```fortran
      SUBROUTINE TM2(ISTEP,NTSD,IDAT,ICL)
C     ---------------------------------------
C                     14/07/99
C                     19/04/2000
C                     04/07/2000
C                     22/05/2001
C     ---------------------------------------
      PARAMETER (IM=111,JM=221,LM=38,LSM=19)
      PARAMETER (IMJM = IM*JM - JM/2)
      PARAMETER (LP1=LM+1)
      PARAMETER (JAM=6+2*(JM-10))
      PARAMETER (IMAX=2*IM-1  , JMAX=JM)
      PARAMETER (KKMAX=LM)
      PARAMETER (KMAX=KKMAX)
      PARAMETER (KMIN = LM-KKMAX)
      PARAMETER (KTOP = KMIN + 1)
      PARAMETER (LENIWA=1000)
      REAL PHI0,LAM0

C
      DIMENSION IDAT(3)
C       Date of initial conditions
C     IDAT(1) is day
C     IDAT(2) is month
C     IDAT(3) is year - 1900
C
C-----------------------------------------------------------------------
                                  C O M M O N /VRBLS/
     & PD(IMJM),RES(IMJM),FIS(IMJM)
C
     &,U(IMJM,LM),V(IMJM,LM),T(IMJM,LM),Q(IMJM,LM)
C-----------------------------------------------------------------------
                                  C O M M O N /MASKS/
     & HBM2  (IMJM),VBM2  (IMJM),VBM3  (IMJM),SM    (IMJM),SICE (IMJM)
C
     &,HTM   (IMJM,LM),VTM   (IMJM,LM)
C-----------------------------------------------------------------------
                                   C O M M O N /MAPOT/
     & LSL,IXM,IYM
     &,ISHDE(49)
     &,R,PT,TSPH
     &,WBD,SBD,TLM0D,TPH0D,DLMD,DPHD,CMLD,DP30,X1P,Y1P
     &,DISLP,Z0SLP,SPL(LSM),ALSL(LSM)
     &,DETA(LM),AETA(LM),ETA(LP1),TSHDE(49)
     &,ERLAM0,CPHI0,SPHI0
     &,KUNIT,LUNIT,MUNIT,IUNIT,NUNIT
C-----------------------------------------------------------------------
                                  C O M M O N /LOOPS/
     & KHLA  (JAM),KHHA  (JAM),KVLA  (JAM),KVHA  (JAM)
C
     &,KHL2  (JM),KHH2  (JM),KVL2  (JM),KVH2  (JM)
C
     &,LMH   (IMJM),LMV   (IMJM)
C------------------------------------------------------------------------
      DIMENSION IWA(LENIWA),COBAL(20)
      DIMENSION VERTFL(KKMAX),VERFLX(KKMAX),DFLX(KKMAX+1),
     *          DIFV(IMJM,KMAX)
      DIMENSION BETA(IMJM,KMAX), IFLAG(IMJM,KMAX)
      DIMENSION DQDT(IMJM,KMAX)
      DIMENSION COLCON(IMJM), COLAIR(IMJM)
C      DIMENSION DPREC(IMJM)
C------------------------------------------------------------------------
      COMMON/ETATRN/
     * QQL(IMJM,KKMAX),QQH(IMJM,KKMAX),
     * PS(IMJM,2), QQ(IMJM,KKMAX,2),
     * UU(IMJM,KKMAX,2), VV(IMJM,KKMAX,2),
     * WW(IMJM,KKMAX,2), RO(IMJM,KKMAX,2),
     * TT(IMJM,KKMAX,2), ZZ(IMJM,KKMAX+1,2),
     * ALFA(IMJM,KKMAX,2),
```



```fortran
     * DIFQ(IMJM,KKMAX),
     * AKH(IMJM,KKMAX,2),AKHS(IMJM,2),
     * TOPG(IMJM)
     *,PREC(IMJM,2),ACPR(IMJM,2)
C
      COMMON/CBT1T2/HINTG(IMJM), HINN(IMJM,KMAX),
     *              HZM(IMJM,KMAX+1),BUFI(IMJM,2),
     *              QFLUX(IMJM,2) ,EFIREA(IMJM,4),
     *              QSOUR(10),ISOUR(10),JSOUR(10),
     *              XSOUR(10),YSOUR(10),
     *              QFIL(IMJM,KKMAX,2),
     *              IDATCP(3)
C
C                   IDATCP(3)= IM, ID, IY
C
      DIMENSION VFLUX(IMJM,2)
C
      PARAMETER (NPOINT=25)
C
      COMMON/ETAGRD/
     *      XB,DEX,YB,DEY,
     *      COSETA(JM),XETA(IMAX),YETA(JM),
     *      ITMP(NPOINT), JTMP(NPOINT), KTMP(NPOINT)
      COMMON/ETAREA/CAREA(IMJM)
      COMMON/CITERB/EPS,MAXIT

      COMMON/TMCTRL/ISTEP1,IBSTEP,DTT,
     *  NSTEP,NSWRI,NSFON,
     *  QMIN,VD,CW,IFDAY,QFLX0,
     *  NSSOUR,QCON0,NSOUR,
     *  IREC,IREC1,IREC2,IREC3,IRECF,
     *  AREAX0,AREAY0,NXAREA,NYAREA,
     *  LOGU,DATE2
      COMMON/CBFIRE/ICLF1,QFLX1,ARFKM2,FLON1,FLAT1,
     *                     FLON2,FLAT2,FLON3,FLAT3
      COMMON/RECRDS/IREC4                     ! nvp

      CHARACTER*6 DATE2
      CHARACTER*6 DATE3
      LOGICAL LOGU
      COMMON/TIMECP/t1,t2,t3,t4, tt1, tt2
      REAL*8 t1,t2,t3,t4, tt1, tt2
C
      COMMON/TM2LOC/ QKM1, QBAKM1, QAAK, QK, QATK, QAWSK, FQ,
     * DELQ1, DELQ2, DELQ3, DPREC(IMJM)
C
      DIMENSION WA51(51*51,6), WA51U(51*51,6), WA51V(51*51,6),
     *          WA(IMJM,KKMAX)                    ! nvp
      COMMON/CFINTY/FINTY(30)
C-----------------------------------------------------------------------
C      DATA FINTY/0.,0.,0. ,0., 0., 0.,0.,0.,0.,0.,
C     *           0.,0.,0. ,0., 0., 0.,0.,0.,0.,0.,
C     *           0.,0.,0.5,2.0,0.5,0.,0.,0.,0.,0./
      DATA G /9.81/
      DATA CON/-999.0/
C
      IF(ICL.EQ.0)THEN
      RETURN
      ELSE
C      |-------------------------------------------|
C      |                                           |
C      |              TIME STEPS START             |
C      |              ISTEP LOOP START             |
C      |-------------------------------------------|

      RADDEG=3.14159265/180.
      DEG=180./3.14159265
      IFILT=0
```

```
      IBSTEP=0
      call clock(t3)

      WRITE(66,*)' ////////////////////////////////// '
      WRITE(66,*)'#/ ISTEP=',IBSTEP+ISTEP,' # ISTEP=',ISTEP,'/#'
      WRITE(66,*)' ////////////////////////////////// '
      WRITE(0,*)'#/ ISTEP=',IBSTEP+ISTEP

C     ==========================
C          NEXT FIRE AREAS
C     ==========================

      IF(MOD(ISTEP,30).EQ.1)THEN
      WRITE(66,*)' FIRE AREAS ON ETA GRID '
      DO K=1,4
      CALL EXTRAC(EFIREA(1,K),IMJM,AMEAN,AMIN,AMAX,0.,NULL)
      WRITE(66,*)'MEAN,MIN,MAX=',AMEAN,AMIN,AMAX,' NULL=',NULL
      ENDDO
      DO K=1,4
      CALL SUMAR(EFIREA(1,K),IMJM,SUMARI)
      WRITE(66,*)'Total fire area=',SUMARI,' km**2'
      ENDDO
      ENDIF
Ci
      IF(MOD(ISTEP,2).NE.0)THEN
      WRITE(66,*)NAME
      WRITE(66,*)'NTSD=',NTSD
      WRITE(66,*)IDAT
      ENDIF

      WRITE(66,*)'DIAG. ETADOT ISTEP=',IBSTEP+ISTEP,' */'
      CALL EXTR2M(66,'ETADOT', WW(1,1,2),HTM(1,KTOP),HINTG,
     *          IMJM,KMAX,1)

      CALL AMWEIG(RO(1,1,2),HTM(1,KTOP),PS(1,2),RES,
     *IMJM,KMAX,DETA(KTOP),CAREA,1.)

C |||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||

C
C                  CALCULATION
C
C |||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||  Warning
      DO J=1,IMJM
      DO K=1,KMAX
      BETA(J,K)=0.
      IFLAG(J,K)=0
      ENDDO
      ENDDO
C ||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||  Warning

      CALL INMASS(QQ(1,1,1),HTM(1,KTOP),RES,PS(1,1),PT,DETA(KTOP),
     *            KMAX,
     *            TQM1,TAM1,RQM1,TAREA)
      DMQ0=TQM1
      DRQ0=RQM1
C ...........................................................
C
C                   SOURCE CALCULATION
C
C ...........................................................

