```
      FUNCTION H0F(R,ET)
C        THE H0 FUNCTION FOR SCATTER FIELDS
C
      DIMENSION A(5),B(5)
C
      DATA A(1),A(2),A(3),A(4),A(5)
     X    / 25., 80.,177.,395.,705./
      DATA B(1),B(2),B(3),B(4),B(5)
     X    / 24., 45., 68., 80.,105./
C
       IT=ET
       IF(IT) 2,2,1
  1    IF(IT-5) 5,4,3
  2       IT=1
       GO TO 4
  3       IT=5
  4       Q=0.
       GO TO 6
  5       Q=ET-FLOAT(IT)
  6    X=(1./R)**2
       H0F=4.343*ALOG((A(IT)*X+B(IT))*X+1.)
       IF(Q .NE. 0.)
     X    H0F=(1.-Q)*H0F+Q*4.343*ALOG((A(IT+1)*X+B(IT+1))*X+1.)
       RETURN
      END
```

```
      FUNCTION AHD(TD)
C        THE F(TH*D) FUNCTION FOR SCATTER FIELDS
C
      DIMENSION A(3),B(3),C(3)
C
      DATA A(1),A(2),A(3)/133.4,104.6,71.8/
      DATA B(1),B(2),B(3)/0.332E-3,0.212E-3,0.157E-3/
      DATA C(1),C(2),C(3)/-4.343,-1.086,2.171/
C
         I=1
       IF(TD .LE. 10E3) GO TO 1
         I=2
       IF(TD .LE. 70E3) GO TO 1
         I=3
  1    AHD=A(I)+B(I)*TD+C(I)*ALOG(TD)
       RETURN
      END
```

```
      FUNCTION AVAR(ZZT,ZZL,ZZC)
C        QUANTILES OF ATTENUATION RELATIVE TO FREE SPACE
C        INCLUDES LONG-TERM TIME VARIABILITY, LOCATION VARIABILITY,
C          AND SITE VARIABILITY
C
      COMMON/PROP/KWX,AREF,MDP,DIST,HG(2),WN,DH,ENS,GME,ZGND,
     X   HE(2),DL(2),THE(2)
         COMPLEX ZGND
      COMMON/PROPV/LVAR,SGC,MDVAR,KLIM
C
      COMMON/SAVE/SAVE(13),KDV,WL,WS,DEXA,DE,VMD,VS0,SGL,
     X   SGTM,SGTP,SGTD,TGTD,GM,GP,CV1,CV2,YV1,YV2,YV3,
     X   CSM1,CSM2,YSM1,YSM2,YSM3,CSP1,CSP2,YSP1,YSP2,YSP3,CSD1,ZD,
     X   CFM1,CFM2,CFM3,CFP1,CFP2,CFP3
C
      DIMENSION BV1(7),BV2(7),XV1(7),XV2(7),XV3(7)
      DIMENSION BSM1(7),BSM2(7),XSM1(7),XSM2(7),XSM3(7)
      DIMENSION BSP1(7),BSP2(7),XSP1(7),XSP2(7),XSP3(7)
      DIMENSION BSD1(7),BZD1(7)
      DIMENSION BFM1(7),BFM2(7),BFM3(7),BFP1(7),BFP2(7),BFP3(7)
C
      LOGICAL WS,WL
C
C          EQUATOR,CON SUB,MAR SUB, DESERT,CON TMP,MAR LND,MAR SEA
C
      DATA  BV1(1), BV1(2), BV1(3), BV1(4), BV1(5), BV1(6), BV1(7)
     X    /  -9.67,  -0.62,   1.26,  -9.21,  -0.62,  -0.39,   3.15/
      DATA  BV2(1), BV2(2), BV2(3), BV2(4), BV2(5), BV2(6), BV2(7)
     X    /   12.7,   9.19,   15.5,   9.05,   9.19,   2.86,  857.9/
