354-1.418-1.316-1.244-1.571-2.219-2.732-2.884-2.411
  11SA C     1 6.601 7.317 7.701 7.695 7.413 7.446 8.87511.43613.57614.36613.105
  11SA D     1-0.036-0.086-0.078-0.010 0.084 0.165 0.209 0.226 0.229 0.220 0.217
  11SA E     1 0.223 0.057 0.081 0.231 0.325 0.329 0.334 0.321 0.260 0.257 0.243
  11SA F     1 1.163 1.342 1.500 1.535 1.427 1.336 1.553 2.019 2.398 2.548 2.232
  11SA G     1-0.915-1.018-1.198-1.058-0.679-0.442-0.523-0.823-1.144-1.233-1.025
  11SA ALPH 1 0.767 0.819 0.900 1.058 1.258 1.500 1.704 2.031 2.663 3.897 4.007
  11SA BETA 1 1.339 1.201 1.047 0.846 0.620 0.314 0.042-0.405-1.216-2.548-2.586
  11SA NPK  1   162    96    57    33    20    11     7     4     2     1     1
   2     2     0    11
  11SA PERIOD-1.398-1.171-0.943-0.716-0.489-0.261-0.034 0.193 0.420 0.648 0.875
  11SA A     2-1.107-1.084-1.110-1.097-1.135-1.228-1.288-1.334-1.444-1.580-1.661
  11SA B     2-1.161-1.172-1.317-1.532-1.515-1.327-1.486-2.089-2.768-3.138-2.651
  11SA C     2 7.203 7.226 7.506 8.019 8.038 7.794 8.74911.12613.76615.28913.942
  11SA D     2-0.015-0.066-0.071-0.024 0.051 0.120 0.162 0.184 0.200 0.210 0.220
  11SA E     2 0.272 0.181 0.174 0.264 0.345 0.352 0.351 0.333 0.277 0.278 0.257
  11SA F     2 1.401 1.411 1.527 1.685 1.637 1.428 1.494 1.930 2.439 2.740 2.407
  11SA G     2-0.972-1.033-1.122-1.031-0.693-0.360-0.377-0.756-1.123-1.138-0.868
  11SA ALPH 2 0.781 0.836 0.913 1.065 1.268 1.538 1.754 2.067 2.682 3.885 3.938
  11SA BETA 2 1.336 1.200 1.049 0.851 0.620 0.291 0.004-0.438-1.236-2.543-2.547
  11SA NPK  2   162    96    57    33    20    11     7     4     2     1     1
   2     3     0    11
  11SA PERIOD-1.398-1.171-0.943-0.716-0.489-0.261-0.034 0.193 0.420 0.648 0.875
  11SA A     3-1.001-1.054-1.071-1.064-1.110-1.204-1.255-1.287-1.387-1.528-1.619
  11   B     3-1.152-1.248-1.347-1.463-1.469-1.322-1.455-2.031-2.753-3.178-2.730
  11   C     3 7.189 7.480 7.635 7.866 7.960 7.849 8.71610.98313.73415.44414.249
  11   D     3-0.019-0.053-0.060-0.024 0.043 0.109 0.146 0.165 0.186 0.203 0.214
  11   E     3 0.266 0.210 0.207 0.281 0.355 0.368 0.370 0.352 0.302 0.301 0.281
  11   F     3 1.387 1.470 1.557 1.640 1.609 1.433 1.478 1.898 2.440 2.775 2.462
  11   G     3-0.941-1.001-1.108-1.104-0.655-0.332-0.401-0.812-1.145-1.093-0.787
  11   ALPH 3 0.786 0.853 0.937 1.084 1.283 1.552 1.769 2.089 2.695 3.896 3.955
  11   BETA 3 1.332 1.195 1.041 0.842 0.613 0.287-0.002-0.451-1.248-2.553-2.556
  11SA NPK  3   162    96    57    33    20    11     7     4     2     1     1
   2     4     0    11
  11SA PERIOD-1.398-1.171-0.943-0.716-0.489-0.261-0.034 0.193 0.420 0.648 0.875
  11SA A     4-0.991-1.028-1.035-1.040-1.089-1.170-1.216-1.244-1.334-1.470-1.566
  11SA B     4-1.112-1.197-1.297-1.408-1.414-1.335-1.481-1.937-2.597-3.161-2.859
  11SA C     4 7.084 7.340 7.518 7.768 7.886 7.980 8.87310.72113.22615.36514.646
  11SA D     4-0.013-0.045-0.052-0.020 0.039 0.096 0.131 0.148 0.169 0.190 0.204
  11SA E     4 0.278 0.232 0.238 0.301 0.363 0.376 0.380 0.367 0.325 0.317 0.302
  11SA F     4 1.348 1.424 1.516 1.596 1.567 1.445 1.504 1.833 2.332 2.773 2.565
  11SA G     4-0.956-1.026-1.128-0.964-0.579-0.287-0.362-0.754-1.070-0.999-0.691
  11SA ALPH 4 0.782 0.858 0.952 1.104 1.289 1.537 1.755 2.085 2.704 3.941 4.055
  11SA BETA 4 1.339 1.194 1.034 0.832 0.608 0.292 0.003-0.453-1.252-2.566-2.581
  11SA NPK  4   162    96    57    33    20    11     7     4     2     1     1
   2     5     0    11
  11SA PERIOD-1.398-1.171-0.943-0.716-0.489-0.261-0.034 0.193 0.420 0.648 0.875
  11SA A     5-0.987-1.016-1.022-1.027-1.068-1.136-1.174-1.188-1.252-1.373-1.482
  11SA B     5-1.039-1.189-1.307-1.356-1.341-1.253-1.308-1.732-2.431-2.924-2.612
  11SA C     5 6.887 7.336 7.594 7.699 7.775 7.811 8.37010.04612.58614.47713.747
  11SA D     5-0.014-0.034-0.037-0.012 0.035 0.084 0.116 0.132 0.150 0.166 0.170
  11SA E     5 0.288 0.252 0.264 0.317 0.368 0.388 0.393 0.374 0.352 0.370 0.356
  11SA F     5 1.280 1.413 1.519 1.547 1.504 1.382 1.375 1.689 2.231 2.617 2.390
  11SA G     5-0.941-0.974-1.014-0.879-0.575-0.310-0.321-0.609-0.889-0.866-0.601
  11SA ALPH 5 0.787 0.867 0.968 1.114 1.292 1.539 1.759 2.096 2.772 4.079 4.200
  11SA BETA 5 1.334 1.191 1.030 0.828 0.604 0.289-0.004-0.458-1.268-2.613-2.673
  11SA NPK  5   162    96    57    33    20    11     7     4     2     1     1
   2     6     0    11
  11PSVPERIOD-1.398-1.171-0.943-0.716-0.489-0.261-0.034 0.193 0.420 0.648 0.875
  11PSV A    1-1.218-1.277-1.275-1.228-1.241-1.312-1.361-1.409-1.498-1.603-1.705
  11PSV B    1-0.863-1.172-1.364-1.350-1.217-1.148-1.461-2.065-2.468-2.544-2.083
  11PSV C    1 6.149 6.802 6.915 6.423 5.814 5.636 6.802 9.00510.57210.891 9.434
  11PSV D    1-0.036-0.090-0.083-0.013 0.082 0.162 0.205 0.221 0.221 0.207 0.202
  11PSV E    1 0.222 0.052 0.079 0.232 0.324 0.328 0.333 0.319 0.256 0.246 0.231
  11PSV F    1 1.144 1.358 1.502 1.477 1.347 1.257 1.458 1.891 2.185 2.276 1.969
  11PSV G    1-0.900-0.998-1.200-1.097-0.718-0.451-0.527-0.839-1.174-1.279-1.085
  11PSV ALPH1 0.765 0.815 0.897 1.057 1.258 1.500 1.707 2.032 2.665 3.909 4.018
  11PSV BETA1 1.340 1.202 1.046 0.844 0.618 0.311 0.036-0.413-1.237-2.599-2.635
  11PSV NPEK1   162    96    57    33    20    11     7     4     2     1     1
   2     7     0    11
  11PSVPERIOD-1.398-1.171-0.943-0.716-0.489-0.261-0.034 0.193 0.420 0.648 0.875
  11PSV A    2-1.013-1.084-1.108-1.092-1.132-1.227-1.289-1.336-1.430-1.552-1.664
  11PSV B    2-1.186-1.266-1.373-1.482-1.419-1.218-1.370-1.967-2.475-2.578-2.115
  11PSV C    2 6.886 6.911 6.843 6.798 6.456 5.950 6.658 8.79510.64711.075 9.642
  11PSV D    2-0.017-0.067-0.072-0.025 0.049 0.117 0.159 0.181 0.193 0.194 0.201
  11PSV E    2 0.275 0.179 0.171 0.263 0.343 0.349 0.349 0.330 0.269 0.273 0.255
  11PSV F    2 1.422 1.484 1.570 1.641 1.556 1.337 1.399 1.828 2.205 2.302 1.980
  11PSV G    2-0.996-1.030-1.106-1.004-0.676-0.367-0.379-0.737-1.141-1.234-0.991
  11PSV ALPH2 0.782 0.838 0.915 1.064 1.267 1.537 1.756 2.066 2.658 3.846 3.930
  11PSV BETA2 1.335 1.200 1.047 0.849 0.617 0.287-0.002-0.445-1.243-2.569-2.585
  11PSV NPEK2   162    96    57    33    20    11     7     4     2     1     1
```