      QFLX=QFLX0                                   !  30/11/98
      QFLX=QFLX0*FINTY(MOD(ISTEP-1,30)+1)              !  16/10/01

      WRITE(66,*)'QFLX=',QFLX,' FOR ISTEP=',ISTEP,
     *' MOD(ISTEP-1,30)=',MOD(ISTEP-1,30),' /#'

      WRITE(66,*)' =================================='
```



```
      WRITE(66,*)'      SURFACE CO2 SOURCES'
      WRITE(66,*)' =================================='
C                  |==================================|
C                  |                                  |
      WRITE(66,*)' ======= DISTRIBUTED SOURCES ======'
C                  |                                  |
C                  |==================================|
      KFIRE=1
      WRITE(66,*)' DISTRIBUTED CO2 SOURCES ISTEP=',IBSTEP+ISTEP,
     * ' KFIRE=',KFIRE,' #/'
C
C                  ---------------------
C                  FLUX CO2 FROM SURFACE
C                       NEW VERSION
C                  ---------------------
      WRITE(66,*)'---------------------'
      WRITE(66,*)'FLUX CO2 FROM SURFACE'
      WRITE(66,*)'    NEW VERSION'
      WRITE(66,*)'---------------------'
      WRITE(66,*)'IRECF=',IRECF

C ==============================================================
C      CALL  RDBUF(4,ISTEP,IRECF,BUFI,EFIREA,IMJM)
C      CALL SFLUXS(4,ISTEP,VFLUX,QFLX,EFIREA)
C      CALL VFLUXS(4,ISTEP,QFLUX,      EFIREA)      ! ,BUFI,IRECF)
Cx      CALL FLUXON(ISTEP,QFLUX,QFLX,EFIREA)
C ==============================================================
C         From TUPI Version
C         ICLF1 = 0 with one fire only
C         ICLF1 = 1 with distribution fires + one fire
C         ICLF1 = 2 with distribution fires only
C
      QFLX=QFLX0

      IF(ICLF1.GE.1)THEN

      CALL RDBUFx(4,ISTEP,IRECF,BUFI,EFIREA,IMJM)

C      CALL SFLUXS(4,ISTEP,VFLUX,QFLX,EFIREA)
C      WRITE(66,*)' 1) Loaded mass, ISTEP=',ISTEP,' end/'
C      CALL LOADMS(66,VFLUX,EFIREA,IMJM,DTT)

      CALL VFLUXS(4,ISTEP,QFLUX,      EFIREA)      ! ,BUFI,IRECF)
      WRITE(66,*)'Fires, ISTEP=',ISTEP
      WRITE(66,*)'RDBUF(4,...; SFLUXS(4,...;VFLUXS(4,...'
      CALL EXDIAG(66,'EFIREA(*,1)',EFIREA,IMJM,1)
      CALL EXDIAG(66,'QFLUX(*,1:2)',QFLUX(1,1),IMJM,2)
      WRITE(66,*)'  '
      WRITE(66,*)' 1) Loaded distribution mass, ISTEP=',ISTEP,' end/'
C23456789 1 23456789 123456789 123456789 123456789 123456789 123456789 1
      CALL LOADMS(66,QFLUX(1,1),EFIREA,IMJM,DTT)
      ENDIF     !  ICLF1.GT.1

      IF(ICLF1.LE.1)THEN
      WRITE(66,*)'  '                                            !  16/10/
01
      QFLX2=QFLX1*FINTY(MOD(ISTEP-1,30)+1)
      CALL NULLI(EFIREA(1,2),IMJM)                 ! Clear one fire area
      CALL ONEFIR(EFIREA(1,2),ARFKM2,FLON1,FLAT1) ! add one fire
C only 1       CALL ONEFIR(EFIREA(1,2),ARFKM2,FLON2,FLAT2) ! add one fire

      CALL FLUXON(ICLF1,QFLUX,QFLX2,EFIREA(1,2))   ! recalculetes QFLUX
      WRITE(66,*)' 2) Loaded total mass?, ISTEP=',ISTEP,' end/'
      CALL LOADMS(66,QFLUX(1,1),EFIREA,IMJM,DTT)
      WRITE(66,*)'FLUXON(ISTEP,...'
      CALL EXDIAG(66,'EFIREA(*,2)',EFIREA(1,2),IMJM,1)
      CALL EXDIAG(66,'QFLUX(*,1:2)',QFLUX(1,1),IMJM,2)
      ENDIF     !  ICLF1.LT.3
C ==============================================================
```

```
      WRITE(66,*)'FIRE AREAS ON ETA GRID FOR ISTEP=',ISTEP,' /#'
      DO K=1,4
      CALL SUMAR(EFIREA(1,K),IMJM,SUMARI)
      WRITE(66,*)K,' #Total fire area=',SUMARI,' km**2'
      ENDDO
      WRITE(66,*)'FIRE AREAS IN CELLS, in km**2'
      DO K=1,4
      CALL EXTRAC(EFIREA(1,K),IMJM,AMEAN,AMIN,AMAX,0.,NULL)
      WRITE(66,*)'MEAN=',AMEAN,' MIN=',AMIN,' MAX=',AMAX,' NULL=',NULL
      ENDDO
C
C |||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||
C                Distribution sources diagnosis
C |||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||
      CALL EXTRAC(QFLUX,IMJM,AMEAN,AMIN,AMAX,0.,NULL)

      CONV1=1.E4*86400.*1.E-6   !  Convert from (m**2 s) to (ha day)

      WRITE(66,*)'AMEAN=',AMEAN*1.E-6,
     *' AMIN=',AMIN*1.E-6,' AMAX=',AMAX*1.E-6,' kg/m**2/s'
      WRITE(66,*)'NULL=',NULL,' #/'
      WRITE(66,*)'AMEAN=',AMEAN*CONV1,
     *' AMIN=',AMIN*CONV1,' AMAX=',AMAX*CONV1,' kg/ha/day'

      CALL SCLINP(QFLUX,CAREA,HZM,IMJM,1.E-6,SUMFLX)
      WRITE(66,*)'1) DISTRIBUTED CO2 FLUX FROM SURFACE=',SUMFLX/1000.,
     * ' t/s'

      WRITE(66,*)'2) DISTRIBUTED CO2 FLUX FROM SURFACE=',
     * DTT*SUMFLX/1000.0,' t/step  1 step=',DTT,' sec'

      QFLUX0=DTT*QFLX*1.E+6
      CALL SCLINP(EFIREA(1,KFIRE),HZM,HZM,IMJM,QFLUX0,SUMFX1)
      WRITE(66,*)'3) DISTRIBUTED CO2 FLUX FROM SURFACE=',
     * SUMFX1/1000.,' t/step'

      CALL SCLINP(EFIREA(1,KFIRE),HZM,HZM,IMJM,1.,SUMFX2)
      WRITE(66,*)'4) FIRE AREA=',SUMFX2,' km**2 ',SUMFX2*1.E6,' m**2'

CX       STOP

      CALL SFLXD(66,'for VFLUXS',VFLUX,EFIREA,CAREA,HZM,
     *   IMJM,QFLX,DTT)

      IF(ISTEP.EQ.1)THEN
      WRITE(66,*)'QFLX          =',QFLX,' kg/m**2/s'
      WRITE(66,*)'1.E+6 x QFLX     =',QFLX*1.E+6,' kg/km**2/s'
      WRITE(66,*)'1.E+6 x DTT x QFLX=',QFLUX0,' kg/km**2/step'
      ENDIF
C |||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||
C     I=======================================I
C     I                                       I
C     I             POINT SOURCES             I
C     I                                       I
C     I=======================================I

CX       GOTO9000
CX
CX9000   CONTINUE

      WRITE(66,*)'POINT SOURCES EXCLUDED'

      CALL SCLINP(QFLUX,CAREA,HZM,IMJM,1.E-6,SUMFLX)
      WRITE(66,*)'TOTAL CO2 FLUX FROM SURFACE=',SUMFLX/1000.,
     * ' t/s'

C ----------------------------------------------------------------
C           F I R E   S O U R C E S   E S T I M A T I O N
C ----------------------------------------------------------------
```



```
      CALL INMASS(QQ(1,1,1),HTM(1,KTOP),RES,PS(1,1),PT,DETA(KTOP),
     *            KMAX,
     *            TQM2,TAM2,RQM2,TAREA)
      WRITE(66,*)'1) FIRE SOURCES STEP=',IBSTEP+ISTEP,' */'
      WRITE(66,*)' TQM1=',TQM1,' kg x1E6, RQM1=',RQM1,' */'
      WRITE(66,*)' TQM2=',TQM2,' kg x1E6, RQM2=',RQM2,' */'
      WRITE(66,*)'2) FIRE SOURCES STEP=',IBSTEP+ISTEP,' */'
      WRITE(66,*)' TQM2-TQM1=',TQM2-TQM1,' kg x1E6'
      WRITE(66,*)' RQM2-RQM1=',RQM2-RQM1,' */'
      DMQF=TQM2
      DRQF=RQM2
C ----------------------------------------------------------------
      QKM1=TQM2              !  kg x 1.E+6  with fire sources

      WRITE(66,*)'AFTER FIRE ESTIMATION QKM1=',QKM1

C      GOTO 7777
C ----------------------------------------------------------------

      IF(IBSTEP+ISTEP.EQ.1)THEN
C
C     RECORD INITIAL CONDITION
C
      WRITE(66,*)' *** RECORD INITIAL CONDITION***************'
      WRITE(66,*)'ISTEP=',ISTEP,' TIME=',0,' hrs'

      WRITE(66,*)' ////////////// START //////////'
      WRITE(66,*)'        CALL WRHIST(60,... ->  WRH6VR(60,'
      WRITE(66,*)' ////////////// ///// //////////'
C ---------------------------------------------------
C
C
C
C ---------------------------------------------------

      CALL WRH6VR(60,IREC3,QQ,RO(1,1,2),ZZ,UU,VV,               ! nvp
     * HTM(1,KTOP),HZM,VTM(1,KTOP),LMH,                         ! nvp
     * AETA(KTOP),ETA(KTOP),                                    ! nvp
     * WA51,WA51U,WA51V,WA,KMAX,CON)                            ! nvp

      CALL WRSUR(60,IREC3,ACPR,HZM,WA51,CON)                    ! nvp

      WRITE(66,*)'IREC3=',IREC3                                 ! nvp

      ENDIF

C =====================================================
C         F L U X   C A L C U L A T I N   FOR t=k-1
C
C         ------------x-------- t=k
C                    /
C         ----------o--------- t=k-1
C
C =====================================================
7777  CONTINUE
      WRITE(66,*)'2) QKM1=',QKM1

      CALL FLUXMS(QQ(1,1,1),HTM(1,KTOP),
     * UU(1,1,2),VV(1,1,1),VTM(1,KTOP),DTT,DELQ1)

      WRITE(66,*)'3) QKM1=',QKM1

      CALL FLUXV(QQ(1,1,1),HTM(1,KTOP),WW(1,1,1),DTT*CW,
     * DELQ2,DELQ3,UPAR,TOAR)

      QBAKM1=QKM1+DELQ1+DELQ2
      DQOUT=DELQ1+DELQ2

      WRITE(66,*)'F L U X  C A L C U L A T I O N  FOR t=k-1'
```

```
      WRITE(66,*)'DELQ1          =',DELQ1,' Later. Flux'
      WRITE(66,*)'DELQ2          =',DELQ2,' vertic. Flux'
      WRITE(66,*)'DQOUT=DELQ1+DELQ2    =',DQOUT
      WRITE(66,*)'QKM1           =',QKM1
      WRITE(66,*)'QBAKM1=QKM1+DELQ1+DELQ2=',QBAKM1

C =====================================================

      CALL POISTA(66,IBSTEP+ISTEP,'Befor TRPORT QQ(1,1,1)',
     * QQ(1,1,1),HTM(1,KTOP),KMAX)

CX       WRITE(66,*)'STOP BEFORE TRPORT(...'