      DATA  XV1(1), XV1(2), XV1(3), XV1(4), XV1(5), XV1(6), XV1(7)
     X    /144.9E3,228.9E3,262.6E3, 84.1E3,228.9E3,141.7E3,2222.E3/
      DATA  XV2(1), XV2(2), XV2(3), XV2(4), XV2(5), XV2(6), XV2(7)
     X    /190.3E3,205.2E3,185.2E3,101.1E3,205.2E3,315.9E3,164.8E3/
      DATA  XV3(1), XV3(2), XV3(3), XV3(4), XV3(5), XV3(6), XV3(7)
     X    /133.8E3,143.6E3, 99.8E3, 98.6E3,143.6E3,167.4E3,116.3E3/
      DATA BSM1(1),BSM1(2),BSM1(3),BSM1(4),BSM1(5),BSM1(6),BSM1(7)
     X    /   2.13,   2.66,   6.11,   1.98,   2.68,   6.86,   8.51/
      DATA BSM2(1),BSM2(2),BSM2(3),BSM2(4),BSM2(5),BSM2(6),BSM2(7)
     X    /  159.5,   7.67,   6.65,  13.11,   7.16,  10.38,  169.8/
      DATA XSM1(1),XSM1(2),XSM1(3),XSM1(4),XSM1(5),XSM1(6),XSM1(7)
     X    /762.2E3,100.4E3,138.2E3,139.1E3, 93.7E3,187.8E3,609.8E3/
      DATA XSM2(1),XSM2(2),XSM2(3),XSM2(4),XSM2(5),XSM2(6),XSM2(7)
     X    /123.6E3,172.5E3,242.2E3,132.7E3,186.8E3,169.6E3,119.9E3/
      DATA XSM3(1),XSM3(2),XSM3(3),XSM3(4),XSM3(5),XSM3(6),XSM3(7)
     X    / 94.5E3,136.4E3,178.6E3,193.5E3,133.5E3,108.9E3,106.6E3/
      DATA BSP1(1),BSP1(2),BSP1(3),BSP1(4),BSP1(5),BSP1(6),BSP1(7)
     X    /   2.11,   6.87,  10.08,   3.68,   4.75,   8.58,   8.43/
      DATA BSP2(1),BSP2(2),BSP2(3),BSP2(4),BSP2(5),BSP2(6),BSP2(7)
     X    /  102.3,  15.53,   9.60,  159.3,   8.12,  13.97,   8.19/
      DATA XSP1(1),XSP1(2),XSP1(3),XSP1(4),XSP1(5),XSP1(6),XSP1(7)
     X    /636.9E3,138.7E3,165.3E3,464.4E3, 93.2E3,216.0E3,136.2E3/
      DATA XSP2(1),XSP2(2),XSP2(3),XSP2(4),XSP2(5),XSP2(6),XSP2(7)
     X    /134.8E3,143.7E3,225.7E3, 93.1E3,135.9E3,152.0E3,188.5E3/
```

```
      DATA XSP3(1),XSP3(2),XSP3(3),XSP3(4),XSP3(5),XSP3(6),XSP3(7)
     X    / 95.6E3, 98.6E3,129.7E3, 94.2E3,113.4E3,122.7E3,122.9E3/
      DATA BSD1(1),BSD1(2),BSD1(3),BSD1(4),BSD1(5),BSD1(6),BSD1(7)
     X    /  1.224,  0.801,  1.380,  1.000,  1.224,  1.518,  1.518/
      DATA BZD1(1),BZD1(2),BZD1(3),BZD1(4),BZD1(5),BZD1(6),BZD1(7)
     X    /  1.282,  2.161,  1.282,    20.,  1.282,  1.282,  1.282/
      DATA BFM1(1),BFM1(2),BFM1(3),BFM1(4),BFM1(5),BFM1(6),BFM1(7)
     X    /     1.,     1.,     1.,     1.,   0.92,     1.,     1./
      DATA BFM2(1),BFM2(2),BFM2(3),BFM2(4),BFM2(5),BFM2(6),BFM2(7)