```
  2    8    0   11
11PSVPERIOD-1.398-1.171-0.943-0.716-0.489-0.261-0.034 0.193 0.420 0.648 0.875
11PSV A    3-0.995-1.056-1.066-1.058-1.107-1.202-1.256-1.288-1.377-1.513-1.650
11PSV B    3-1.129-1.212-1.292-1.375-1.361-1.218-1.351-1.902-2.466-2.680-2.280
11PSV C    3 6.731 6.761 6.624 6.534 6.348 6.021 6.664 8.62910.64411.43610.241
11PSV D    3-0.020-0.053-0.060-0.026 0.039 0.105 0.143 0.161 0.177 0.190 0.206
11PSV E    3 0.267 0.208 0.208 0.282 0.353 0.364 0.368 0.350 0.294 0.301 0.281
11PSV F    3 1.371 1.439 1.510 1.567 1.521 1.347 1.391 1.789 2.210 2.387 2.102
11PSV G    3-0.954-0.986-1.119-1.042-0.684-0.353-0.426-0.866-1.266-1.241-0.852
11PSV ALPH3 0.792 0.853 0.931 1.078 1.279 1.548 1.769 2.082 2.681 3.868 3.901
11PSV BETA3 1.327 1.194 1.042 0.842 0.610 0.284-0.007-0.455-1.260-2.585-2.579
11PSV NPEK3   162    96    57    33    20    11     7     4     2     1     1
  2    9    0   11
11PSVPERIOD-1.398-1.171-0.943-0.716-0.489-0.261-0.034 0.193 0.420 0.648 0.875
11PSV A    4-0.982-1.029-1.035-1.038-1.087-1.172-1.226-1.261-1.345-1.480-1.621
11PSV B    4-1.068-1.137-1.220-1.325-1.319-1.205-1.354-1.848-2.410-2.768-2.416
11PSV C    4 6.562 6.550 6.449 6.457 6.315 6.078 6.767 8.53010.51111.75710.705
11PSV D    4-0.016-0.046-0.054-0.022 0.037 0.094 0.130 0.149 0.169 0.187 0.208
11PSV E    4 0.277 0.230 0.236 0.301 0.362 0.375 0.378 0.363 0.316 0.304 0.278
11PSV F    4 1.309 1.374 1.451 1.526 1.488 1.337 1.394 1.750 2.173 2.460 2.209
11PSV G    4-0.923-0.980-1.080-0.946-0.588-0.280-0.313-0.691-1.056-1.042-0.725
11PSV ALPH4 0.783 0.856 0.951 1.104 1.290 1.539 1.758 2.082 2.691 3.888 3.930
11PSV BETA4 1.337 1.192 1.031 0.829 0.605 0.287-0.004-0.460-1.266-2.587-2.582
11PSV NPEK4   162    96    57    33    20    11     7     4     2     1     1
  2   10    0   11
11PSVPERIOD-1.398-1.171-0.943-0.716-0.489-0.261-0.034 0.193 0.420 0.648 0.875
11PSV A    5-0.983-1.021-1.023-1.027-1.072-1.148-1.196-1.230-1.316-1.455-1.597
11PSV B    5-1.023-1.143-1.227-1.274-1.277-1.202-1.297-1.755-2.344-2.744-2.553
11PSV C    5 6.447 6.595 6.534 6.416 6.327 6.196 6.682 8.30410.34311.71411.170
11PSV D    5-0.016-0.033-0.035-0.011 0.037 0.088 0.122 0.141 0.160 0.184 0.207
11PSV E    5 0.289 0.255 0.264 0.318 0.370 0.387 0.388 0.370 0.338 0.314 0.277
11PSV F    5 1.270 1.374 1.448 1.475 1.446 1.334 1.357 1.686 2.132 2.453 2.328
11PSV G    5-0.864-0.894-0.911-0.783-0.521-0.370-0.355-0.669-0.945-0.902-0.646
11PSV ALPH5 0.793 0.870 0.970 1.119 1.291 1.538 1.761 2.101 2.741 3.979 4.036
11PSV BETA5 1.327 1.186 1.025 0.823 0.603 0.287-0.007-0.470-1.288-2.619-2.605
11PSV NPEK5   162    96    57    33    20    11     7     4     2     1     1
  2   11    0   11
11SV  PER  1-1.398-1.168-0.938-0.708-0.478-0.247-0.017 0.213 0.443 0.673 0.903
11SV   A   1-1.521-1.469-1.340-1.241-1.247-1.310-1.343-1.359-1.405-1.479-1.566
11SV   B   1-1.857-1.836-1.539-1.327-1.195-1.105-1.365-1.905-2.363-2.549-2.339
11SV   C   1 9.629 9.059 7.491 6.365 5.753 5.502 6.490 8.41910.04110.645 9.975
11SV   D   1-0.047-0.099-0.083-0.011 0.079 0.157 0.194 0.202 0.203 0.191 0.173
11SV   E   1-0.020-0.033 0.065 0.227 0.321 0.329 0.338 0.330 0.297 0.307 0.330
11SV   F   1 1.961 1.912 1.644 1.456 1.332 1.227 1.390 1.781 2.126 2.304 2.169
11SV   G   1-1.203-1.214-1.219-1.049-0.749-0.542-0.600-0.872-1.111-1.045-0.721
11SV  ALPH1 1.142 1.135 1.143 1.198 1.273 1.501 1.803 2.299 2.646 3.973 4.387
11SV  BETA1 0.669 0.662 0.653 0.636 0.595 0.309-0.081-0.711-1.205-2.577-2.799
11SV  NPK 1    20    20    20    20    19    11     6     3     2     1     1
  2   12    0   11
11SV  PER  2-1.398-1.168-0.938-0.708-0.478-0.247-0.017 0.213 0.443 0.673 0.903
11SV   A   2-1.290-1.286-1.213-1.130-1.138-1.212-1.250-1.253-1.294-1.391-1.511
11SV   B   2-1.225-1.357-1.612-1.664-1.435-1.181-1.241-1.691-2.219-2.447-2.199
11SV   C   2 7.627 7.583 7.736 7.393 6.499 5.810 6.189 7.745 9.50910.283 9.545
11SV   D   2-0.066-0.118-0.104-0.037 0.043 0.108 0.141 0.155 0.170 0.172 0.159
11SV   E   2 0.068 0.019 0.100 0.251 0.339 0.350 0.354 0.345 0.316 0.332 0.356
11SV   F   2 1.490 1.579 1.770 1.791 1.575 1.315 1.309 1.640 2.047 2.236 2.059
11SV   G   2-1.173-1.181-1.236-1.102-0.769-0.478-0.510-0.837-1.104-1.000-0.630
11SV  ALPH2 1.160 1.132 1.120 1.181 1.280 1.536 1.849 2.342 2.688 3.990 4.358
11SV  BETA2 0.661 0.665 0.674 0.657 0.598 0.289-0.116-0.746-1.235-2.595-2.781
11SV  NPK 2    20    20    20    20    19    11     6     3     2     1     1
  2   13    0   11
11SV  PER  3-1.398-1.168-0.938-0.708-0.478-0.247-0.017 0.213 0.443 0.673 0.903
11SV   A   3-1.235-1.239-1.186-1.108-1.106-1.172-1.207-1.203-1.237-1.331-1.445
11SV   B   3-1.275-1.376-1.487-1.523-1.392-1.187-1.207-1.541-2.039-2.342-2.175
11SV   C   3 7.796 7.700 7.450 7.050 6.427 5.875 6.116 7.272 8.913 9.914 9.439
11SV   D   3-0.067-0.115-0.105-0.044 0.031 0.091 0.120 0.132 0.150 0.155 0.144
11SV   E   3 0.102 0.044 0.118 0.255 0.342 0.359 0.369 0.360 0.330 0.350 0.369
11SV   F   3 1.533 1.594 1.672 1.691 1.556 1.332 1.294 1.538 1.923 2.169 2.048
11SV   G   3-1.283-1.202-1.111-0.987-0.731-0.467-0.475-0.773-1.081-1.103-0.869
11SV  ALPH3 1.159 1.133 1.127 1.186 1.288 1.545 1.868 2.385 2.764 4.104 4.457
11SV  BETA3 0.662 0.667 0.669 0.650 0.592 0.284-0.129-0.775-1.279-2.654-2.835
11SV  NPK 3    20    20    20    20    19    11     6     3     2     1     1
  2   14    0   11
11SV  PER  4-1.398-1.168-0.938-0.708-0.478-0.247-0.017 0.213 0.443 0.673 0.903
11SV   A   4-1.190-1.195-1.156-1.097-1.087-1.139-1.170-1.166-1.191-1.279-1.400
11SV   B   4-1.132-1.337-1.426-1.458-1.367-1.174-1.150-1.392-1.876-2.318-2.299
11SV   C   4 7.377 7.598 7.327 6.950 6.441 5.899 5.976 6.810 8.373 9.799 9.781
11SV   D   4-0.080-0.105-0.095-0.044 0.023 0.078 0.106 0.115 0.130 0.141 0.136
11SV   E   4 0.110 0.081 0.141 0.261 0.343 0.366 0.379 0.374 0.348 0.367 0.391
11SV   F   4 1.409 1.565 1.629 1.644 1.543 1.332 1.259 1.430 1.813 2.163 2.156
11SV   G   4-1.097-1.065-1.052-0.969-0.710-0.397-0.365-0.698-1.051-1.049-0.781
11SV  ALPH4 1.151 1.131 1.130 1.190 1.288 1.550 1.877 2.418 2.830 4.206 4.537
11SV  BETA4 0.659 0.671 0.671 0.649 0.593 0.281-0.133-0.791-1.306-2.688-2.855
11SV  NPK 4    20    20    20    20    19    11     6     3     2     1     1
  2   15    0   11
11SV  PER  5-1.398-1.168-0.938-0.708-0.478-0.247-0.017 0.213 0.443 0.673 0.903
11SV   A   5-1.144-1.152-1.120-1.076-1.068-1.103-1.132-1.130-1.138-1.223-1.368
11SV   B   5-1.165-1.245-1.307-1.391-1.350-1.165-1.103-1.247-1.593-2.031-2.174
11SV   C   5 7.450 7.351 7.055 6.871 6.507 5.952 5.870 6.377 7.481 8.863 9.377
11SV   D   5-0.074-0.099-0.090-0.046 0.013 0.061 0.086 0.096 0.110 0.121 0.117
11SV   E   5 0.127 0.122 0.171 0.264 0.342 0.372 0.386 0.385 0.360 0.374 0.412
11SV   F   5 1.445 1.494 1.535 1.594 1.534 1.331 1.235 1.332 1.601 1.951 2.066
11SV   G   5-1.043-1.057-1.138-1.077-0.744-0.371-0.323-0.615-0.925-0.986-0.847
11SV  ALPH5 1.136 1.129 1.141 1.204 1.300 1.552 1.879 2.437 2.889 4.324 4.616
11SV  BETA5 0.672 0.668 0.663 0.642 0.585 0.278-0.136-0.800-1.334-2.749-2.889
11SV  NPK 5    20    20    20    20    19    11     6     3     2     1     1
  3    0    0    8
11FSIPERIOD-1.398-1.141-0.883-0.626-0.368-0.111 0.146 0.404 0.661 0.919 1.176
11FSIA     1 1.707 1.688 1.559 1.387 1.294 1.316 1.413 1.516 1.537 1.485 1.473
11     B   1 0.341 0.312 0.285 0.272 0.272 0.286 0.312 0.320 0.280 0.216 0.174
11     C   1-4.295-3.467-2.523-1.886-1.626-1.667-1.937-2.097-1.947-1.793-1.983
11     D   1 0.159 0.222 0.178 0.092 0.023-0.016-0.039-0.079-0.102-0.063-0.032
11     E   1 0.011 0.025-0.104-0.264-0.335-0.338-0.277-0.207-0.234-0.214-0.014
11    MEAN 1 0.476 0.496 0.506 0.501 0.496 0.497 0.508 0.519 0.522 0.530 0.541
11    ST DEV 0.321 0.326 0.326 0.315 0.308 0.307 0.314 0.333 0.342 0.329 0.318
  4    1    0    9
11SAI PER  1-1.398-1.171-0.943-0.716-0.489-0.261-0.034 0.193 0.420 0.648 0.875
11SAI A    1 1.262 1.370 1.389 1.268 1.119 1.061 1.124 1.270 1.428 1.490 1.428
11SAI B    1 0.345 0.327 0.301 0.279 0.271 0.278 0.300 0.326 0.329 0.295 0.248
11SAI C    1-3.923-3.718-3.302-2.920-2.766-2.896-3.289-3.810-4.209-4.391-4.533
11SAI D    1 0.192 0.201 0.176 0.113 0.044-0.007-0.034-0.060-0.089-0.105-0.093
11SAI E    1-0.197-0.064-0.089-0.217-0.312-0.341-0.331-0.275-0.212-0.215-0.228
11SAI ALPH1 2.639 2.542 2.528 2.599 2.640 3.886 3.861 3.776 3.558 3.398 3.457
11SAI BETA1-1.169-1.137-1.143-1.178-1.186-2.456-2.456-2.452-2.360-2.268-2.282
11SAI NPK 1     2     2     2     2     2     1     1     1     1     1     1
  4    2    0    9
11SAI PER  2-1.398-1.171-0.943-0.716-0.489-0.261-0.034 0.193 0.420 0.648 0.875
11SAI A    2 1.067 1.170 1.224 1.161 1.050 0.995 1.046 1.194 1.394 1.499 1.412
11SAI B    2 0.310 0.305 0.296 0.287 0.283 0.293 0.317 0.342 0.343 0.307 0.254
11SAI C    2-3.672-3.636-3.436-3.192-3.077-3.204-3.574-4.056-4.423-4.568-4.629