CX       STOP

      call clock(tt1)
C
C     TRANSPORT CALCULATION
C
      CALL TRPORT(DTT,QMIN,CW)
C       CALL CORREC(QQH,QQL,HTM,IMJM,KMAX,QMIN)
C
      call clock(tt2)
      WRITE(66,*)'*/ TRANSP CP time=',tt2-tt1,
     *' STEP=',IBSTEP+ISTEP,'/*'
C
      IF(ISTEP.EQ.2)THEN
      WRITE(66,*)'ISTEP =',ISTEP
      WRITE(66,*)'IBSTEP=',IBSTEP
      WRITE(66,*)'DTT  =',DTT
      WRITE(66,*)'QMIN  =',QMIN
      WRITE(66,*)'VD   =',VD
      WRITE(66,*)'CW   =',CW
      WRITE(66,*)'LOGU  =',LOGU
      WRITE(66,*)'QBAKM1=',QBAKM1

      CALL EXTRAC(HINTG,IMJM,AMEAN,AMIN,AMAX,0.,NULL)
      WRITE(66,*)'HINTG:  AMEAN,AMIN,AMAX,NULL=',
     * AMEAN,AMIN,AMAX,NULL
      CALL EXTRAC(HINN,IMJM*KMAX,AMEAN,AMIN,AMAX,0.,NULL)
      WRITE(66,*)'HINN:  AMEAN,AMIN,AMAX,NULL=',
     * AMEAN,AMIN,AMAX,NULL
      CALL EXTRAC(HTM,IMJM*KMAX,AMEAN,AMIN,AMAX,0.,NULL)
      WRITE(66,*)'HTM:  AMEAN,AMIN,AMAX,NULL=',
     * AMEAN,AMIN,AMAX,NULL

C       STOP

      ENDIF
C
      CALL POISTA(66,IBSTEP+ISTEP,'After TRANSP, QQ(1,1,2)',
     * QQ(1,1,2),HTM(1,KTOP),KMAX)

      CALL INMASS(QQ(1,1,2),HTM(1,KTOP),RES,PS(1,2),PT,
     *      DETA(KTOP),KMAX,
     *      DMQA,TAM2,DRQA,TAREA)
C ==================================
      QAAK=DMQA        ! After advection
C =====================================================
C         F L U X   C A L C U L A T I N   FOR t=k
C
C         ------------x------- t=k
C                    /
C         ----------o--------- t=k-1
C
C =====================================================

      CALL FLUXMS(QQ(1,1,2),HTM(1,KTOP),
     * UU(1,1,2),VV(1,1,2),VTM(1,KTOP),DTT,DELQ1)
```



```
      CALL FLUXV(QQ(1,1,2),HTM(1,KTOP),WW(1,1,2),DTT*CW,
     * DELQ2,DELQ3,UPAR,TOAR)

CX       QK=QKM1+DELQ1+DELQ2

      QK=QKM1+0.5*(DELQ1+DELQ2+DQOUT)        !  22/05/2001
      QBAKM1=QKM1+0.5*(DELQ1+DELQ2+DQOUT)    !  22/05/2001
C =====================================================
C                                                 From To
C                                                    |   |
      CALL VLFLUX(QQ(1,1,2),HTM(1,KTOP),WW(1,1,2),CW,1,KMAX,DTT,
     * VERTFL,VERFLX)
      WRITE(66,*)'VERTICAL FLUX1 STEP= ',IBSTEP+ISTEP,' */'
      DO KL=1,KMAX-1
      WRITE(66,*)KL,VERTFL(KL),' 1.E+6 kg/step: ^ plus; V minus'
      ENDDO
C =====================================================
      WRITE(66,*)'FLUX STEP=',IBSTEP+ISTEP,
     * '/* HOR=',DELQ1,' VER=',DELQ2,'*/'
      WRITE(66,*)'FLUX = a)',DELQ2,'b)',DELQ3,
     *'c)',UPAR/1.E6,'d)',TOAR/1.E6,'*/'
      WRITE(66,*)'OUTFLUX STEP=',IBSTEP+ISTEP,
     * ' DQOUT=',DQOUT,' */'
      WRITE(66,*)'DELQ1 - the lateral flux  =',DELQ1
      WRITE(66,*)'DELQ2 - the vertical flux =',DELQ2
C
C       DELQ1 - the lateral flux
C       DELQ2 - the vertical flux   kg x 1.E+6
C       DELQ3 - the normalazed vertical flux = total flux / area
C                              (kg x 1.E+6)/m**2
C        UPAR - the inner area with up velocity in km**2
C        TOAR - the total inner area in km**2
CCCCCC ============================================= CCCCC
CCCCCC         CONSERVATION WITHOUT V.TURBULENCE         CCCCC
CCCCCC ============================================= CCCCC
C      ---------------------------
C      QUASI-CONSERVATION ALGORITHM
C      ---------------------------
      WRITE(66,*)'QUASI-CONSERVATION ALGORITHM'

C       STOP

      call clock(tt1)
      FQ=QBAKM1

      WRITE(66,*)'FQ=QBAKM1 =',FQ,' */'

      CALL CONSV1(QQH,QQL,RO,HINN,IMJM*KMAX,
     *     ALFA,BETA,FQ,CSTAR,IR)

      IF(IR.EQ.0)THEN
      ICON=1
      CALL CONSV2(QQH,QQL,QQ(1,1,2),IMJM*KMAX,
     *      ALFA,BETA,IFLAG,CSTAR,ICON)

      IF(ICON.EQ.0)THEN
      CALL CONMAS(QQ(1,1,2),HTM(1,KTOP),RES,PS(1,2),PT,
     * DETA(KTOP),KMAX,0.,QMIN,
     * FQ,DQADJ,QMNEW)
      ENDIF

      ELSE
      CALL CONSV3(QQH,QQL,QQ(1,1,2),IMJM*KMAX,
     *     ALFA)
      ENDIF

      call clock(tt2)
      WRITE(66,*)'*/ CONSERV CP time=',tt2-tt1,
     *' STEP=',IBSTEP+ISTEP,'/*'
```

```
CX        WRITE(66,*)'STOP AFTER CONSV'
CX        STOP

      CALL IPOSTA(66,IBSTEP+ISTEP,'BETA',BETA,HTM(1,KTOP),KMAX)
      CALL IPOSTA(66,IBSTEP+ISTEP,'ALFA',ALFA,HTM(1,KTOP),KMAX)
         WRITE(66,*)' ****** CONSERVATION, ISTEP=',IBSTEP+ISTEP
         WRITE(66,*)'FQ  =',FQ
         WRITE(66,*)'CSTAR=',CSTAR
         WRITE(66,*)'IR  =',IR

      CALL POISTA(66,IBSTEP+ISTEP,'After CONSERV., QQ(1,1,2)',
     * QQ(1,1,2),HTM(1,KTOP),KMAX)

      CALL INMASS(QQ(1,1,2),HTM(1,KTOP),RES,PS(1,2),PT,
     *            DETA(KTOP),KMAX,
     *            TQM,TAM,RQM,TAREA)

      QACK=TQM
      DMQT=TQM
      DRQT=RQM

      WRITE(66,*)'CONSERVATION=============='
      WRITE(66,*)'AFTER ADVECTION=',QBAKM1,' */'
      WRITE(66,*)'AFTER CONSERV =',TQM,' */'

CX        WRITE(66,*)'STOP BEFORE VERTICAL DIFFUSION'
CX        STOP

CCCCCC ================================================= CCCCC
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC

C
C     VERTICAL DIFFUSION
C
      call clock(tt1)
C ---------------------------------------------------

      CALL QDIFF(QQ(1,1,2),QFLUX,DFLX,DIFV,LMH,AKH,
     * RO(1,1,2),ZZ(1,1,2),KMAX,DTT)

      CALL INMASS(QQ(1,1,2),HTM(1,KTOP),RES,PS(1,2),PT,
     *            DETA(KTOP),KMAX,
     *            TQM,TAM,RQM,TAREA)
      QATK=TQM
      DMQT=TQM
      DRQT=RQM
C ---------------------------------------------------
      call clock(tt2)
      WRITE(66,*)'*/ VSDIFF CP time=',tt2-tt1,
     *' STEP=',IBSTEP+ISTEP,'/*'

      WRITE(66,*)'VERTICAL FLUX2 STEP= ',IBSTEP+ISTEP,' */'
      DO KL=1,KMAX+1
      WRITE(66,*)KL,DFLX(KL),' 1.E+6 kg/step: ^ plus; V minus'
      ENDDO

      CALL POISTA(66,IBSTEP+ISTEP,'After VSDIFF, QQ(1,1,2)',
     * QQ(1,1,2),HTM(1,KTOP),KMAX)

CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C
C                    WET SEDIMENTATION
C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
      WRITE(0,*)'NO WET SEDIMENTATION'
      WRITE(0,*)'ISTEP=',ISTEP
```



```
      CALL SUBTRA(ACPR(1,2),ACPR(1,1),IMJM,DPREC)
      CALL EXTRAC(DPREC,IMJM,AMEAN,AMIN,AMAX,0.,NULL)
      WRITE(66,*)'DPREC: AMEAN,AMIN,AMAX,NULL=',
     * AMEAN,AMIN,AMAX,NULL

      WRITE(66,*)'SUBTRA... O.K.'