     X    /     0.,     0.,     0.,     0.,   0.25,     0.,     0./
      DATA BFM3(1),BFM3(2),BFM3(3),BFM3(4),BFM3(5),BFM3(6),BFM3(7)
     X    /     0.,     0.,     0.,     0.,   1.77,     0.,     0./
      DATA BFP1(1),BFP1(2),BFP1(3),BFP1(4),BFP1(5),BFP1(6),BFP1(7)
     X    /     1.,   0.93,     1.,   0.93,   0.93,     1.,     1./
      DATA BFP2(1),BFP2(2),BFP2(3),BFP2(4),BFP2(5),BFP2(6),BFP2(7)
     X    /     0.,   0.31,     0.,   0.19,   0.31,     0.,     0./
      DATA BFP3(1),BFP3(2),BFP3(3),BFP3(4),BFP3(5),BFP3(6),BFP3(7)
     X    /     0.,   2.00,     0.,   1.79,   2.00,     0.,     0./
C
      DATA RT,RL/7.8,24./
C
      DATA THIRD/0.3333333/
C
      CURV(C1,C2,X1,X2,X3)=(C1+C2/(1.+((DE-X2)/X3)**2))*
     X   ((DE/X1)**2)/(1.+((DE/X1)**2))
C
       IF(LVAR .EQ. 0) GO TO 60
       IF(LVAR .LT. 5)
     X    GO TO (10,20,30,40),LVAR
C        CLIMATE
       IF(KLIM .GT. 0 .AND. KLIM .LE. 7) GO TO 51
          KLIM=5
          KWX=MAX0(KWX,2)
 51    CV1=BV1(KLIM)
       CV2=BV2(KLIM)
       YV1=XV1(KLIM)
       YV2=XV2(KLIM)
       YV3=XV3(KLIM)
       CSM1=BSM1(KLIM)
       CSM2=BSM2(KLIM)
       YSM1=XSM1(KLIM)
       YSM2=XSM2(KLIM)
       YSM3=XSM3(KLIM)
       CSP1=BSP1(KLIM)
       CSP2=BSP2(KLIM)
       YSP1=XSP1(KLIM)
       YSP2=XSP2(KLIM)
       YSP3=XSP3(KLIM)
       CSD1=BSD1(KLIM)
       ZD=BZD1(KLIM)
       CFM1=BFM1(KLIM)
       CFM2=BFM2(KLIM)
       CFM3=BFM3(KLIM)
```

```
      CFP1=BFP1(KLIM)
      CFP2=BFP2(KLIM)
      CFP3=BFP3(KLIM)
C       MODE OF VARIABILITY
 40   KDV=MDVAR
      WS=KDV .GE. 20
      IF(WS) KDV=KDV-20
      WL=KDV .GE. 10
      IF(WL) KDV=KDV-10
      IF(KDV .GE. 0 .AND. KDV .LE. 3) GO TO 41
         KDV=0
         KWX=MAX0(KWX,2)
 41   KDV=KDV+1
C       FREQUENCY
 30   Q=ALOG(0.133*WN)
      GM=CFM1+CFM2/((CFM3*Q)**2+1.)
      GP=CFP1+CFP2/((CFP3*Q)**2+1.)
C       SYSTEM PARAMETERS
 20   DEXA=SQRT(18E6*HE(1))+SQRT(18E6*HE(2))+(575.7E12/WN)**THIRD
C       DISTANCE
 10   IF(DIST .GE. DEXA) GO TO 11
         DE=130E3*DIST/DEXA
       GO TO 12
 11      DE=130E3+DIST-DEXA
 12   VMD=CURV(CV1,CV2,YV1,YV2,YV3)
      SGTM=CURV(CSM1,CSM2,YSM1,YSM2,YSM3)*GM
      SGTP=CURV(CSP1,CSP2,YSP1,YSP2,YSP3)*GP
      SGTD=SGTP*CSD1
      TGTD=(SGTP-SGTD)*ZD
      SGL=0.