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11SAI D     2 0.184 0.200 0.194 0.149 0.087 0.036 0.004-0.029-0.069-0.097-0.091
11SAI E     2-0.249-0.173-0.176-0.251-0.324-0.350-0.338-0.290-0.241-0.240-0.234
11SAI ALPH2 2.609 2.559 2.560 2.626 2.649 3.842 3.771 3.707 3.551 3.414 3.423
11SAI BETA2-1.164-1.147-1.161-1.203-1.204-2.444-2.418-2.423-2.363-2.278-2.256
11SAI NPK 2     2     2     2     2     2     1     1     1     1     1     1
  4   3   0   9
11SAI PER 3-1.398-1.171-0.943-0.716-0.489-0.261-0.034 0.193 0.420 0.648 0.875
11SAI A     3 1.045 1.111 1.154 1.109 1.021 0.979 1.028 1.161 1.357 1.479 1.396
11SAI B     3 0.307 0.301 0.292 0.285 0.284 0.296 0.322 0.348 0.351 0.317 0.264
11SAI C     3-3.652-3.616-3.452-3.263-3.192-3.342-3.714-4.186-4.550-4.694-4.731
11SAI D     3 0.181 0.191 0.189 0.153 0.097 0.048 0.019-0.012-0.056-0.092-0.092
11SAI E     3-0.266-0.201-0.204-0.271-0.334-0.356-0.346-0.306-0.265-0.267-0.260
11SAI ALPH3 2.613 2.568 2.569 2.626 2.655 3.863 3.786 3.696 3.553 3.437 3.417
11SAI BETA3-1.170-1.152-1.164-1.201-1.207-2.458-2.426-2.413-2.358-2.288-2.256
11SAI NPK 3     2     2     2     2     2     1     1     1     1     1     1
  4   4   0   9
11SAI PER 4-1.398-1.171-0.943-0.716-0.489-0.261-0.034 0.193 0.420 0.648 0.875
11SAI A     4 1.028 1.073 1.104 1.070 0.997 0.968 1.020 1.142 1.308 1.412 1.348
11SAI B     4 0.303 0.297 0.289 0.284 0.286 0.299 0.324 0.350 0.355 0.328 0.284
11SAI C     4-3.621-3.594-3.463-3.324-3.295-3.463-3.829-4.282-4.632-4.793-4.881
11SAI D     4 0.177 0.183 0.181 0.152 0.104 0.058 0.028-0.001-0.041-0.079-0.077
11SAI E     4-0.270-0.223-0.231-0.289-0.343-0.360-0.350-0.317-0.281-0.273-0.266
11SAI ALPH4 2.612 2.572 2.570 2.619 2.648 3.872 3.801 3.705 3.547 3.416 3.406
11SAI BETA4-1.171-1.150-1.158-1.192-1.201-2.463-2.436-2.414-2.344-2.267-2.248
11SAI NPK 4     2     2     2     2     2     1     1     1     1     1     1
  4   5   0   9
11SAI PER 5-1.398-1.171-0.943-0.716-0.489-0.261-0.034 0.193 0.420 0.648 0.875
11SAI A     5 1.005 1.038 1.061 1.035 0.979 0.949 0.976 1.059 1.182 1.278 1.270
11SAI B     5 0.296 0.292 0.287 0.285 0.288 0.301 0.322 0.345 0.354 0.340 0.312
11SAI C     5-3.571-3.569-3.483-3.399-3.409-3.571-3.888-4.286-4.631-4.853-5.015
11SAI D     5 0.170 0.173 0.170 0.149 0.111 0.070 0.040 0.015-0.017-0.041-0.034
11SAI E     5-0.266-0.242-0.256-0.303-0.350-0.367-0.357-0.326-0.299-0.300-0.303
11SAI ALPH5 2.596 2.581 2.583 2.619 2.639 3.865 3.784 3.685 3.558 3.455 3.429
11SAI BETA5-1.164-1.160-1.168-1.193-1.201-2.463-2.420-2.388-2.340-2.292-2.277
11SAI NPK 1     2     2     2     2     2     1     1     1     1     1     1
  4   6   0   9
11IPSVPER 1-1.398-1.171-0.943-0.716-0.489-0.261-0.034 0.193 0.420 0.648 0.875
11IPSVA     1 1.262 1.376 1.400 1.274 1.120 1.061 1.126 1.271 1.428 1.493 1.440
11IPSVB     1 0.348 0.331 0.303 0.280 0.271 0.278 0.301 0.327 0.328 0.296 0.251
11IPSVC     1-3.546-3.129-2.482-1.858-1.467-1.370-1.537-1.829-1.995-1.955-1.897
11IPSVD     1 0.193 0.206 0.180 0.114 0.043-0.007-0.034-0.061-0.090-0.106-0.091
11IPSVE     1-0.197-0.063-0.090-0.219-0.313-0.342-0.331-0.275-0.214-0.216-0.224
11IPSVALPH1 2.631 2.537 2.529 2.605 2.641 3.885 3.866 3.780 3.562 3.424 3.496
11IPSVBETA1-1.163-1.134-1.144-1.182-1.187-2.456-2.462-2.454-2.362-2.284-2.308
11IPSVNPK 1     2     2     2     2     2     1     1     1     1     1     1
  4   7   0   9
11IPSVPER 2-1.398-1.171-0.943-0.716-0.489-0.261-0.034 0.193 0.420 0.648 0.875
11IPSVA     2 1.065 1.177 1.228 1.160 1.048 0.996 1.048 1.195 1.389 1.495 1.442
11IPSVB     2 0.310 0.307 0.298 0.287 0.283 0.293 0.317 0.343 0.344 0.307 0.256
11IPSVC     2-3.276-3.037-2.606-2.122-1.775-1.677-1.823-2.082-2.216-2.132-2.006
11IPSVD     2 0.184 0.203 0.196 0.150 0.087 0.036 0.004-0.028-0.068-0.100-0.094
11IPSVE     2-0.249-0.168-0.171-0.251-0.325-0.350-0.338-0.290-0.242-0.241-0.239
11IPSVALPH2 2.612 2.574 2.572 2.624 2.642 3.841 3.773 3.713 3.558 3.450 3.483
11IPSVBETA2-1.167-1.159-1.171-1.203-1.200-2.444-2.419-2.425-2.367-2.302-2.296
11IPSVNPK 2     2     2     2     2     2     1     1     1     1     1     1
  4   8   0   9
11IPSVPER 3-1.398-1.171-0.943-0.716-0.489-0.261-0.034 0.193 0.420 0.648 0.875
11IPSVA     3 1.041 1.109 1.151 1.107 1.021 0.979 1.027 1.165 1.354 1.467 1.425
11IPSVB     3 0.307 0.300 0.292 0.285 0.284 0.297 0.323 0.350 0.352 0.317 0.262
11IPSVC     3-3.253-2.996-2.604-2.189-1.895-1.821-1.970-2.217-2.347-2.256-2.090
11IPSVD     3 0.180 0.191 0.188 0.152 0.097 0.049 0.020-0.011-0.056-0.096-0.098
11IPSVE     3-0.265-0.201-0.205-0.271-0.334-0.356-0.348-0.306-0.261-0.258-0.258
11IPSVALPH3 2.612 2.562 2.567 2.627 2.656 3.859 3.772 3.696 3.560 3.420 3.366
11IPSVBETA3-1.170-1.149-1.163-1.202-1.208-2.457-2.418-2.414-2.364-2.280-2.227
11IPSVNPK 3     2     2     2     2     2     1     1     1     1     1     1
  4   9   0   9
11IPSVPER 4-1.398-1.171-0.943-0.716-0.489-0.261-0.034 0.193 0.420 0.648 0.875
11IPSV.     4 1.026 1.074 1.103 1.068 0.996 0.966 1.021 1.150 1.320 1.427 1.399
11IPSVB     4 0.304 0.297 0.289 0.284 0.286 0.299 0.325 0.351 0.355 0.322 0.270
11IPSVC     4-3.232-2.983-2.623-2.256-2.001-1.943-2.088-2.322-2.443-2.357-2.201
11IPSVD     4 0.177 0.183 0.181 0.152 0.103 0.056 0.026-0.003-0.045-0.086-0.093
11IPSVE     4-0.270-0.226-0.234-0.289-0.343-0.361-0.351-0.317-0.278-0.265-0.264
11IPSVALPH4 2.614 2.578 2.575 2.623 2.652 3.866 3.794 3.708 3.542 3.390 3.334
11IPSVBETA4-1.173-1.156-1.163-1.194-1.203-2.460-2.433-2.416-2.346-2.259-2.211
11IPSVNPK 4     2     2     2     2     2     1     1     1     1     1     1
  4  10   0   9
11IPSVPER 5-1.398-1.171-0.943-0.716-0.489-0.261-0.034 0.193 0.420 0.648 0.875
11IPSVA     5 0.997 1.035 1.055 1.028 0.976 0.952 0.993 1.110 1.269 1.370 1.369
11IPSVB     5 0.296 0.292 0.287 0.285 0.289 0.304 0.327 0.351 0.356 0.330 0.283
11IPSVC     5-3.172-2.955-2.649-2.345-2.141-2.098-2.221-2.423-2.544-2.495-2.370
11IPSVD     5 0.169 0.171 0.169 0.148 0.107 0.065 0.036 0.007-0.033-0.072-0.087
11IPSVE     5-0.268-0.247-0.262-0.308-0.352-0.367-0.357-0.326-0.288-0.269-0.260
11IPSVALPH5 2.593 2.586 2.601 2.628 2.639 3.855 3.770 3.686 3.552 3.394 3.319
11IPSVBETA5-1.166-1.166-1.180-1.200-1.200-2.456-2.412-2.394-2.348-2.262-2.204
11IPSVNPK 5     2     2     2     2     2     1     1     1     1     1     1
  4  11   0   9
11SVI PER 1-1.398-1.171-0.943-0.716-0.489-0.261-0.034 0.193 0.420 0.648 0.875
11SVI A     1 1.562 1.556 1.460 1.286 1.125 1.059 1.106 1.221 1.349 1.402 1.332
11SVI B     1 0.339 0.320 0.296 0.278 0.271 0.275 0.296 0.324 0.333 0.316 0.292
11SVI C     1-4.010-3.342-2.522-1.859-1.473-1.358-1.498-1.774-1.956-1.962-1.931
11SVI D     1 0.208 0.203 0.173 0.115 0.049-0.002-0.031-0.051-0.070-0.074-0.045
11SVI E     1 0.034 0.032-0.074-0.221-0.314-0.342-0.331-0.287-0.249-0.268-0.308
11SVI ALPH1 2.487 2.486 2.515 2.591 2.627 3.867 3.859 3.807 3.644 3.518 3.574
11SVI BETA1-1.066-1.097-1.134-1.173-1.177-2.444-2.454-2.467-2.401-2.322-2.329
11SVI NPK 1     2     2     2     2     2     1     1     1     1     1     1
  4  12   0   9
11SVI PER 2-1.398-1.171-0.943-0.716-0.489-0.261-0.034 0.193 0.420 0.648 0.875
11SVI A     2 1.371 1.393 1.358 1.222 1.066 0.999 1.028 1.113 1.240 1.329 1.308
11SVI B     2 0.341 0.331 0.311 0.291 0.282 0.287 0.307 0.332 0.343 0.330 0.307
11SVI C     2-4.173-3.640-2.907-2.228-1.793-1.644-1.731-1.935-2.078-2.083-2.053
11SVI D     2 0.237 0.243 0.221 0.164 0.097 0.040 0.007-0.016-0.041-0.056-0.034
11SVI E     2-0.077-0.031-0.098-0.230-0.323-0.348-0.338-0.303-0.270-0.285-0.329
11SVI ALPH2 2.516 2.498 2.535 2.618 2.649 3.872 3.820 3.758 3.613 3.528 3.625
11SVI BETA2-1.089-1.110-1.157-1.206-1.206-2.464-2.445-2.441-2.379-2.324-2.358
11SVI NPK 2     2     2     2     2     2     1     1     1     1     1     1
  4  13   0   9
11SVI PER 3-1.398-1.171-0.943-0.716-0.489-0.261-0.034 0.193 0.420 0.648 0.875
11SVI A     3 1.325 1.349 1.321 1.193 1.040 0.968 0.986 1.058 1.168 1.260 1.272
11SVI B     3 0.340 0.328 0.307 0.288 0.282 0.290 0.310 0.333 0.347 0.341 0.323
11SVI C     3-4.194-3.682-2.984-2.334-1.915-1.770-1.837-2.005-2.137-2.174-2.169
11SVI D     3 0.238 0.241 0.222 0.171 0.110 0.061 0.029 0.004-0.024-0.037-0.015
11SVI E     3-0.107-0.057-0.118-0.241-0.328-0.355-0.349-0.319-0.289-0.295-0.327
11SVI ALPH3 2.482 2.491 2.541 2.619 2.647 3.863 3.797 3.758 3.657 3.538 3.515
11SVI BETA3-1.074-1.105-1.159-1.206-1.206-2.461-2.431-2.435-2.395-2.328-2.304
11SVI NPK 3     2     2     2     2     2     1     1     1     1     1     1
  4  14   0   9
11SVI PER 4-1.398-1.171-0.943-0.716-0.489-0.261-0.034 0.193 0.420 0.648 0.875
11SVI A     4 1.298 1.322 1.293 1.172 1.026 0.948 0.954 1.016 1.111 1.190 1.221
11SVI B     4 0.333 0.322 0.304 0.287 0.282 0.291 0.309 0.329 0.342 0.343 0.334
11SVI C     4-4.184-3.701-3.052-2.441-2.035-1.881-1.917-2.035-2.142-2.205-2.240