      COEWS=2.8
      COEWS=1.4
CNO      CALL WTSCA(QQ(1,1,2),COEWS,ACPR,DQDT,HTM(1,KTOP),KMAX,DTT)
C      CALL WTSCA(QQ(1,1,2),2.8,ACPR,DQDT,HTM(1,KTOP),KMAX,DTT)
C                            0.1

C      CALL WETSED(QQ(1,1,2),ACPR,DQDT,HTM(1,KTOP),KMAX,DTT)
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC

      CALL INMASS(QQ(1,1,2),HTM(1,KTOP),RES,PS(1,2),PT,
     *            DETA(KTOP),KMAX,
     *            TQM,TAM,RQM,TAREA)

      QAWSK=TQM
      DMQT=TQM
      DRQT=RQM

      WRITE(66,*)'  MASS BALANCE FOR STEP=',IBSTEP+ISTEP,' */'
      WRITE(66,*)'DMQ0 =',DMQ0  ,' 1.E6 kg '
      WRITE(66,*)'QKM1 =',QKM1  ,' 1.E6 kg '
      WRITE(66,*)'QBAKM1=',QBAKM1,' 1.E6 kg '
      WRITE(66,*)'QAAK =',QAAK  ,' 1.E6 kg '
      WRITE(66,*)'QACK =',QACK  ,' 1.E6 kg '
      WRITE(66,*)'QATK =',QATK  ,' 1.E6 kg '
      WRITE(66,*)'QAWSK =',QAWSK ,' 1.E6 kg '
      WRITE(0,*)'START CLMDOM'
C
C     * DETA(KTOP),KMAX,
C
CX       WRITE(0,*)'FINISH COLMAS'

      WRITE(66,*)'START COLMAS ISTEP=',ISTEP,' */'

            CALL CLMDOM(QQ(1,1,2),HTM(1,KTOP),RES,PS(1,2),
     *      DETA(KTOP),KMAX,
     *      COLCON,COLAIR)

      CALL EXTRAC(COLCON,IMJM,AMEAN,AMIN,AMAX,0.,NULL)
      WRITE(66,*)'COLCON: AMEAN, AMIN, AMAX, NULL=',
     * 1000.*AMEAN,1000.*AMIN,1000.*AMAX,NULL,' g/m^2'

      WRITE(66,*)'FINISH COLMAS'

C19/02/99       CALL COLDIA(6,IBSTEP+ISTEP,
C19/02/99      * COLCON,COLAIR,1.E-6,1.)    ! in kg


C       STOP
      WRITE(66,*)'AREAS BALANCE CALCULATION JUMP'
      GOTO 777
C     .........................................
C
C             AREAS BALANCE CALCULATION
C
C     .........................................
      AREAX0=-66.0
      AREAY0=-14.0
      CALL PARARE(AREAX0,AREAY0,I0,J0,TLM0D*RADDEG,TPH0D*RADDEG)

      WRITE(66,*)'PARARE: I0=',I0,' J0=',J0

      NXAREA=25
      NYAREA=25
```

```
C/      NXAREA=35
C/      NYAREA=45

C/      NXAREA=5
C/      NYAREA=5

      IF(ISTEP.EQ.1)THEN
      CALL PASSAB(QQ(1,1,1),IMJM*KMAX ,QFIL(1,1,1))
      CALL ENFILT(QQ(1,1,1),QFIL(1,1,1))
      ENDIF


      CALL PASSAB(QQ(1,1,2),IMJM*KMAX ,QFIL(1,1,2))
      CALL ENFILT(QQ(1,1,2),QFIL(1,1,2))

      WRITE(66,*)'Longitude:',DEX*(NXAREA-1),' degr.'
      WRITE(66,*)'From ',AREAX0,' to ',AREAX0+DEX*(NXAREA-1)
      WRITE(66,*)'Latitude : ',DEY*(NYAREA-1),' degr.'
      WRITE(66,*)'From ',AREAY0,' to ',AREAY0+DEY*(NYAREA-1)

      CALL BALARE(I0,NXAREA,J0,NYAREA,DTT,
     * QFIL(1,1,1),QFLUX,HTM,UU(1,1,1),VV(1,1,1),VTM,PS(1,1),
     * IWA,LENIWA,COBAL)

C/      CALL LOCADR(6,IWA,NXAREA,NYAREA)
      WRITE(66,*)'   BALANCE FOR FILTERING DATA'
      WRITE(66,*)'AREA BALANCE: I=',I0,' J=',J0,' ISTEP=',ISTEP,' #/'
      WRITE(66,*)'         M=',NXAREA,' N=',NYAREA,' #/'
      WRITE(66,*)'1) TOTM=',COBAL(1),' #/ 1.E6 kg'
      WRITE(66,*)'1) FBOT=',COBAL(2),' #/ 1.E6 kg/step'
      WRITE(66,*)'1) FLAT=',COBAL(3),' #/ 1.E6 kg/step'
      WRITE(66,*)'   '
      WRITE(66,*)'1) FSOU=',COBAL(4),' #/ 1.E6 kg/step'
      WRITE(66,*)'1) FEST=',COBAL(5),' #/ 1.E6 kg/step'
      WRITE(66,*)'1) FNOR=',COBAL(6),' #/ 1.E6 kg/step'
      WRITE(66,*)'1) FWES=',COBAL(7),' #/ 1.E6 kg/step'
      WRITE(66,*)'1) AREA=',COBAL(8),' #/ 1.E6 kg/step'
      WRITE(66,*)'1) QMEAN=',COBAL(9),' #/ ppm'
      WRITE(66,*)'1) COVQ=',COBAL(10),' #/ ppm'
      WRITE(66,*)'1) AIMA=',COBAL(11),' #/ kg'
      WRITE(66,*)'   '
      WRITE(66,*)'   '
      CALL BALARE(I0,NXAREA,J0,NYAREA,DTT,
     * QFIL(1,1,2),QFLUX,HTM,UU(1,1,2),VV(1,1,2),VTM,PS(1,2),
     * IWA,LENIWA,COBAL)
      WRITE(66,*)'2) TOTM=',COBAL(1),' #/ 1.E6 kg'
      WRITE(66,*)'2) FBOT=',COBAL(2),' #/ 1.E6 kg/step'
      WRITE(66,*)'2) FLAT=',COBAL(3),' #/ 1.E6 kg/step'
      WRITE(66,*)'   '
      WRITE(66,*)'2) FSOU=',COBAL(4),' #/ 1.E6 kg/step'
      WRITE(66,*)'2) FEST=',COBAL(5),' #/ 1.E6 kg/step'
      WRITE(66,*)'2) FNOR=',COBAL(6),' #/ 1.E6 kg/step'
      WRITE(66,*)'2) FWES=',COBAL(7),' #/ 1.E6 kg/step'
      WRITE(66,*)'2) AREA=',COBAL(8),' #/ 1.E6 kg/step'
      WRITE(66,*)'2) QMEAN=',COBAL(9),' #/ ppm'
      WRITE(66,*)'2) COVQ=',COBAL(10),' #/ ppm'
      WRITE(66,*)'2) AIMA=',COBAL(11),' #/ kg'

      CALL LATFLX(QFIL,HTM,UU,VV,VTM,PS,IWA,LEN,FLXL)
      WRITE(66,*)'3) FLAT ISTEP=',ISTEP,' FLXL=',FLXL*DTT,
     * ' #/ 1.E6 kg/step'

      IF(ISTEP.EQ.1)THEN
      OPEN(50,FILE=
     * '/pesqout/sdg04/igor/Data/dataout/bnd1area.dat',
     *  STATUS='UNKNOWN')
      CALL BNDAR(50,I0,NXAREA,J0,NYAREA,3)
      WRITE(66,*)'OPEN AND READ of bnd1area.dat done'
```



```
      ENDIF

      STOP

777   CONTINUE

      CALL ATMOSM(66,PS,ATM1,ATM2)

      CALL PASSAB(QQ(1,1,2),IMJM*KMAX ,QQ(1,1,1))
      CALL PASSAB(PS(1,2),IMJM ,PS(1,1))
      CALL PASSAB(TT(1,1,2),IMJM*KMAX ,TT(1,1,1))
      CALL PASSAB(UU(1,1,2),IMJM*KMAX ,UU(1,1,1))
      CALL PASSAB(VV(1,1,2),IMJM*KMAX ,VV(1,1,1))
      CALL PASSAB(WW(1,1,2),IMJM*KMAX ,WW(1,1,1))
      CALL PASSAB(RO(1,1,2),IMJM*KMAX ,RO(1,1,1))

      CALL PASSAB(ZZ(1,1,2),IMJM*(KMAX+1) ,ZZ(1,1,1))
      CALL PASSAB(AKH(1,1,2),IMJM*KMAX ,AKH(1,1,1))
      CALL PASSAB(AKHS(1,2),IMJM ,AKHS(1,1))
      CALL PASSAB(PREC(1,2),IMJM ,PREC(1,1))
      CALL PASSAB(ACPR(1,2),IMJM ,ACPR(1,1))

      CALL PASSAB(QFIL(1,1,2),IMJM*KMAX ,QFIL(1,1,2))

      CALL EXTR2M(66,'CO2', QQ(1,1,1),HTM(1,KTOP),HINTG,
     *          IMJM,KMAX,1)
      CALL EXTR2M(66,'VDIFF', DIFV,HTM(1,KTOP),HINTG,
     *          IMJM,KMAX,1)

      CALL EXTR2M(66,'AKH', AKH,HTM(1,KTOP),HINTG,
     *          IMJM,KMAX,1)
C     --------------------------
C
C     --------------------------
      CALL AVSUR(ACPR,HTM1,CON,ACPI,ACPA)
      WRITE(66,*)'#/ ACPR ISTEP=',IBSTEP+ISTEP,