      VS0=0.
      IF(WL) GO TO 13
         Q=(1.-0.8*EXP(-AMIN1(20.,DIST/50E3)))*DH*WN
         SGL=10.*Q/(Q+13.)
 13   IF(WS) GO TO 14
         VS0=(5.+3.*EXP(-AMIN1(20.,DE/100E3)))**2
 14   CONTINUE
C
      LVAR=0
C
 60   CONTINUE
      ZT=ZZT
      ZL=ZZL
      ZC=ZZC
      GO TO (600,601,602,603),KDV
 600     ZT=ZC
 601     ZL=ZC
       GO TO 603
 602     ZL=ZT
 603  CONTINUE
      IF(ABS(ZT) .GT. 3.10) GO TO 605
      IF(ABS(ZL) .GT. 3.10) GO TO 605
      IF(ABS(ZC) .GT. 3.10) GO TO 605
```

```
      GO TO 608
605      KWX=MAX0(KWX,1)
608   CONTINUE
      IF(ZT .GT. 0.) GO TO 611
         SGT=SGTM
       GO TO 618
611      IF(ZT .GT. ZD) GO TO 612
         SGT=SGTP
       GO TO 618
612      SGT=SGTD+TGTD/ZT
618   CONTINUE
      VS=VS0+(SGT*ZT)**2/(RT+ZC**2)+(SGL*ZL)**2/(RL+ZC**2)
      GO TO (620,621,622,623),KDV
620      YR=0.
         SGC=SQRT(SGT**2+SGL**2+VS)
       GO TO 628
621      YR=SGT*ZT
         SGC=SQRT(SGL**2+VS)
       GO TO 628
622      YR=SQRT(SGT**2+SGL**2)*ZT
         SGC=SQRT(VS)
       GO TO 628
623      YR=SGT*ZT+SGL*ZL
         SGC=SQRT(VS)
628   CONTINUE
C
      AVAR=AREF-VMD-YR-SGC*ZC
      IF(AVAR .LT. 0.) AVAR=AVAR*(29.-AVAR)/(29.-10.*AVAR)
      RETURN
     END
```

```
      FUNCTION QERF(Z)
C        THE STANDARD NORMAL COMPLEMENTARY PROBABILITY
C        APPROXIMATION DUE TO C. HASTINGS, JR.
C        MAX ERROR 7.5E-8
C
      DATA B1,B2,B3,B4,B5/0.319381530,-0.356563782,1.781477937,
     X   -1.821255987,1.330274429/
      DATA RP,RRT2PI/4.317008,0.398942280/
C
       X=Z
       T=ABS(X)
       IF(T .LT. 10.) GO TO 1
       QERF=0.
       GO TO 2
  1    T=RP/(T+RP)
       QERF=EXP(-0.5*X**2)*RRT2PI*((((B5*T+B4)*T+B3)*T+B2)*T+B1)*T
  2    IF(X .LT. 0.) QERF=1.-QERF
       RETURN
      END
```

```
      FUNCTION QERFI(Q)
C        THE INVERSE OF QERF, GIVES THE STANDARD NORMAL DEVIATE AS A
C           FUNCTION OF THE COMPLEMENTARY PROBABILITY
C        TRUNCATED AT 0.000001 AND 0.999999
C        APPROXIMATION DUE TO C. HASTINGS, JR.
C        MAX ERROR 4.5E-4
C
      DATA C0,C1,C2/2.515516698,0.802853,0.010328/
      DATA D1,D2,D3/1.432788,0.189269,0.001308/
C
       X=0.5-Q
       T=AMAX1(0.5-ABS(X),0.000001)
       T=SQRT(-2.*ALOG(T))
       QERFI=T-((C2*T+C1)*T+C0)/(((D3*T+D2)*T+D1)*T+1.)
       IF(X .LT. 0.) QERFI=-QERFI
       RETURN
      END
```