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11SVI D    4 0.237 0.237 0.219 0.174 0.119 0.077 0.048 0.016-0.016-0.021 0.001
11SVI E    4-0.107-0.087-0.146-0.251-0.328-0.359-0.359-0.329-0.297-0.303-0.335
11SVI ALPH4 2.475 2.501 2.553 2.620 2.652 3.878 3.797 3.758 3.684 3.569 3.515
11SVI BETA4-1.075-1.111-1.161-1.203-1.208-2.471-2.430-2.429-2.405-2.345-2.313
11SVI NPK 4     2     2     2     2     2     1     1     1     1     1     1
 4  15    0    9
11SVI PER  5-1.398-1.171-0.943-0.716-0.489-0.261-0.034 0.193 0.420 0.648 0.875
11SVI A    5 1.274 1.304 1.268 1.148 1.015 0.941 0.931 0.964 1.031 1.106 1.170
11SVI B    5 0.322 0.315 0.301 0.287 0.284 0.291 0.306 0.323 0.336 0.340 0.340
11SVI C    5-4.139-3.708-3.128-2.567-2.182-2.014-2.008-2.074-2.146-2.217-2.297
11SVI D    5 0.226 0.225 0.211 0.173 0.127 0.093 0.068 0.039 0.006-0.004 0.016
11SVI E    5-0.118-0.120-0.177-0.260-0.325-0.360-0.368-0.345-0.314-0.317-0.351
11SVI ALPH5 2.511 2.555 2.594 2.634 2.651 3.889 3.800 3.738 3.681 3.586 3.495
11SVI BETA5-1.094-1.141-1.182-1.208-1.207-2.480-2.433-2.409-2.387-2.342-2.293
11SVI NPK 5     2     2     2     2     2     1     1     1     1     1     1
 5    0    0   10
11HFSM PER  -1.398-1.141-0.883-0.626-0.368-0.111 0.146 0.404 0.661 0.919 1.176
11HFSM A      -1.00 -1.00 -1.00 -1.00 -1.00 -1.00 -1.00 -1.00 -1.00 -1.00 -1.00
11HFSM B      -1.190-1.360-1.350-0.869-0.465-0.422-0.662-1.020-1.020-0.192 0.199
11HFSM C       7.050 7.050 6.250 4.410 3.120 3.150 4.270 5.680 5.610 2.880 1.780
11HFSM D       0.446 0.823 0.908-0.564-3.050-4.930-6.210-7.970-8.750-7.020-2.620
11HFSM E      -0.047-0.014 0.115 0.273 0.327 0.326 0.289 0.231 0.250 0.195-0.030
11HFSM F       1.370 1.500 1.490 1.110 0.787 0.725 0.849 1.110 1.170 0.598 0.328
11HFSM G      -0.410-0.514-1.150-2.440-3.740-4.470-4.530-4.860-5.780-6.200-5.190
11HFSM RMN     0.003 0.015 0.018 0.006-0.001-0.000 0.024 0.072 0.088 0.037-0.001
11HFSM SIG     0.492 0.479 0.435 0.390 0.379 0.389 0.406 0.450 0.481 0.469 0.501
 6    6    0   11
11HPSV PER1-1.398-1.141-0.883-0.626-0.368-0.111 0.146 0.404 0.661 0.919 1.176
11HPSV A   1 -1.00 -1.00 -1.00 -1.00 -1.00 -1.00 -1.00 -1.00 -1.00 -1.00 -1.00
11HPSV B   1-1.020-1.190-1.300-1.000-0.624-0.636-1.020-1.350-1.220-0.483-0.285
11HPSV C   1 5.950 6.150 5.960 4.700 3.480 3.690 5.300 6.700 6.300 3.880 3.330
11HPSV D   1 0.109 0.328 0.320-0.997-2.940-4.760-6.910-9.090-9.260-7.750-5.810
11HPSV E   1 0.168 0.107 0.137 0.279 0.341 0.343 0.322 0.266 0.250 0.201 0.049
11HPSV F   1 1.250 1.370 1.450 1.210 0.909 0.886 1.120 1.330 1.280 0.787 0.686
11HPSV G   1-0.757-0.785-1.190-2.320-3.650-4.520-4.560-4.610-5.200-5.470-4.090
11HPSV ALF1 1.280 1.170 1.160 1.290 1.350 1.370 1.470 1.440 1.770 2.730 2.650
11HPSV BTA1 1.000 0.984 0.978 0.988 0.993 0.959 0.771 0.502-0.022-0.665-0.485
11HPSV NPK1    10    10    10    10    10     9     6     4     2     1     1
 6    7    0   11
11HPSV PER2-1.398-1.141-0.883-0.626-0.368-0.111 0.146 0.404 0.661 0.919 1.176
11HPSV A   2 -1.00 -1.00 -1.00 -1.00 -1.00 -1.00 -1.00 -1.00 -1.00 -1.00 -1.00
11HPSV B   2-0.978-1.130-1.320-1.190-0.850-0.756-1.030-1.380-1.270-0.582-0.691
11HPSV C   2 5.750 5.940 6.020 5.300 4.250 4.190 5.440 6.880 6.540 4.280 4.810
11HPSV D   2 0.062-0.000-0.031-0.642-1.970-3.990-6.300-8.250-8.720-7.580-6.120
11HPSV E   2 0.254 0.202 0.208 0.311 0.364 0.366 0.339 0.281 0.265 0.213 0.093
11HPSV F   2 1.250 1.360 1.510 1.410 1.120 0.991 1.140 1.370 1.310 0.859 0.970
11HPSV G   2-1.090-0.774-0.889-2.120-3.420-4.050-4.140-4.340-4.960-5.450-4.210
11HPSV ALF2 1.630 1.450 1.370 1.450 1.500 1.500 1.570 1.490 1.790 2.740 2.590
11HPSV BTA2 1.010 0.994 0.992 1.000 1.000 0.960 0.756 0.482-0.029-0.655-0.489
11HPSV NPK2    10    10    10    10    10     9     6     4     2     1     1
 6    8    0   11
11HPSV PER3-1.398-1.141-0.883-0.626-0.368-0.111 0.146 0.404 0.661 0.919 1.176
11HPSV A   3 -1.00 -1.00 -1.00 -1.00 -1.00 -1.00 -1.00 -1.00 -1.00 -1.00 -1.00
11HPSV B   3-0.928-1.050-1.210-1.130-0.828-0.769-1.050-1.370-1.290-0.677-0.767
11HPSV C   3 5.620 5.750 5.770 5.200 4.250 4.300 5.540 6.900 6.700 4.670 5.110
11HPSV D   3-0.093-0.438-0.343-0.361-1.680-3.700-5.830-7.890-8.550-7.490-4.410
11HPSV E   3 0.270 0.234 0.242 0.327 0.377 0.383 0.362 0.310 0.291 0.239 0.116
11HPSV F   3 1.210 1.300 1.440 1.370 1.110 1.010 1.160 1.360 1.320 0.920 1.030
11HPSV G   3-1.220-0.961-0.967-2.030-3.200-3.790-3.970-4.100-4.380-4.970-5.420
11HPSV ALF3 1.670 1.530 1.460 1.520 1.570 1.560 1.640 1.540 1.810 2.740 2.830
11HPSV BTA3 1.010 0.998 0.996 1.000 1.000 0.959 0.753 0.480-0.039-0.690-0.514
11HPSV NPK3    10    10    10    10    10     9     6     4     2     1     1
 6    9    0   11
11HPSV PER4-1.398-1.141-0.883-0.626-0.368-0.111 0.146 0.404 0.661 0.919 1.176
11HPSV A   4 -1.00 -1.00 -1.00 -1.00 -1.00 -1.00 -1.00 -1.00 -1.00 -1.00 -1.00
11HPSV B   4-0.871-0.986-1.140-1.060-0.797-0.800-1.070-1.320-1.340-0.863-0.858
11HPSV C   4 5.450 5.570 5.600 5.090 4.260 4.490 5.670 6.800 6.920 5.330 5.420
11HPSV D   4-0.145-0.430-0.051-0.295-1.800-3.480-5.610-7.560-8.330-7.580-4.730
11HPSV E   4 0.270 0.253 0.268 0.338 0.382 0.391 0.375 0.325 0.275 0.228 0.237
11HPSV F   4 1.160 1.260 1.380 1.320 1.080 1.030 1.180 1.330 1.370 1.070 1.080
11HPSV G   4-1.650-1.500-1.390-2.020-3.010-3.570-3.690-3.980-4.570-5.020-4.450
11HPSV ALF4 1.680 1.580 1.530 1.590 1.620 1.610 1.700 1.590 1.850 2.770 2.860
11HPSV BTA4 1.010 1.000 1.000 1.000 0.999 0.956 0.752 0.475-0.035-0.673-0.523
11HPSV NPK4    10    10    10    10    10     9     6     4     2     1     1
 6   10    0   11
11HPSV PER5-1.398-1.141-0.883-0.626-0.368-0.111 0.146 0.404 0.661 0.919 1.176
11HPSV A   5 -1.00 -1.00 -1.00 -1.00 -1.00 -1.00 -1.00 -1.00 -1.00 -1.00 -1.00
11HPSV B   5-0.873-0.966-1.060-0.993-0.827-0.801-1.000-1.270-1.330-0.960-0.780
11HPSV C   5 5.460 5.540 5.450 5.010 4.490 4.590 5.520 6.680 6.940 5.730 5.380
11HPSV D   5-0.004-0.186 0.062-0.587-2.050-3.270-5.120-7.230-8.070-7.590-6.320
11HPSV E   5 0.290 0.277 0.294 0.352 0.395 0.402 0.385 0.346 0.288 0.229 0.199
11HPSV F   5 1.160 1.240 1.320 1.260 1.110 1.040 1.140 1.300 1.370 1.130 1.000
11HPSV G   5-1.550-1.830-1.910-2.250-3.170-3.630-3.580-3.830-4.350-4.650-4.440
11HPSV ALF5 1.700 1.600 1.590 1.640 1.640 1.650 1.750 1.660 1.930 2.830 2.860
11HPSV BTA5 1.010 1.010 1.000 1.010 1.020 0.964 0.747 0.473-0.030-0.668-0.572
11HPSV NPK5    10    10    10    10    10     9     6     4     2     1     1
 7    0    0    8
11IHFS PER  -1.398-1.141-0.883-0.626-0.368-0.111 0.146 0.404 0.661 0.919 1.176
11IHFS A      1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000
11IHFS B      0.340 0.312 0.278 0.269 0.266 0.276 0.308 0.322 0.277 0.203 0.175
11IHFS C     -3.200-2.460-1.490-1.080-0.951-1.030-1.360-1.590-1.400-1.120-1.320
11IHFS D     -3.370-2.920-1.980-0.038 2.090 4.230 6.730 9.72010.500 7.460 4.400
11IHFS E      0.039 0.008-0.124-0.281-0.343-0.347-0.287-0.204-0.237-0.226-0.004
11IHFS RMN   -0.069-0.046-0.024-0.020-0.016-0.012-0.002 0.010 0.012-0.010-0.044
11IHFS SIG    0.581 0.574 0.523 0.442 0.400 0.401 0.426 0.475 0.496 0.467 0.500
 8    6    0    9
11IHPSVPER1-1.398-1.141-0.883-0.626-0.368-0.111 0.146 0.404 0.661 0.919 1.176
11IHPSVA   1 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000
11IHPSVB   1 0.349 0.326 0.291 0.271 0.265 0.282 0.318 0.331 0.287 0.229 0.235
11IHPSVC   1-2.730-2.210-1.390-0.945-0.806-0.931-1.300-1.560-1.400-1.250-1.670
11IHPSVD   1-2.530-2.890-2.400 0.052 2.320 4.580 7.34010.20010.900 8.650 6.890
11IHPSVE   1-0.134-0.091-0.141-0.282-0.342-0.350-0.306-0.217-0.215-0.229-0.108
11IHPSVALF1 1.940 1.780 1.800 2.170 2.480 3.700 3.320 2.750 2.500 2.660 2.580
11IHPSVBTA1 0.230 0.205 0.179 0.175 0.179-0.450-0.491-0.529-0.532-0.475-0.319
11IHPSVNPK1     2     2     2     2     2     1     1     1     1     1     1
 8    7    0    9
11IHPSVPER2-1.398-1.141-0.883-0.626-0.368-0.111 0.146 0.404 0.661 0.919 1.176
11IHPSVA   2 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000
11IHPSVB   2 0.310 0.306 0.294 0.282 0.280 0.299 0.334 0.350 0.301 0.235 0.266
11IHPSVC   2-2.600-2.270-1.680-1.240-1.100-1.220-1.550-1.790-1.580-1.350-1.900
11IHPSVD   2-0.961-1.540-2.130-1.240 0.898 3.660 6.470 9.29010.200 8.290 4.810
11IHPSVE   2-0.238-0.193-0.206-0.303-0.354-0.357-0.319-0.242-0.237-0.239-0.124
11IHPSVALF2 2.310 2.100 2.050 2.340 2.590 3.870 3.490 2.830 2.480 2.640 2.650
11IHPSVBTA2 0.230 0.214 0.193 0.178 0.179-0.446-0.490-0.537-0.540-0.479-0.376
11IHPSVNPK2     2     2     2     2     2     1     1     1     1     1     1
 8    8    0    9
11IHPSVPER3-1.398-1.141-0.883-0.626-0.368-0.111 0.146 0.404 0.661 0.919 1.176
11IHPSVA   3 1.000 1.000 1.000 1.000 1.0() 1.000 1.000 1.000 1.000 1.000 1.000
11IHPSVB   3 0.304 0.298 0.288 0.281 0.283 0.305 0.340 0.356 0.311 0.242 0.242
11IHPSVC   3-2.560-2.260-1.730-1.360-1.230-1.360-1.680-1.910-1.720-1.460-1.760
```