     *  'ACPI=',ACPI,' ACPA=',ACPA,' /# Old'

      CALL AVSUR(ACPR,HINTG,CON,ACPI,ACPA)
      WRITE(66,*)'#/ ACPR ISTEP=',IBSTEP+ISTEP,
     *  'ACPI=',ACPI,' ACPA=',ACPA,' /#'


      CALL AVSUR(PREC,HTM1,CON,PREI,PREA)
      WRITE(66,*)'#/ PREC ISTEP=',IBSTEP+ISTEP,
     *  'PREI=',PREI,' PREA=',PREA,' /# Old'

      CALL AVSUR(PREC,HINTG,CON,PREI,PREA)
      WRITE(66,*)'#/ PREC ISTEP=',IBSTEP+ISTEP,
     *  'PREI=',PREI,' PREA=',PREA,' /#'

      IF(ISTEP.EQ.2)CALL SITIOS(66,WA)
C                                                      !     22/05/2001
      IF(MOD(ISTEP,NSWRI).EQ.0.OR.ISTEP.EQ.53)THEN ! for 42h or 24+18h
C     -----------------------------
C
C       OPTICAL PARAMETER RECORD
C
C     -----------------------------
      WRITE(66,*)' OPTICAL PARAMETER RECORD, ISTEP=',
     * ISTEP,' #/'
      CALL SITIOS(66,WA)
C23456
C     -----------------------------
C
C             OUTPUT RECORD
C
C     -----------------------------
      WRITE(66,*)'OUTPUT RECORD ISTEP=',ISTEP
```

```
      CALL EXTRAC(DPREC,IMJM,AMEAN,AMIN,AMAX,0.,NULL)
      WRITE(66,*)'DPREC: AMEAN,AMIN,AMAX,NULL=',
     * AMEAN,AMIN,AMAX,NULL

      CALL WRH6VR(60,IREC3,QQ,RO,ZZ,UU,VV,              !  nvp
     * HTM(1,KTOP),HZM,VTM(1,KTOP),LMH,                 !  nvp
     * AETA(KTOP),ETA(KTOP),                            !  nvp
     * WA51,WA51U,WA51V,WA,KMAX,CON)                    !  nvp


      WRITE(66,*)'CALL CALL WRH6VR(60,IREC3,QQ,RO,ZZ,UU,VV, ,...+...'
      WRITE(66,*)'IREC3=',IREC3                         !  nvp

      CALL WRSUR(60,IREC3,DPREC,HZM,WA51,CON)           !  nvp
      WRITE(66,*)'IREC3=',IREC3                         !  nvp

      WRITE(66,*)'END OF OUTPUT RECORD ISTEP=',ISTEP
      ENDIF

      call clock(t4)
      write(66,103) t4-t3

      IF(ISTEP.EQ.NSTEP)THEN
C     ----------------------------
C             CHECK POINT
C     ----------------------------
      CALL CHKPT(58,'W',IDAT,IBSTEP+ISTEP,
     * IREC,IREC1,IREC2,QQ,IMJM,KMAX)
C23456
      WRITE(66,*)'CHKPT(58,''W'',IDAT,..., write'

      call clock(t2)
      write(66,102) t2-t1
102   format('CPU TIME for calculation: ',f10.4,' sec')
103   format('CPU TIME for step calculation: ',f10.4,' sec')

C      STOP 'ETA-TRANSPORT MODEL'

      ENDIF

      RETURN

      ENDIF
C     See top
      END
C& CORREC
      SUBROUTINE CORREC(A,B,H,IMJM,KMAX,QMIN)
      DIMENSION A(IMJM,KMAX),B(IMJM,KMAX),H(IMJM,KMAX)

      DO K=1,KMAX
      DO J=1,IMJM
      IF(H(J).EQ.1.)THEN
        IF(A(J)*H(J).LT.QMIN)A(J)=0.
        IF(B(J)*H(J).LT.QMIN)B(J)=0.
      ENDIF
      ENDDO
      ENDDO
      RETURN
      END
C& QDIFF
      SUBROUTINE QDIFF(Q,FSUR,DFLX,DIFLV,LMH,AKH,
     * RO,ZINT,KMAX,DTQ2)
      PARAMETER (IM=111,JM=221,LM=38,LSM=19)
      PARAMETER (IMJM = IM*JM - JM/2)
      PARAMETER (LP1=LM+1, LM1=LM-1)
      DIMENSION Q(IMJM,KMAX),FSUR(IMJM),LMH(IMJM),
     * AKH(IMJM,KMAX),RO(IMJM,KMAX),ZINT(IMJM,KMAX+1),
     * DFLX(KMAX+1),DIFLV(IMJM,KMAX)
```



```
C-----------------------------------------------------------------------
      DIMENSION
     & DC(LM1),AC(LM),BC(LM),CC(LM),FC(LM),
     & ROC(LM),ZC(LP1),CKH(LM1),
     & SOLC(LM),BET(LM+1),Z(LM+1),
     & TFLX(LM+1)
      DIMENSION DIRO(LM),DIZ(LP1),DIKH(LM1)
C                             C O M M O N
      COMMON/INNERP/IPN,INP(IMJM),IINP(IMJM),JINP(IMJM)
      COMMON/ETAREA/CAREA(IMJM)
C
C                     S T A R T
C

CX      WRITE(66,*)'THE QDIFF SUBROUTINE STARTS'
CX      STOP

      DO K=1,LM+1
      TFLX(K)=0.
      ENDDO

      DO1000 J=1,IPN
      JP=INP(J)
      KB=LMH(JP)
      DS=CAREA(JP)

CX         IF(J.GT.22680)THEN
CX         WRITE(0,*)'J=',J,' JP=',JP,' KB=',KB
CX         ENDIF

      ZC(1)=ZINT(JP,1)
      DO K=1,KB
      ZC(K+1)=ZINT(JP,K+1)
      ROC(K)=RO(JP,K)/DS/(ZC(K)-ZC(K+1))    !   21/02/99
      ENDDO

      DO K=1,KB-1
      CKH(K)=AKH(JP,K)
      ENDDO

      DO K=1,KB-1
      DC(K)=(ROC(K)+ROC(K+1))*CKH(K)/(ZC(K)-ZC(K+2))
      FC(K)=Q(JP,K)
      ENDDO
      FC(KB)=Q(JP,KB)+DTQ2*FSUR(JP)/(ROC(KB)*(ZC(KB)-ZC(KB+1)))
C                   -

      AC(1)=0.
      DO K=2,KB          !   -1
      AC(K)=DTQ2*DC(K-1)/(ROC(K)*(ZC(K)-ZC(K+1)))
      ENDDO

      DO K=1,KB-1
      CC(K)=DTQ2*DC(K)/(ROC(K)*(ZC(K)-ZC(K+1)))
      ENDDO
      CC(KB)=0.

      DO K=1,KB
      BC(K)=1.+AC(K)+CC(K)
      ENDDO

CX      WRITE(66,*)'STOP BEFORE PROGON'
CX      STOP
CX      IF(J.EQ.5590)THEN
CX      WRITE(66,*)' ////////////////////'
CX      WRITE(66,*)'  POINT=',J
CX      WRITE(66,*)' ////////////////////'
CX      WRITE(66,*)'FSUR(JP)=',FSUR(JP)
CX      WRITE(66,*)' K   q   Ro   z   KH'
```

```
CX       DO KL=1,KB
CX       WRITE(66,*)KL,Q(JP,KL),ROC(KL),ZC(KL),CKH(KL)
CX       ENDDO
CX       WRITE(66,*)'ZC(KB+1)=',ZC(KB+1)
CX
CX       ENDIF

      CALL PROGON(AC,BC,CC,FC,KB,SOLC,BET,Z)
C23456
CX       IF(J.EQ.5590)THEN
CX       WRITE(66,*)'    SOLUTION'
CX       DO KL=1,KB
CX       WRITE(66,*)KL,SOLC(KL)
CX       ENDDO
CX
CX       WRITE(66,*)'      EQUATION'
CX       WRITE(66,*)'KL,AC(KL),BC(KL),CC(KL),FC(KL),DC(KL)'
CX       DO KL=1,KB
CX       WRITE(66,*)KL,AC(KL),BC(KL),CC(KL),FC(KL),DC(KL)
CX       ENDDO
CX
CX       ENDIF

      DO K=1,KB
      DIFLV(JP,K)=SOLC(K)-Q(JP,K)
      Q(JP,K)=SOLC(K)
      ENDDO
C
C             TOTAL FLUX OVER ETA SURFACES
C
      TFLX(1)=0.
      DO K=1,KB-1
      TFLX(K+1)=TFLX(K+1)+DS*DC(K)*(SOLC(K)-SOLC(K+1))
      ENDDO
      TFLX(KB+1)=TFLX(KB+1)+DS*FSUR(JP)
C                                  -


1000  CONTINUE                                 !     J loop

CX       WRITE(0,*)'End of 1000 loop'
C     Let us calculate the turbulent flux !