```
11IHPSVD   3-0.835-1.520-2.080-1.100 0.686 3.100 5.910 9.18010.600 8.770 5.340
11IHPSVE   3-0.257-0.223-0.237-0.318-0.362-0.366-0.334-0.269-0.259-0.258-0.175
11IHPSVALF3 2.410 2.220 2.170 2.430 2.660 3.930 3.560 2.880 2.480 2.600 2.790
11IHPSVBTA3 0.231 0.217 0.198 0.183 0.183-0.443-0.485-0.527-0.527-0.469-0.358
11IHPSVNPK3     2     2     2     2     2     1     1     1     1     1     1
 8   9   0   9
11IHPSVPER4-1.398-1.141-0.883-0.626-0.368-0.111 0.146 0.404 0.661 0.919 1.176
11IHPSVA   4 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000
11IHPSVB   4 0.301 0.294 0.285 0.282 0.286 0.307 0.340 0.357 0.319 0.255 0.253
11IHPSVC   4-2.560-2.270-1.800-1.470-1.360-1.490-1.780-1.990-1.840-1.610-1.860
11IHPSVD   4-0.406-1.080-1.870-1.260 0.388 3.040 5.840 8.550 9.830 8.300 4.880
11IHPSVE   4-0.273-0.250-0.263-0.331-0.369-0.369-0.340-0.281-0.256-0.258-0.250
11IHPSVALF4 2.440 2.300 2.280 2.510 2.700 3.990 3.620 2.970 2.560 2.630 2.710
11IHPSVBTA4 0.230 0.220 0.203 0.188 0.185-0.444-0.482-0.529-0.529-0.474-0.380
11IHPSVNPK4     2     2     2     2     2     1     1     1     1     1     1
 8  10   0   9
11IHPSVPER5-1.398-1.141-0.883-0.626-0.368-0.111 0.146 0.404 0.661 0.919 1.176
11IHPSVA   5 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000
11IHPSVB   5 0.292 0.289 0.284 0.284 0.291 0.311 0.340 0.356 0.325 0.271 0.266
11IHPSVC   5-2.500-2.270-1.880-1.600-1.520-1.630-1.880-2.080-1.980-1.810-2.050
11IHPSVD   5-0.457-0.741-1.370-0.890 0.611 2.620 5.020 7.930 9.390 8.550 6.630
11IHPSVE   5-0.277-0.270-0.291-0.345-0.377-0.376-0.349-0.295-0.264-0.260-0.223
11IHPSVALF5 2.480 2.410 2.440 2.590 2.710 3.990 3.660 3.060 2.670 2.670 2.650
11IHPSVBET5 0.227 0.220 0.205 0.192 0.192-0.428-0.467-0.520-0.524-0.472-0.407
11IHPSVNPK5     2     2     2     2     2     1     1     1     1     1     1
```

Listing of an Example of Part I
of the Input for Computer Program EQRISK