      DO K=1,LM+1
      DFLX(K)=DTQ2*TFLX(K)
      ENDDO

      RETURN
      END
C *********************************************
C                                             *
C           FROM    TRPORT.f                  *
C                                             *
C *********************************************
C
C     Version 1/12/98
C
C& TRPORT
      SUBROUTINE TRPORT(DT,QMIN,CW)
      PARAMETER (IM=111,JM=221,LM=38,LSM=19)
      PARAMETER (LDA=LM+9,LA=13)
C
      PARAMETER (
     &  IMJM=IM*JM-JM/2,JMP1=JM+1,JAM=6+2*(JM-10),LB=2*IM+JM-3
     &, LM1=LM-1,LP1=LM+1,L3=LDA+LM+1,L4=LDA+2*LM+1,L7=L4+3
     &, LSCRCH=4*LM+1+LA+1)

      PARAMETER (IMT=2*IM-1)
      PARAMETER (IMAX=2*IM-1  , JMAX=JM)
```



```
      PARAMETER (KKMAX=LM)
      PARAMETER (KMIN =LM-KKMAX)
      PARAMETER (KMAX=KKMAX)
      PARAMETER (KTOP=KMIN+1)

      COMMON/ETATRN/
     * QQL(IMJM,KKMAX),QQH(IMJM,KKMAX),
     * PS(IMJM,2), QQ(IMJM,KKMAX,2),
     * UU(IMJM,KKMAX,2), VV(IMJM,KKMAX,2),
     * WW(IMJM,KKMAX,2), RO(IMJM,KKMAX,2),
     * TT(IMJM,KKMAX,2), ZZ(IMJM,KKMAX+1,2),
     * ALFA(IMJM,KKMAX,2),
     * DIFQ(IMJM,KKMAX),
     * AKH(IMJM,KKMAX,2),AKHS(IMJM,2),
     * TOPG(IMJM)
     *,PREC(IMJM,2),ACPR(IMJM,2)

      COMMON/DBGXYZ/IXYZ

      PARAMETER (NPOINT=25)
C
      COMMON/ETAGRD/
     *      XB,DEX,YB,DEY,
     *      COSETA(JM),XETA(IMAX),YETA(JM),
     *      ITMP(NPOINT), JTMP(NPOINT), KTMP(NPOINT)

      COMMON/ETAREA/CAREA(IMJM)

      COMMON/ETABND/IBND1,IBND2,JBND1,JBND2

      COMMON/INNERP/IPN,INP(IMJM),IINP(IMJM),JINP(IMJM)

      COMMON/TAB25A/IOA(25),WET(26),IOAC(16)

      COMMON/INNER2/IPN2,IPN3,INP2(IMJM),IIN2(IMJM),JIN2(IMJM),
     *                        INP3(IMJM)
      COMMON/CITERB/EPS,MAXIT

C-----------------------------------------------------------------------
                                    C O M M O N /LOOPS/
     & KHLA  (JAM),KHHA  (JAM),KVLA  (JAM),KVHA  (JAM)
C
     &,KHL2  (JM),KHH2  (JM),KVL2  (JM),KVH2  (JM)
C
     &,LMH   (IMJM),LMV   (IMJM)
C-----------------------------------------------------------------------
                                    C O M M O N /MASKS/
     & HBM2  (IMJM),VBM2  (IMJM),VBM3  (IMJM),SM    (IMJM),SICE (IMJM)
C
     &,HTM   (IMJM,LM),VTM   (IMJM,LM)
C-----------------------------------------------------------------------
                                    C O M M O N /VRBLS/
     & PD(IMJM),RES(IMJM),FIS(IMJM)
C
     &,U(IMJM,LM),V(IMJM,LM),T(IMJM,LM),Q(IMJM,LM)
C-----------------------------------------------------------------------
                                     C O M M O N /MAPOT/
     & LSL,IXM,IYM
     &,ISHDE(49)
     &,R,PT,TSPH
     &,WBD,SBD,TLM0D,TPH0D,DLMD,DPHD,CMLD,DP30,X1P,Y1P
     &,DISLP,Z0SLP,SPL(LSM),ALSL(LSM)
     &,DETA(LM),AETA(LM),ETA(LP1),TSHDE(49)
     &,ERLAM0,CPHI0,SPHI0
     &,KUNIT,LUNIT,MUNIT,IUNIT,NUNIT
C------------------------------------------------------------------------
      COMMON/TM3COM/SURP8(8),STAX(10,20)
      LOGICAL LFIL, UNDIS
```

```
      DATA PAI /3.14159265/
      DATA G /9.81/
      DATA RGAS /287.04/
      DATA ERAD /6370000./
      DATA CON /-999.0/
C
C         S T A R T
      WRITE(66,*)'START TRPORT'
C/      WRITE(66,*)'IPN=',IPN
C/      WRITE(0,*)'START TRPORT'
C/      WRITE(0,*)'IPN=',IPN
C
      DO I=1,20
      STAX(1,I)=0.
      ENDDO

      PID180=PAI/180.
      CONV=PID180
C
C     XB, DEX
C     YB, DEY
C     CON        = -999.0
C
CX      CALL SETID3(XB,DEX,YB,DEY,IM,JM,CON)    ! See TRNETA

C
C      DENSITY CALCULATION
C      &  ALFA CALCULATION
C
       DO K=1,KMAX

       DO I=1,IMJM

       IF(HTM(I,K+KMIN).EQ.1.)THEN

CX       PETA=PT+AETA(K+KMIN)*PD(I)*RES(I)    ! #############
CX       C1=PETA/RGAS

       ALFA(I,K,1)=1.
       ALFA(I,K,2)=1.
       ELSE
       ALFA(I,K,1)=0.         ! CON                   !   -999.0
       ALFA(I,K,2)=0.         ! CON                   !   -999.0
       ENDIF

       ENDDO
       ENDDO

      ILENG=IBND2-IBND1+1
      JLENG=JBND2-JBND1+1

      ICL2=0                            ! Debuging control

      CX=1./(ERAD*PID180)

C/      WRITE(66,*)'IPN2=',IPN2,' IPN3=',IPN3
C/      WRITE(0,*)'IPN2=',IPN2,' IPN3=',IPN3

      IXYZ=0
CDB      IDEBUG=0


C/      WRITE(0,*)'START JP and KL Loops'

      DO1000 JP=1,IPN
C/      WRITE(0,*)'JP=',JP

CDB      NUMPOI=JP                  !DB
```



```
      IH=INP(JP)

      IVE=IH
      IVW=IVE-1
      IVN=IH+IM-1
      IVS=IH-IM

      I=IINP(JP)
      J=JINP(JP)

      CY=CX/COSETA(J)

      XA=XB+(I-1)*DEX
      YA=YB+(J-1)*DEY
      TOPA=TOPG(IH)

CX      CALL SAMPLX(FLOAT(IH),STAX(1,9))

      DO3000 KL=1,KMAX

C/      WRITE(0,*)'KL=',KL

      KIT=0
      NSURP8=0

      IF(HTM(IH,KL+KMIN).EQ.0.)THEN
C --------------------------------
C     UNDER SURFACE
C --------------------------------
C/      WRITE(0,*)'UNDER SURFACE'

      QQ(IH,K,2)=0.
      ELSE
C --------------------------------
C     OVER SURFACE
C --------------------------------
C/      WRITE(0,*)'OVER SURFACE'

      QA=QQ(IH,KL,1)

      ZA=AETA(KL+KMIN)
      WAR=WW(IH,KL,2)*HTM(IH,KL+KMIN)

      UA=VTM(IVE,KL+KMIN)*UU(IVE,KL,2)+
     *   VTM(IVW,KL+KMIN)*UU(IVW,KL,2)+
     *   VTM(IVS,KL+KMIN)*UU(IVS,KL,2)+
     *   VTM(IVN,KL+KMIN)*UU(IVN,KL,2)

      VA=VTM(IVE,KL+KMIN)*VV(IVE,KL,2)+
     *   VTM(IVW,KL+KMIN)*VV(IVW,KL,2)+
     *   VTM(IVS,KL+KMIN)*VV(IVS,KL,2)+
     *   VTM(IVN,KL+KMIN)*VV(IVN,KL,2)

      IW=INT(VTM(IVE,KL+KMIN)+VTM(IVW,KL+KMIN)+
     *       VTM(IVN,KL+KMIN)+VTM(IVS,KL+KMIN))+1

      UA=UA*WET(IW)
      VA=VA*WET(IW)

      X1=XA-CX*UA*DT
      Y1=YA-CY*VA*DT
      Z1=ZA-CW*WAR*DT

      QQH(IH,KL)=0.               !  21/12/98
      QQL(IH,KL)=0.               !  21/12/98

C/      WRITE(0,*)'START SAMPLX'

      ONE=1.
```

```
CX       CALL SAMPLX(ONE,STAX(1,1))
CX       CALL SAMPLX(QA,STAX(1,2))
CX       CALL SAMPLX(UA,STAX(1,3))
CX       CALL SAMPLX(VA,STAX(1,4))
C/       WRITE(0,*)'IH =',IH,' KL=',KL
C/       WRITE(0,*)'START LATERAL BOUNDARY FILTR'

C
C          LATERAL BOUNDARY FILTR
C
      CALL BOUNDT(X1,Y1,XETA(IBND1),ILENG,
     * YETA(JBND1),JLENG,IBOUND)
C/       WRITE(0,*)'IH =',IH,' KL=',KL
C/        WRITE(0,*)'IBOUND=',IBOUND

      IF(IBOUND.NE.0)THEN
      Q2=0.