```
6 8 1 0 1 0 6 0 0 111 1 1.0
    117.9       34.1     0  2.3    20 4179  LA. VICINITY
      0.9        0.5        0.3        0.2        0.1       0.05       0.02      0.01
    0.005      0.002      0.001     0.0450     0.0138    0.00711    0.00445   0.00210
 0.001025   0.000404   0.000201     0.0001
```

Listing of an Example of Part 3
of the Input for Computer Program EQRISK

```
  0    2    1    0              8
3 0 2 511 SIERRA MADRE - CUCAMONGA FAULT ZONE
     0.0        0.86       2.75        7.5        3.8        24.0
  118.480      34.281 WEST END - 1971 BREAK
  118.420      34.293  CENTER,1971 BREAK
  118.294      34.266  EAST END,1971 BREAK
  118.128      34.185  ALTADENA
  118.000      34.158  RAYMOND FAULT
  117.910      34.144  AZUSA
  117.844      34.152  GLENDORA
  117.735      34.118  CLAREMONT
  117.645      34.163  ALTA LOMA
  117.488      34.165  RIALTO-COLTON FAULT
  117.425      34.196  SAN JACINTO FAULT - EAST END
3 0 2 517 SAN ANDREAS FAULT - CAJON PASS TO SAN LUIS OBISPO
     0.0        0.86       2.75        8.5        7.9        25.0
  117.482      34.277     CAJON JCT.
  117.627      34.345     WRIGHTWOOD
  117.844      34.438     VALLERMO
  118.285      34.612     LEONA VALLEY
  118.713      34.759     SANDBERG
  118.946      34.818     FRAZIER PARK
  119.008      34.816     BIG PINE FLT. JCT
  119.251      34.871     BIG BEND
  119.364      34.911     BIG BEND
  119.443      34.963     RT. 166 & 33
  119.675      35.136     SOUTH CARRIZO PLAIN
  119.885      35.329     HWY. 58
  120.296      35.718     CHOLAME
  120.337      35.806
  120.424      35.889     PARKFIELD
  121.248      36.647     "ABOVE S"
  121.533      36.843     SAN JUAN BAUTISTA - S.END,1906
4 0 2 0 2 TRANSVERSE RANGES
                9.6        2.8       0.84       0.25      0.073      0.022      .0064

     33.0      121.0      117.5
     35.5      121.0      117.5
```

Listing of the Printer Output Generated by
Computer Program EQRISK for the Preceding Sample Inputs

```
1THE FREQUENCY DEPENDENT SEISMIC RISK

     THIS PROGRAM USES A METHOD DEVELOPED BY J.G.ANDERSON AND M.D.TRIFUNAC

     CONTROL PARAMETERS
  MTY   MRS   MAL  ILTL  IPPL IMRAC   MRL  IPPC LSSUP  IDL1  IDL2  IDL3
    6     8     1     0     1     0     6     0     0     1    11     1
     SEE PROGRAM LISTING FOR EXPLANATION

     YRS =      1.000
     INPUT SEISMICITY RATES ARE MULTIPLIED BY YRS FOR RISK CALCULATIONS

     AMPLITUDE - DISTANCE CURVE FOR   CALIFORNIA           GIVEN AT   71  POINTS
       0.0 -1.400      5.0 -1.500     10.0 -1.605     15.0 -1.716     20.0 -1.833
      25.0 -1.955     30.0 -2.078     35.0 -2.199     40.0 -2.314     45.0 -2.421
      50.0 -2.517     55.0 -2.603     60.0 -2.679     65.0 -2.746     70.0 -2.805
      80.0 -2.920     85.0 -2.958     90.0 -2.989     95.0 -3.020    100.0 -3.044
     110.0 -3.089    120.0 -3.135    130.0 -3.182    140.0 -3.230    150.0 -3.279
     160.0 -3.328    170.0 -3.378    180.0 -3.429    190.0 -3.480    200.0 -3.530
     210.0 -3.581    220.0 -3.631    230.0 -3.680    240.0 -3.729    250.0 -3.779
     260.0 -3.828    270.0 -3.877    280.0 -3.926    290.0 -3.975    300.0 -4.024
     310.0 -4.072    320.0 -4.119    330.0 -4.164    340.0 -4.209    350.0 -4.253
     360.0 -4.295    370.0 -4.336    380.0 -4.376    390.0 -4.414    400.0 -4.451
     410.0 -4.485    420.0 -4.518    430.0 -4.549    440.0 -4.579    450.0 -4.607
     460.0 -4.634    470.0 -4.660    480.0 -4.685    490.0 -4.709    500.0 -4.732
     510.0 -4.755    520.0 -4.776    530.0 -4.797    540.0 -4.817    550.0 -4.835
     560.0 -4.853    570.0 -4.869    580.0 -4.885    590.0 -4.900    600.0 -4.900
    1000.0 -5.700
     11HPSV PER3-1.398-1.141-0.883-0.626-0.368-0.111 0.146 0.404 0.661 0.919 1.176
     11HPSV A   3-1.000-1.000-1.000-1.000-1.000-1.000-1.000-1.000-1.000-1.000-1.000
     11HPSV B   3-0.928-1.050-1.210-1.130-0.828-0.769-1.050-1.370-1.290-0.677-0.767
     11HPSV C   3 5.620 5.750 5.770 5.200 4.250 4.300 5.540 6.900 6.700 4.670 5.110
     11HPSV D   3-0.093-0.438-0.343-0.361-1.680-3.700-5.830-7.890-8.550-7.490-4.410
     11HPSV E   3 0.270 0.234 0.242 0.327 0.377 0.383 0.362 0.310 0.291 0.239 0.116
     11HPSV F   3 1.210 1.300 1.440 1.370 1.110 1.010 1.160 1.360 1.320 0.920 1.030
     11HPSV G   3-1.220-0.961-0.967-2.030-3.200-3.790-3.970-4.100-4.380-4.970-5.420
     11HPSV ALF3 1.670 1.530 1.460 1.520 1.570 1.560 1.640 1.540 1.810 2.740 2.830
     11HPSV BTA3 1.010 0.998 0.996 1.000 1.000 0.959 0.753 0.480-0.039-0.690-0.514
     11HPSV NPK3    10    10    10    10    10     9     6     4     2     1     1