      QHP=Q2
      QLP=Q2
      QHP2=Q2
      NSURP8=0
      GOTO999
      ENDIF
C/       WRITE(0,*)'IH =',IH,' KL=',KL
C/       WRITE(0,*)'START Z FILTER'
C
C                 Z  FILTER
C
      IF(Z1.LT.AETA(KTOP))THEN        !   Change 7/02/99
      Q2=0.                           !           /
      QHP=Q2                          !          /
      QLP=Q2                          !         /
      QHP2=Q2
      NSURP8=0                        !        /
      GOTO999                         !       /
      ENDIF                           !   Change 7/02/99

      Z1=AMAX1(Z1,AETA(KTOP))
      Z1=AMIN1(Z1,AETA(LM))

C     ---------------------------------
C             X,Y, and Z  FILTER
C     ---------------------------------
      CALL LOCATE(AETA(KTOP),KMAX,Z1,LEVTOP)

      IF(LEVTOP.LT.1)LEVTOP=1
      IF(LEVTOP.GE.KMAX)LEVTOP=KMAX-1

      LEVBOT=LEVTOP+1

C     =================

      KCELL=INDEXC(X1,Y1)

C/       WRITE(0,*)'KCELL=',KCELL

      IF(LEVBOT.GT.LMH(KCELL))THEN
C               UNDER

C/       WRITE(0,*)'UNDER'
      NSURP8=0
      Q2=0.
      QHP=Q2
      QLP=Q2
      QHP2=Q2
      GOTO999
      ELSE
C               OVER
      ENDIF
```



```
C     ------------------------------------
C
C     FILTRATION OF SMALL VALUES (Q.LT. QMIN)
C
C     ------------------------------------
C/       WRITE(0,*)'START FILTRATION OF SMALL ...'

      CALL CFILT2
     * (X1,Y1,LEVTOP,LEVBOT,QQ(1,1,1),
     * HTM(1,KTOP),KMAX,QMIN,UNDIS)

      LFIL=.FALSE.

C/       WRITE(0,*)'UNDIS=',UNDIS

      IF(UNDIS)THEN
      Q2=QQ(IH,KL,1)
      Q22=QQ(IH,KL,1)
      DIF=0.
      QHP=Q2
      QLP=Q2
      QHP2=Q2
      NSURP8=0
      GOTO999
      ENDIF

      X0=X1
      Y0=Y1
      Z0=Z1
      X2=X1
      Y2=Y1
      Z2=Z1
      KIT=1

      DQA=0.

C/       WRITE(0,*)'START ITERATIONS'

C     ----------------------------  ITERATIONS
C     ITERATIONS
C     ----------------------------  ITERATIONS
10    CONTINUE

      CALL BOUNDT(X2,Y2,XETA(IBND1),ILENG,
     * YETA(JBND1),JLENG,IBOUND)

      IF(IBOUND.NE.0)THEN
      Q2=0.
      QHP=Q2
      QLP=Q2
      QHP2=Q2
      NSURP8=0
      GOTO999
      ENDIF

      Z2=AMAX1(Z2,AETA(KTOP))
      Z2=AMIN1(Z2,AETA(LM))

C     ---------------------------------
C             X,Y, and Z  FILTER
C     ---------------------------------
      CALL LOCATE(AETA(KTOP),KMAX,Z2,LEVTOP)

      IF(LEVTOP.LT.1)LEVTOP=1
      IF(LEVTOP.GE.KMAX)LEVTOP=KMAX-1

      LEVBOT=LEVTOP+1

C     =================
```

```
      KCELL=INDEXC(X2,Y2)

      IF(LEVBOT.GT.LMH(KCELL))THEN
C               UNDER
      Q2=0.
      QHP=Q2
      QLP=Q2
      QHP2=Q2
      NSURP8=0
      GOTO999
      ELSE
C               OVER
      ENDIF
C
C     INTERPOLATION FOR (X2,Y2,Z2) POINT
C

C/      WRITE(0,*)
C/     *'START INTERPOLATION FOR (X2,Y2,Z2)'

C ............... UU(1,1,1)
       CALL VUBI3D(X2,Y2,Z2,AETA(KTOP),KMAX,
     * UU(1,1,1),VTM(1,KTOP),U2,HU2)
C ............... VV(1,1,1)
       CALL VUBI3D(X2,Y2,Z2,AETA(KTOP),KMAX,
     * VV(1,1,1),VTM(1,KTOP),V2,HV2)
C ............... WW(1,1,1)
       CALL CUBI3D(X2,Y2,Z2,AETA(KTOP),KMAX,
     * WW(1,1,1),HTM(1,KTOP),W2,HW2)

      IF(HU2*HV2*HW2.EQ.1)THEN
      X2=XA-.5*CX*(UA+U2)*DT
      Y2=YA-.5*CY*(VA+V2)*DT
      Z2=ZA-.5*CW*(WAR+W2)*DT

      ELSE
      X2=X1
      Y2=Y1
      Z2=Z1
      ENDIF

      D=DIST(X1,Y1,X2,Y2)
      IF(D.GT.EPS)THEN
      X1=X2
      Y1=Y2
      KIT=KIT+1
           IF(KIT.GE.MAXIT)THEN
           X2=X0
           Y2=Y0
           ELSE
           GOTO10
           ENDIF
      ENDIF
      DA2=DIST(XA,YA,X2,Y2)
C     ----------------------------  END OF ITERATIONS
11    CONTINUE
C     -----------------------------------
C
C                Z  FILTER
C
      IF(Z2.GT.AETA(LM))THEN
      Z2=AETA(LM)
      ELSE
      IF(Z2.LT.AETA(KTOP))THEN
      Z2=AETA(KTOP)
      ENDIF
      ENDIF
C     -----------------------------------
```



```
      CALL CUBI3D(X2,Y2,Z2,AETA(KTOP),KMAX,
     * QQ(1,1,1),HTM(1,KTOP),QHP2,HHP2)

      QHP=QHP2*HHP2

CX      CALL SAMPLX(HHP2,STAX(1,5))
CX      CALL SAMPLX(QHP,STAX(1,6))

      IXYZ=0

      CALL LI3DSU(X2,Y2,Z2,AETA(KTOP),KMAX,
     * QQ(1,1,1),HTM(1,KTOP),SURP8,NSURP8,QLP,HQLP)

CX      CALL SAMPLX(QLP,STAX(1,7))
CX      CALL SAMPLX(HQLP,STAX(1,8))

      IF(HQLP.NE.1.)QLP=0.
C ----------------------------
C     QUASI-MONOTONIC ALGORITHM
C ----------------------------
      IF(NSURP8.NE.0)THEN
      QMN=SURP8(1)
      QMX=SURP8(1)
      DO I=1,NSURP8
      QMN=AMIN1(QMN,SURP8(I))
      QMX=AMAX1(QMX,SURP8(I))
      ENDDO

      QHP=AMAX1(QHP,QMN)
      QHP=AMIN1(QHP,QMX)
      ELSE
      QHP=0.
      ENDIF
CX            O.K.
CX      IF(QHP.LT.0.)THEN
CX      QHP=0.
CX      ENDIF
C ----------------------------

      QQH(IH,KL)=QHP
      QQL(IH,KL)=QLP

C     -------------
C     Internal point
C     -------------

C     --------------------------------
C            BOUNDARY?
C     --------------------------------
 999    CONTINUE

C/      WRITE(0,*)'999'
C/      WRITE(0,*)'NSURP8=',NSURP8
C     --------------------------------sem diffusion
      Q3=QHP
      Q23=QLP
C     --------------------------------
      IF(QHP.LT.0..AND.QHP.NE.CON)THEN
      QHP=0.