1THE FREQUENCY DEPENDENT SEISMIC RISK

     THE RISK IS FOUND FOR THE SITE
      LA. VICINITY                                    SITE NO. 4179
      117.90000  DEG WEST LONGITUDE
       34.10000  DEG NORTH LATITUDE
     IV =      0
    HIS =  2.300
     RISK FOUND FOR    20    PROBABILITIES OF EXCEEDANCE --
  0.90000    0.50000    0.30000    0.20000    0.10000
  0.05000    0.02000    0.01000    0.00500    0.00200
  0.00100    0.04500    0.01380    0.00711    0.00445
  0.00210    0.00103    0.00040    0.00020    0.00010
```

```
1    THE FOLLOWING SOURCES TREATED AS POISSON
      MODEL OF SEISMICITY NO. (MOSN)...    8

    THE SEISMICITY IS REGARDED AS A SUPERPOSITION OF
       0  POINT SOURCES
       2  LINE SOURCES (FAULTS)
       1  REGIONS OF DIFFUSE SEISMICITY
       0  DIPPING PLANES

    LINE SOURCE    SIERRA MADRE - CUCAMONGA FAULT ZONE

    SEISMICITY INPUT BY MOMENT RATE (PER YEAR),B, MMAX
    A,B,M-MIN,M-MAX,MO/YR
    3.948       0.860       2.750       7.500     0.38000E+25
    SEISMICITY SCALED UP BY FACTOR OF        1.000
      LOCATIONS OF ENDS ARE
     118.48000   WEST LONGITUDE        34.28100  NORTH LATITUDE
     117.42500   WEST LONGITUDE        34.19600  NORTH LATITUDE
    FAULT IS REPRESENTED BY     11 - 1  STRAIGHT LINE SEGMENTS
    ISI=  3
    SEISMICITY - MAGNITUDE AND NUMBER OF EARTHQUAKES,  ASSUMED FAULT LENGTH
       3.0   12.1547090    0.1259
       3.5    4.5159031    0.2512
       4.0    1.6778171    0.5012
       4.5    0.6233682    1.0000
       5.0    0.2316032    1.9953
       5.5    0.0860488    3.9811
       6.0    0.0319701    7.9433
       6.5    0.0118780   15.8489
       7.0    0.0044131   31.6228
       7.5    0.0010187   63.0957
       8.0    0.0000000  125.8926
       8.5    0.0000000  251.1887
    THE FAULT IS REPRESENTED BY    22  POINTS AT SPACING OF   5.00  KILOMETER
    THIS GIVES A LENGTH OF   105.00  KILOMETER
    INSERTED IN DISTANCE AND SEISMICITY ARRAYS IN POSITIONS       1  TO      22


    LINE SOURCE   SAN ANDREAS FAULT - CAJON PASS TO SAN LUIS OBISPO

    SEISMICITY INPUT BY MOMENT RATE (PER YEAR),B, MMAX
    A,B,M-MIN,M-MAX,MO/YR
    4.626       0.860       2.750       8.500     0.79000E+26
    SEISMICITY SCALED UP BY FACTOR OF        1.000
      LOCATIONS OF ENDS ARE
     117.48200   WEST LONGITUDE        34.27700  NORTH LATITUDE
     121.53300   WEST LONGITUDE        36.84300  NORTH LATITUDE
    FAULT IS REPRESENTED BY     17 - 1  STRAIGHT LINE SEGMENTS
    ISI=  3
    SEISMICITY - MAGNITUDE AND NUMBER OF EARTHQUAKES,  ASSUMED FAULT LENGTH
       3.0   57.8879360    0.1259
       3.5   21.5074090    0.2512
       4.0    7.9907603    0.5012
       4.5    2.9688489    1.0000
       5.0    1.1030320    1.9953
       5.5    0.4098152    3.9811
       6.0    0.1522608    7.9433
       6.5    0.0565702   15.8489
       7.0    0.0210178   31.6228
```

```
  7.5     0.0078089   63.0957
  8.0     0.0029013  125.8926
  8.5     0.0006697  251.1887
THE FAULT IS REPRESENTED BY    96  POINTS AT SPACING OF   5.00  KILOMETER
THIS GIVES A LENGTH OF  475.00  KILOMETER
INSERTED IN DISTANCE AND SEISMICITY ARRAYS IN POSITIONS      1  TO     96


DIFFUSE SEISMICITY REGION  TRANSVERSE RANGES

N(M) READ DIRECTLY
SEISMICITY SCALED UP BY FACTOR OF     1.000
SEISMICITY - MAGNITUDE AND NUMBER OF EARTHQUAKES
  3.0     0.0000000
  3.5     9.6000000
  4.0     2.8000000
  4.5     0.8400000
  5.0     0.2500000
  5.5     0.0730000
  6.0     0.0220000
  6.5     0.0064000
  7.0     0.0000000
  7.5     0.0000000
  8.0     0.0000000
  8.5     0.0000000
EVENTS ARE ASSUMED TO BE UNILATERAL RUPTURES
 INPUT GIVES LONGITUDE OF EAST AND WEST BOUNDARY AT  2  LATITUDES
INITIALLY     4  RECTANGLES
REGION HAS AREA            89388.3
BEGINNING AREA-DISTANCE CHECKS
AREA, CORNER DISTANCE, CENTER DISTANCE
 10000.000        220.000         339.052
NOW    16  RECTANGLES
REGION HAS AREA            89388.3
AREA, CORNER DISTANCE, CENTER DISTANCE
  1140.000         75.000         154.057
NOW    80  RECTANGLES
REGION HAS AREA            89388.3
AREA, CORNER DISTANCE, CENTER DISTANCE
   130.000         25.000          51.693
NOW   184  RECTANGLES
REGION HAS AREA            89388.3
AREA, CORNER DISTANCE, CENTER DISTANCE
    15.000          9.000          18.014
NOW   304  RECTANGLES
REGION HAS AREA            89388.3
INSERTED INTO RA,SA  ARRAYS IN ELEMENTS     1  TO  304


ML,MX     1    12
MAGNITUDE-RUPTURE LENGTH NO...    6
  3.0    1.3183
  3.5    2.4266
  4.0    4.4668
  4.5    8.2224
  5.0   15.1356
  5.5   27.8612
  6.0   51.2861
  6.5   94.4061
  7.0  173.7801
  7.5  319.8895
  8.0  588.8437
  8.5 1083.9269
DATA COMPRESSED TO  144   DISTANCES FOR INTEGRATION
```

1 LOG10(EXPECTED NUMBER OF EXCEEDANCES) --- IV = 0 HIS = 2.300

LOG(SL)	LOG(PER) -1.39800	-1.14100	-0.88300	-0.62600	-0.36800	-0.11100	0.14600	0.40400	0.66100	0.91900	1.17600
-5.00	2.09658	2.09679	2.09704	2.09705	2.09705	2.09705	2.09705	2.09705	2.09701	2.09697	2.09690
-4.80	2.09442	2.09565	2.09699	2.09705	2.09705	2.09705	2.09705	2.09704	2.09698	2.09691	2.09679
-4.60	2.08688	2.09142	2.09671	2.09705	2.09705	2.09705	2.09705	2.09704	2.09691	2.09681	2.09660
-4.40	2.06986	2.08059	2.09540	2.09705	2.09705	2.09705	2.09705	2.09703	2.09678	2.09663	2.09626
-4.20	2.04301	2.06087	2.09093	2.09704	2.09705	2.09705	2.09705	2.09700	2.09650	2.09633	2.09566
-4.00	2.00883	2.03309	2.08005	2.09700	2.09705	2.09705	2.09704	2.09689	2.09594	2.09581	2.09460
-3.80	1.96780	1.99891	2.06059	2.09674	2.09705	2.09705	2.09704	2.09657	2.09484	2.09491	2.09275
-3.60	1.91836	1.95824	2.03312	2.09533	2.09704	2.09705	2.09699	2.09569	2.09267	2.09335	2.08950
-3.40	1.85953	1.90970	1.99905	2.09003	2.09703	2.09704	2.09676	2.09335	2.08853	2.09067	2.08381
-3.20	1.79220	1.85248	1.95841	2.07610	2.09688	2.09697	2.09576	2.08767	2.08082	2.08605	2.07392
-3.00	1.71472	1.78703	1.91000	2.05005	2.09592	2.09652	2.09208	2.07520	2.06697	2.07815	2.05688
-2.80	1.62126	1.71175	1.85308	2.01229	2.09133	2.09414	2.08097	2.05081	2.04324	2.06470	2.02804
-2.60	1.50978	1.62202	1.78781	1.96418	2.07642	2.08493	2.05448	2.00891	2.00490	2.04215	1.98071
-2.40	1.38442	1.51540	1.71262	1.90570	2.04330	2.05971	2.00520	1.94594	1.94734	2.00515	1.90722
-2.20	1.24504	1.39420	1.62346	1.83697	1.99014	2.01064	1.93265	1.86227	1.86798	1.94691	1.80322
-2.00	1.08622	1.25912	1.51805	1.75695	1.92141	1.93939	1.84194	1.76047	1.76788	1.86151	1.67342
-1.80	0.91137	1.10672	1.39799	1.66188	1.83981	1.85216	1.73443	1.64203	1.65025	1.74935	1.52614
-1.60	0.72849	0.93810	1.26396	1.54985	1.74242	1.74801	1.60869	1.50776	1.51696	1.61836	1.36272
-1.40	0.53878	0.75977	1.11345	1.42334	1.62604	1.62464	1.46781	1.35988	1.36926	1.47113	1.18848
-1.20	0.34339	0.57540	0.94725	1.28294	1.49350	1.48588	1.31474	1.20094	1.21044	1.30732	1.00650
-1.00	0.14150	0.38623	0.77095	1.12598	1.34714	1.33341	1.15007	1.03318	1.04319	1.13497	0.81552
-0.80	-0.07062	0.19187	0.58873	0.95463	1.18421	1.16600	0.97747	0.85984	0.86967	0.95147	0.61909
-0.60	-0.29316	-0.01012	0.40220	0.77466	1.00665	0.98727	0.80069	0.68399	0.69347	0.75995	0.41271
-0.40	-0.52758	-0.22084	0.21108	0.58873	0.82010	0.80120	0.62084	0.50689	0.51575	0.56429	0.19731
-0.20	-0.77531	-0.44189	0.01348	0.39795	0.62577	0.60836	0.43820	0.32852	0.33612	0.35819	-0.03089
0.00	-1.03703	-0.67524	-0.19182	0.20150	0.42411	0.40919	0.25134	0.14802	0.15398	0.14593	-0.27371
0.20	-1.31401	-0.92172	-0.40677	-0.00278	0.21445	0.20226	0.05889	-0.03583	-0.03277	-0.07813	-0.53245
0.40	-1.60747	-1.18255	-0.63370	-0.21571	-0.00588	-0.01440	-0.14013	-0.22449	-0.22512	-0.31359	-0.81100
0.60	-1.92558	-1.45896	-0.87394	-0.43930	-0.23762	-0.24161	-0.34788	-0.41961	-0.42478	-0.56167	-1.10797
0.80	-2.29616	-1.75467	-1.12915	-0.67530	-0.48127	-0.48037	-0.56530	-0.62232	-0.63360	-0.82430	-1.42332
1.00	-2.76820	-2.08419	-1.40096	-0.92442	-0.73683	-0.73032	-0.79243	-0.83343	-0.85207	-1.09961	-1.75180
1.20	-3.39826	-2.47930	-1.69279	-1.18838	-1.00379	-0.98996	-1.02907	-1.05341	-1.08113	-1.38737	-2.09453
1.40	-4.24340	-2.98311	-2.01714	-1.46927	-1.28279	-1.25786	-1.27374	-1.28201	-1.32060	-1.68519	-2.46972
1.60	-5.37423	-3.64024	-2.40192	-1.77213	-1.57655	-1.53477	-1.52615	-1.51956	-1.57006	-1.99561	-2.91981
1.80	-6.89537	-4.49784	-2.88553	-2.11336	-1.89326	-1.82696	-1.79022	-1.76830	-1.83150	-2.33007	-3.51048
2.00	-8.00000	-5.61809	-3.50798	-2.52636	-2.25327	-2.14913	-2.07606	-2.03390	-2.11029	-2.71529	-4.35057
2.20	-8.00000	-7.09115	-4.31117	-3.05462	-2.69294	-2.52646	-2.40161	-2.32752	-2.41803	-3.19304	-5.63126
2.40	-8.00000	-8.00000	-5.34885	-3.74264	-3.25802	-2.99429	-2.79298	-2.66600	-2.77327	-3.82788	-7.72010
2.60	-8.00000	-8.00000	-6.69719	-4.63917	-3.99579	-3.59360	-3.28390	-3.07133	-3.20137	-4.73114	-8.00000
2.80	-8.00000	-8.00000	-8.00000	-5.81021	-4.96008	-4.36917	-3.91516	-3.57064	-3.73640	-6.11783	-8.00000
3.00	-8.00000	-8.00000	-8.00000	-7.35083	-6.22584	-5.37707	-4.73731	-4.19743	-4.42511	-8.00000	-8.00000
3.20	-8.00000	-8.00000	-8.00000	-8.00000	-7.90197	-6.69888	-5.82074	-4.99591	-5.33563	-8.00000	-8.00000
3.40	-8.00000	-8.00000	-8.00000	-8.00000	-8.00000	-8.00000	-7.27278	-6.02860	-6.57122	-8.00000	-8.00000
3.60	-8.00000	-8.00000	-8.00000	-8.00000	-8.00000	-8.00000	-8.00000	-7.38764	-8.00000	-8.00000	-8.00000
3.80	-8.00000	-8.00000	-8.00000	-8.00000	-8.00000	-8.00000	-8.00000	-8.00000	-8.00000	-8.00000	-8.00000
4.00	-8.00000	-8.00000	-8.00000	-8.00000	-8.00000	-8.00000	-8.00000	-8.00000	-8.00000	-8.00000	-8.00000
4.20	-8.00000	-8.00000	-8.00000	-8.00000	-8.00000	-8.00000	-8.00000	-8.00000	-8.00000	-8.00000	-8.00000
4.40	-8.00000	-8.00000	-8.00000	-8.00000	-8.00000	-8.00000	-8.00000	-8.00000	-8.00000	-8.00000	-8.00000
4.60	-8.00000	-8.00000	-8.00000	-8.00000	-8.00000	-8.00000	-8.00000	-8.00000	-8.00000	-8.00000	-8.00000
4.80	-8.00000	-8.00000	-8.00000	-8.00000	-8.00000	-8.00000	-8.00000	-8.00000	-8.00000	-8.00000	-8.00000
5.00	-8.00000	-8.00000	-8.00000	-8.00000	-8.00000	-8.00000	-8.00000	-8.00000	-8.00000	-8.00000	-8.00000

1 POISSON PROBABILITY OF EXCEEDANCE --- IV= 0 HIS= 2.300

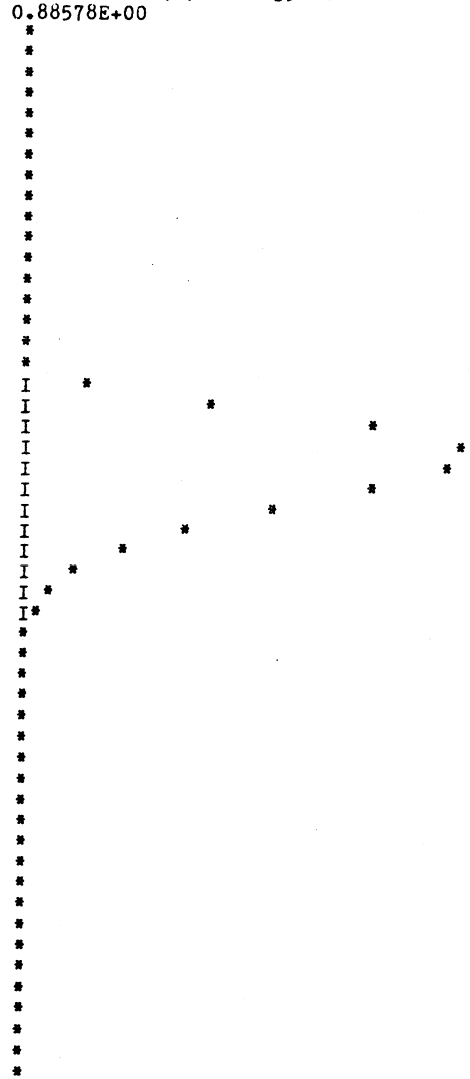
LOG(SL)	LOG(PER) -1.39800	-1.14100	-0.88300	-0.62600	-0.36800	-0.11100	0.14600	0.40400	0.66100	0.91900	1.17600
-5.00	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000
-4.80	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000
-4.60	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000
-4.40	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000
-4.20	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000
-4.00	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000
-3.80	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000
-3.60	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000
-3.40	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000
-3.20	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000
-3.00	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000
-2.80	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000
-2.60	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000
-2.40	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000
-2.20	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000
-2.00	0.99999	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000
-1.80	0.99971	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000
-1.60	0.99526	0.99983	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000
-1.40	0.96850	0.99682	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000
-1.20	0.88974	0.97676	0.99986	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	0.99996
-1.00	0.74971	0.91227	0.99726	1.00000	1.00000	1.00000	1.00000	0.99998	0.99998	1.00000	0.99855
-0.80	0.57256	0.78891	0.97933	0.99988	1.00000	1.00000	0.99992	0.99928	0.99939	0.99987	0.98439
-0.60	0.39899	0.62355	0.91991	0.99740	0.99996	0.99994	0.99820	0.99202	0.99282	0.99683	0.92472
-0.40	0.25679	0.45195	0.80325	0.97933	0.99865	0.99821	0.98465	0.95976	0.96234	0.97444	0.79302
-0.20	0.15444	0.30337	0.64354	0.91792	0.98537	0.98272	0.93561	0.88124	0.88563	0.89785	0.60598
0.00	0.08774	0.19041	0.47426	0.79615	0.92972	0.92313	0.83200	0.75491	0.75962	0.75324	0.41285
0.20	0.04737	0.11286	0.32426	0.62977	0.80573	0.79672	0.68185	0.60180	0.60439	0.56628	0.25432
0.40	0.02439	0.06357	0.20740	0.45586	0.62714	0.61992	0.51530	0.44919	0.44871	0.38476	0.14318
0.60	0.01180	0.03416	0.12513	0.30487	0.43932	0.43634	0.36165	0.31650	0.31342	0.23995	0.07502
0.80	0.00504	0.01744	0.07159	0.19039	0.28119	0.28169	0.23821	0.21228	0.20744	0.13918	0.03703
1.00	0.00170	0.00820	0.03894	0.11220	0.16749	0.16978	0.14894	0.13649	0.13115	0.07643	0.01755
1.20	0.00040	0.00331	0.02008	0.06275	0.09438	0.09728	0.08929	0.08463	0.07961	0.04016	0.00601
1.40	0.00006	0.00104	0.00957	0.03337	0.05081	0.05373	0.05185	0.05090	0.04667	0.02043	0.00338
1.60	0.00000	0.00023	0.00396	0.01676	0.02616	0.02877	0.02934	0.02978	0.02655	0.01005	0.00120
1.80	0.00000	0.00003	0.00130	0.00767	0.01270	0.01478	0.01608	0.01690	0.01463	0.00467	0.00031
2.00	0.00000	0.00000	0.00031	0.00297	0.00557	0.00707	0.00836	0.00921	0.00773	0.00192	0.00004
2.20	0.00000	0.00000	0.00005	0.00088	0.00203	0.00297	0.00396	0.00469	0.00381	0.00064	0.00000
2.40	0.00000	0.00000	0.00000	0.00018	0.00055	0.00101	0.00161	0.00216	0.00168	0.00015	0.00000
2.60	0.00000	0.00000	0.00000	0.00002	0.00010	0.00025	0.00052	0.00085	0.00063	0.00002	0.00000
2.80	0.00000	0.00000	0.00000	0.00000	0.00001	0.00004	0.00012	0.00027	0.00018	0.00000	0.00000
3.00	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00002	0.00006	0.00004	0.00000	0.00000
3.20	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00001	0.00000	0.00000	0.00000
3.40	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
3.60	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
3.80	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
4.00	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
4.20	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
4.40	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
4.60	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
4.80	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
5.00	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000

FOLLOWING SPECTRA ASSUME EARTHQUAKES ARE POISSON, WITH MEAN AS INPUT

1 PROB. DENSITY FUNCTION FOR LOG(T) = -1.39800

PEAK VALUE IS 0.88578E+00

-5.000	0.0000
-4.800	0.0000
-4.600	0.0000
-4.400	0.0000
-4.200	0.0000
-4.000	0.0000
-3.800	0.0000
-3.600	0.0000
-3.400	0.0000
-3.200	0.0000
-3.000	0.0000
-2.800	0.0000
-2.600	0.0000
-2.400	0.0000
-2.200	0.0000
-2.000	0.0014
-1.800	0.0223
-1.600	0.1338
-1.400	0.3938
-1.200	0.7001
-1.000	0.8858
-0.800	0.8678
-0.600	0.7110
-0.400	0.5117
-0.200	0.3335
0.000	0.2018
0.200	0.1149
0.400	0.0629
0.600	0.0338
0.800	0.0167
1.000	0.0065
1.200	0.0017
1.400	0.0003
1.600	0.0000
1.800	0.0000
2.000	0.0000
2.200	0.0000
2.400	0.0000
2.600	0.0000
2.800	0.0000
3.000	0.0000
3.200	0.0000
3.400	0.0000
3.600	0.0000
3.800	0.0000
4.000	0.0000
4.200	0.0000
4.400	0.0000
4.600	0.0000
4.800	0.0000
5.000	0.0000



MOSN= 8 SITE NO.= 4179 SPECTRUM NO. 1

LOG PERIOD AND LOG SPECTRUM FOR 0.90000 PROBABILITY OF EXCEEDANCE

-1.398	-1.141	-0.883	-0.626	-0.368	-0.111	0.146	0.404	0.661	0.919	1.176
-1.2196	-0.9755	-0.5586	-0.1640	0.0583	0.0449	-0.1195	-0.2384	-0.2296	-0.2040	-0.5537

MOSN= 8 SITE NO.= 4179 SPECTRUM NO. 2

LOG PERIOD AND LOG SPECTRUM FOR 0.50000 PROBABILITY OF EXCEEDANCE

-1.398	-1.141	-0.883	-0.626	-0.368	-0.111	0.146	0.404	0.661	0.919	1.176
-0.7187	-0.4572	-0.0310	0.3481	0.5339	0.5291	0.4188	0.3318	0.3325	0.2706	-0.0922

MOSN= 8 SITE NO.= 4179 SPECTRUM NO. 3

LOG PERIOD AND LOG SPECTRUM FOR 0.30000 PROBABILITY OF EXCEEDANCE

-1.398	-1.141	-0.883	-0.626	-0.368	-0.111	0.146	0.404	0.661	0.919	1.176
-0.4664	-0.1948	0.2372	0.6074	0.7734	0.7735	0.6934	0.6283	0.6225	0.5101	0.1367

MOSN= 8 SITE NO.= 4179 SPECTRUM NO. 4

LOG PERIOD AND LOG SPECTRUM FOR 0.20000 PROBABILITY OF EXCEEDANCE

-1.398	-1.141	-0.883	-0.626	-0.368	-0.111	0.146	0.404	0.661	0.919	1.176
-0.2982	-0.0198	0.4152	0.7804	0.9346	0.9382	0.8771	0.8281	0.8167	0.6700	0.2877

MOSN= 8 SITE NO.= 4179 SPECTRUM NO. 5

LOG PERIOD AND LOG SPECTRUM FOR 0.10000 PROBABILITY OF EXCEEDANCE

-1.398	-1.141	-0.883	-0.626	-0.368	-0.111	0.146	0.404	0.661	0.919	1.176
-0.0446	0.2436	0.6825	1.0410	1.1806	1.1904	1.1569	1.1317	1.1105	0.9123	0.5136

MOSN= 8 SITE NO.= 4179 SPECTRUM NO. 6

LOG PERIOD AND LOG SPECTRUM FOR 0.05000 PROBABILITY OF EXCEEDANCE

-1.398	-1.141	-0.883	-0.626	-0.368	-0.111	0.146	0.404	0.661	0.919	1.176
0.1830	0.4789	0.9197	1.2736	1.4050	1.4234	1.4130	1.4068	1.3748	1.1328	0.7163

MOSN= 8 SITE NO.= 4179 SPECTRUM NO. 7

LOG PERIOD AND LOG SPECTRUM FOR 0.02000 PROBABILITY OF EXCEEDANCE

-1.398	-1.141	-0.883	-0.626	-0.368	-0.111	0.146	0.404	0.661	0.919	1.176
0.4562	0.7603	1.2012	1.5500	1.6759	1.7103	1.7283	1.7415	1.6961	1.4061	0.9650

MOSN= 8 SITE NO.= 4179 SPECTRUM NO. 8

LOG PERIOD AND LOG SPECTRUM FOR 0.01000 PROBABILITY OF EXCEEDANCE

-1.398	-1.141	-0.883	-0.626	-0.368	-0.111	0.146	0.404	0.661	0.919	1.176
0.6414	0.9496	1.3886	1.7348	1.8606	1.9082	1.9467	1.9735	1.9205	1.6014	1.1433

MOSN= 8 SITE NO.= 4179 SPECTRUM NO. 9

LOG PERIOD AND LOG SPECTRUM FOR 0.00500 PROBABILITY OF EXCEEDANCE

-1.398	-1.141	-0.883	-0.626	-0.368	-0.111	0.146	0.404	0.661	0.919	1.176
0.8018	1.1137	1.5502	1.8951	2.0232	2.0836	2.1403	2.1820	2.1253	1.7824	1.3108

MOSN= 8 SITE NO.= 4179 SPECTRUM NO. 10

LOG PERIOD AND LOG SPECTRUM FOR 0.00200 PROBABILITY OF EXCEEDANCE

-1.398	-1.141	-0.883	-0.626	-0.368	-0.111	0.146	0.404	0.661	0.919	1.176
0.9735	1.2929	1.7278	2.0705	2.2022	2.2784	2.3550	2.4174	2.3601	1.9918	1.5057

MOSN= 8 SITE NO.= 4179 SPECTRUM NO. 11

LOG PERIOD AND LOG SPECTRUM FOR 0.00100 PROBABILITY OF EXCEEDANCE

-1.398	-1.141	-0.883	-0.626	-0.368	-0.111	0.146	0.404	0.661	0.919	1.176
1.0797	1.4057	1.8399	2.1812	2.3139	2.4020	2.4895	2.5671	2.5101	2.1239	1.6303

MOSN= 8 SITE NO.= 4179 SPECTRUM NO. 12

LOG PERIOD AND LOG SPECTRUM FOR 0.04500 PROBABILITY OF EXCEEDANCE

-1.398	-1.141	-0.883	-0.626	-0.368	-0.111	0.146	0.404	0.661	0.919	1.176
0.2159	0.5128	0.9538	1.3070	1.4374	1.4574	1.4503	1.4467	1.4132	1.1652	0.7458

MOSN= 8 SITE NO.= 4179 SPECTRUM NO. 13

LOG PERIOD AND LOG SPECTRUM FOR 0.01380 PROBABILITY OF EXCEEDANCE

-1.398	-1.141	-0.883	-0.626	-0.368	-0.111	0.146	0.404	0.661	0.919	1.176
0.5581	0.8644	1.3038	1.6520	1.7778	1.8195	1.8481	1.8682	1.8188	1.5109	1.0614

MOSN= 8 SITE NO.= 4179 SPECTRUM NO. 14

LOG PERIOD AND LOG SPECTRUM FOR 0.00711 PROBABILITY OF EXCEEDANCE

-1.398	-1.141	-0.883	-0.626	-0.368	-0.111	0.146	0.404	0.661	0.919	1.176
0.7229	1.0341	1.4711	1.8176	1.9432	1.9985	2.0455	2.0790	2.0245	1.6915	1.2285

MOSN= 8 SITE NO.= 4179 SPECTRUM NO. 15

LOG PERIOD AND LOG SPECTRUM FOR 0.00445 PROBABILITY OF EXCEEDANCE

-1.398	-1.141	-0.883	-0.626	-0.368	-0.111	0.146	0.404	0.661	0.919	1.176
0.8258	1.1388	1.5753	1.9195	2.0478	2.1106	2.1704	2.2146	2.1577	1.8114	1.3376

MOSN= 8 SITE NO.= 4179 SPECTRUM NO. 16

LOG PERIOD AND LOG SPECTRUM FOR 0.00210 PROBABILITY OF EXCEEDANCE

-1.398	-1.141	-0.883	-0.626	-0.368	-0.111	0.146	0.404	0.661	0.919	1.176
0.9652	1.2844	1.7192	2.0621	2.1935	2.2691	2.3446	2.4061	2.3486	1.9814	1.4963

MOSN= 8 SITE NO.= 4179 SPECTRUM NO. 17

LOG PERIOD AND LOG SPECTRUM FOR 0.00103 PROBABILITY OF EXCEEDANCE

-1.398	-1.141	-0.883	-0.626	-0.368	-0.111	0.146	0.404	0.661	0.919	1.176
1.0762	1.4020	1.8363	2.1774	2.3102	2.3980	2.4851	2.5620	2.5051	2.1195	1.6263

MOSN= 8 SITE NO.= 4179 SPECTRUM NO. 18

LOG PERIOD AND LOG SPECTRUM FOR 0.00040 PROBABILITY OF EXCEEDANCE

-1.398	-1.141	-0.883	-0.626	-0.368	-0.111	0.146	0.404	0.661	0.919	1.176
1.1986	1.5285	1.9652	2.3019	2.4391	2.5369	2.6377	2.7328	2.6762	2.2688	1.7640

MOSN= 8 SITE NO.= 4179 SPECTRUM NO. 19

LOG PERIOD AND LOG SPECTRUM FOR 0.00020 PROBABILITY OF EXCEEDANCE

-1.398	-1.141	-0.883	-0.626	-0.368	-0.111	0.146	0.404	0.661	0.919	1.176
1.2718	1.6137	2.0477	2.3869	2.5200	2.6279	2.7340	2.8427	2.7862	2.3621	1.8492

MOSN= 8 SITE NO.= 4179 SPECTRUM NO. 20

LOG PERIOD AND LOG SPECTRUM FOR 0.00010 PROBABILITY OF EXCEEDANCE

-1.398	-1.141	-0.883	-0.626	-0.368	-0.111	0.146	0.404	0.661	0.919	1.176
1.3389	1.6813	2.1187	2.4555	2.6009	2.7040	2.8215	2.9386	2.8795	2.4416	1.9208

Listing of the Card Punch Output Generated by
Computer Program EQRISK for the Preceding Sample Inputs

HPS3	84179 0	-1.398	-1.141	-0.883	-0.626	-0.368	-0.111	0.146	0.404	0.661	0.919	1.176
HPS3	84179 1	-1.220	-0.976	-0.559	-0.164	0.058	0.045	-0.119	-0.238	-0.230	-0.204	-0.554
HPS3	84179 2	-0.719	-0.457	-0.031	0.348	0.534	0.529	0.419	0.332	0.333	0.271	-0.092
HPS3	84179 3	-0.466	-0.195	0.237	0.607	0.773	0.774	0.693	0.628	0.623	0.510	0.137
HPS3	84179 4	-0.298	-0.020	0.415	0.780	0.935	0.938	0.877	0.828	0.817	0.670	0.288
HPS3	84179 5	-0.045	0.244	0.683	1.041	1.181	1.190	1.157	1.132	1.111	0.912	0.514
HPS3	84179 6	0.183	0.479	0.920	1.274	1.405	1.423	1.413	1.407	1.375	1.133	0.716
HPS3	84179 7	0.456	0.760	1.201	1.550	1.676	1.710	1.728	1.741	1.696	1.406	0.965
HPS3	84179 8	0.641	0.950	1.389	1.735	1.861	1.908	1.947	1.974	1.921	1.601	1.143
HPS3	84179 9	0.802	1.114	1.550	1.895	2.023	2.084	2.140	2.182	2.125	1.782	1.311
HPS3	8417910	0.973	1.293	1.728	2.070	2.202	2.278	2.355	2.417	2.360	1.992	1.506
HPS3	8417911	1.080	1.406	1.840	2.181	2.314	2.402	2.490	2.567	2.510	2.124	1.630
HPS3	8417912	0.216	0.513	0.954	1.307	1.437	1.457	1.450	1.447	1.413	1.165	0.746
HPS3	8417913	0.558	0.864	1.304	1.652	1.778	1.819	1.848	1.868	1.819	1.511	1.061
HPS3	8417914	0.723	1.034	1.471	1.818	1.943	1.998	2.046	2.079	2.025	1.691	1.228
HPS3	8417915	0.826	1.139	1.575	1.920	2.048	2.111	2.170	2.215	2.158	1.811	1.338
HPS3	8417916	0.965	1.284	1.719	2.062	2.194	2.269	2.345	2.406	2.349	1.981	1.496
HPS3	8417917	1.076	1.402	1.836	2.177	2.310	2.398	2.485	2.562	2.505	2.119	1.626
HPS3	8417918	1.199	1.529	1.965	2.302	2.439	2.537	2.638	2.733	2.676	2.269	1.764
HPS3	8417919	1.272	1.614	2.048	2.387	2.520	2.628	2.734	2.843	2.786	2.362	1.849
HPS3	8417920	1.339	1.681	2.119	2.455	2.601	2.704	2.822	2.939	2.880	2.442	1.921

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