      ENDIF

C/      WRITE(0,*)'QHP=',QHP
C/      WRITE(0,*)'IH =',IH,' KL=',KL

      QQ(IH,KL,2)=QHP

C     -------------------------------------------------------
C                   Here I can calculate ALFA
```

```
C      -------------------------------------------------------

C/       WRITE(0,*)'NSURP8=',NSURP8

           IF(NSURP8.NE.0)THEN
C/           WRITE(0,*)'SURP8=',SURP8
C
      CALL ALFMAX(QHP,QLP,QMP,SURP8,NSURP8,ALFA(IH,KL,2))
C
C/           WRITE(0,*)'QHP=',QHP
C/           WRITE(0,*)'QLP=',QLP
C/           WRITE(0,*)'QMP=',QMP
           ENDIF
C      -------------------------------------------------------
      ENDIF     ! ONE POINT CALCULATION OVER SURFACE END

CX       CALL SAMPLX(QHP,STAX(1,8))
CX       CALL SAMPLX(QLP,STAX(1,9))

C/       WRITE(0,*)'End of loop KL'

 3000      CONTINUE                 !   LEVEL LOOP
 1000      CONTINUE             !   J LOOP

C/       CALL WRISAM(0,'N p.',STAX(1,1))
C/       CALL WRISAM(0,'QHP ',STAX(1,6))

CX       CALL WRISAM(66,'N p.',STAX(1,1))
CX       CALL WRISAM(66,'QA  ',STAX(1,2))
CX       CALL WRISAM(66,'UA  ',STAX(1,3))
CX       CALL WRISAM(66,'VA  ',STAX(1,4))
CX       CALL WRISAM(66,'HHP2',STAX(1,5))
CX       CALL WRISAM(66,'QHP ',STAX(1,6))
CX       CALL WRISAM(66,'QLP ',STAX(1,7))
CX       CALL WRISAM(66,'2.QHP',STAX(1,8))
CX       CALL WRISAM(66,'2.QLP',STAX(1,9))


      CALL EXTRAC(QQ(1,1,1),IMJM*KMAX,AMEAN,AMIN,AMAX,0.,NULL)
      WRITE(66,*)'Q(K ): AMEAN,AMIN,AMAX,NULL=',
     * AMEAN,AMIN,AMAX,NULL
      CALL EXTRAC(QQ(1,1,2),IMJM*KMAX,AMEAN,AMIN,AMAX,0.,NULL)
      WRITE(66,*)'Q(K+1): AMEAN,AMIN,AMAX,NULL=',
     * AMEAN,AMIN,AMAX,NULL
      CALL EXTRAC(HTM,IMJM*KMAX,AMEAN,AMIN,AMAX,0.,NULL)
      WRITE(66,*)'HTM (0): AMEAN,AMIN,AMAX,NULL=',
     * AMEAN,AMIN,AMAX,NULL
      CALL EXTRAC(HTM,IMJM*KMAX,AMEAN,AMIN,AMAX,1.,NULL)
      WRITE(66,*)'HTM (1): AMEAN,AMIN,AMAX,NULL=',
     * AMEAN,AMIN,AMAX,NULL

      RETURN

      END
C& BOUNDT
      SUBROUTINE BOUNDT(XP,YP,X,M,Y,N,IB)
      DIMENSION X(M),Y(N)
      IB=0
      IF(XP.LT.X(1))IB=1000
      IF(XP.GT.X(M))IB=IB+100
      IF(YP.LT.Y(1))IB=IB+10
      IF(YP.GT.Y(N))IB=IB+1
      RETURN
      END
C& VFLUXS
      SUBROUTINE VFLUXS(NU,ISTEP,QFLUX,EFIREA)     !  ,BUFI,IRECF)
C
C     SURFACE FLUX
C
```



```
      PARAMETER (IM=111,JM=221,LM=38,LSM=19)
      PARAMETER (IMJM = IM*JM - JM/2)
      PARAMETER (LP1=LM+1)
      PARAMETER (JAM=6+2*(JM-10))
      PARAMETER (IMAX=2*IM-1  , JMAX=JM)
      PARAMETER (KKMAX=LM)
      PARAMETER (KMAX=KKMAX)
      PARAMETER (KMIN = LM-KKMAX)


      DIMENSION QFLUX(IMJM,2),EFIREA(IMJM,4)    !  ,BUFI(IMJM,2)
      DIMENSION VFLX(14)
C-----------------------------------------------------------------------
      COMMON/ETAVEG/IHVEG(IMJM)
C-----------------------------------------------------------------------
                                   C O M M O N /LOOPS/
     & KHLA  (JAM),KHHA  (JAM),KVLA  (JAM),KVHA  (JAM)
C
     &,KHL2  (JM),KHH2  (JM),KVL2  (JM),KVH2  (JM)
C
     &,LMH   (IMJM),LMV   (IMJM)
C------------------------------------------------------------------------
                                    C O M M O N /MAPOT/
     & LSL,IXM,IYM
     &,ISHDE(49)
     &,R,PT,TSPH
     &,WBD,SBD,TLM0D,TPH0D,DLMD,DPHD,CMLD,DP30,X1P,Y1P
     &,DISLP,Z0SLP,SPL(LSM),ALSL(LSM)
     &,DETA(LM),AETA(LM),ETA(LP1),TSHDE(49)
     &,ERLAM0,CPHI0,SPHI0
     &,KUNIT,LUNIT,MUNIT,IUNIT,NUNIT
C-----------------------------------------------------------------------
                                   C O M M O N /VRBLS/
     & PD(IMJM),RES(IMJM),FIS(IMJM)
C
     &,U(IMJM,LM),V(IMJM,LM),T(IMJM,LM),Q(IMJM,LM)
C-----------------------------------------------------------------------
      COMMON/ETATRN/
     * QQL(IMJM,KKMAX),QQH(IMJM,KKMAX),
     * PS(IMJM,2), QQ(IMJM,KKMAX,2),
     * UU(IMJM,KKMAX,2), VV(IMJM,KKMAX,2),
     * WW(IMJM,KKMAX,2), RO(IMJM,KKMAX,2),
     * TT(IMJM,KKMAX,2), ZZ(IMJM,KKMAX+1,2),
     * ALFA(IMJM,KKMAX,2),
     * DIFQ(IMJM,KKMAX),
     * AKH(IMJM,KKMAX,2),AKHS(IMJM,2),
     * TOPG(IMJM)
     *,PREC(IMJM,2),ACPR(IMJM,2)
C-----------------------------------------------------------------------
C
      COMMON/ETAREA/CAREA(IMJM)
C                   0  1 2 3 4 5 6 7 8 9 10 11 12 13
      DATA VFLX/ 0.,                ! 0 ocean
     *           0.206E-3,          ! 1 floresta
     *           0.580E-4,          ! 2
     *           0.580E-4,          ! 3
     *           0.580E-4,          ! 4
     *           0.580E-4,          ! 5
     *           0.903E-6,          ! 6 cerrado
     *           0.580E-4,          ! 7
     *           0.580E-4,          ! 8
     *           0.580E-4,          ! 9
     *           0.580E-4,          ! 10
     *           0.580E-4,          ! 11
     *           0.580E-4,          ! 12
     *           0.580E-4/          ! 13
C
      DATA RGAS/287.04/
C-----------------------------------------------------------------------
```

```
      IHR=MOD(ISTEP,30)
C
C                 QFLUX(*,1)
C
C
C     EFIREA(J) in km**2
C     CAREA(J)  in m**2
C
C      C1=QFLX*1.E6  ! For converting EFIREA(J) to m**2
C
      C2=1.E12    ! For converting to ppm  and EFIREA(J) to m**2
      DO J=1,IMJM
      IVT=IHVEG(J)

      IF(IVT.GT.13)THEN
      WRITE(66,*)'IVT=',IVT,' for ',J,' point'
      STOP
      ENDIF

      QFLXV=VFLX(IVT+1)   !*0.5    !  equiv fire area change by 0.5 times
      QFLUX(J,1)=QFLXV*C2*EFIREA(J,1)/CAREA(J)
      EFIREA(J,2)=0.
      EFIREA(J,3)=0.
      EFIREA(J,4)=0.
      ENDDO
C
C                 QFLUX(*,2)
C
       DO10 J=1,IMJM

       C=PD(J)*RES(J)
       K=LMH(J)
       IF(K.EQ.0)THEN
       QFLUX(J,2)=0.
       QFLUX(J,1)=0.
       ELSE
       PSUR=PT+AETA(K+KMIN)*C
       TEM=TT(J,K,2)
       ROP=PSUR/(RGAS*TEM)
       DZ=ZZ(J,K,2)-ZZ(J,K+1,2)
       QFLUX(J,2)=QFLUX(J,1)/(ROP*DZ)
       ENDIF

 10    CONTINUE
C
      RETURN
      END
C& SFLUXS
      SUBROUTINE SFLUXS(NU,ISTEP,QFLUX,QFLX,EFIREA,BUFI,IRECF)
C
C     SURFACE FLUX
C
      PARAMETER (IM=111,JM=221,LM=38,LSM=19)
      PARAMETER (IMJM = IM*JM - JM/2)
      PARAMETER (LP1=LM+1)
      PARAMETER (JAM=6+2*(JM-10))
      PARAMETER (IMAX=2*IM-1  , JMAX=JM)
      PARAMETER (KKMAX=LM)
      PARAMETER (KMAX=KKMAX)
      PARAMETER (KMIN = LM-KKMAX)


      DIMENSION QFLUX(IMJM,2),EFIREA(IMJM,4),BUFI(IMJM,2)
C-----------------------------------------------------------------------
                              C O M M O N /LOOPS/
     & KHLA  (JAM),KHHA  (JAM),KVLA  (JAM),KVHA  (JAM)
C
     &,KHL2  (JM),KHH2  (JM),KVL2  (JM),KVH2  (JM)
```



```
C
     &,LMH   (IMJM),LMV   (IMJM)
C-------------------------------------------------------------------------
                              C O M M O N /MAPOT/
     & LSL,IXM,IYM
     &,ISHDE(49)
     &,R,PT,TSPH
     &,WBD,SBD,TLM0D,TPH0D,DLMD,DPHD,CMLD,DP30,X1P,Y1P
     &,DISLP,Z0SLP,SPL(LSM),ALSL(LSM)
     &,DETA(LM),AETA(LM),ETA(LP1),TSHDE(49)
     &,ERLAM0,CPHI0,SPHI0
     &,KUNIT,LUNIT,MUNIT,IUNIT,NUNIT
C------------------------------------------------------------------------
                             C O M M O N /VRBLS/
     & PD(IMJM),RES(IMJM),FIS(IMJM)
C
     &,U(IMJM,LM),V(IMJM,LM),T(IMJM,LM),Q(IMJM,LM)
C------------------------------------------------------------------------
      COMMON/ETATRN/
     * QQL(IMJM,KKMAX),QQH(IMJM,KKMAX),
     * PS(IMJM,2), QQ(IMJM,KKMAX,2),
     * UU(IMJM,KKMAX,2), VV(IMJM,KKMAX,2),
     * WW(IMJM,KKMAX,2), RO(IMJM,KKMAX,2),
     * TT(IMJM,KKMAX,2), ZZ(IMJM,KKMAX+1,2),
     * ALFA(IMJM,KKMAX,2),
     * DIFQ(IMJM,KKMAX),
     * AKH(IMJM,KKMAX,2),AKHS(IMJM,2),
     * TOPG(IMJM)
     *,PREC(IMJM,2),ACPR(IMJM,2)
C------------------------------------------------------------------------
C
      COMMON/ETAREA/CAREA(IMJM)
C
      DATA RGAS/287.04/
C------------------------------------------------------------------------

      IHR=MOD(ISTEP,30)
C
C      CALL RDBUF(NU,ISTEP,IRECF,BUFI,EFIREA,IMJM)
C          RDBUF(NU,ISTEP,IREC,BUFI,FIRE,IMJM)
C
C                 QFLUX(*,1)
C
C
C     EFIREA(J) in km**2
C     CAREA(J)  in m**2
C
      C1=QFLX*1.E6  ! For converting EFIREA(J) to m**2
      C2=C1*1.E6    ! For converting to ppm
      DO J=1,IMJM
      QFLUX(J,1)=C2*EFIREA(J,1)/CAREA(J)
      EFIREA(J,2)=0.
      EFIREA(J,3)=0.
      EFIREA(J,4)=0.
      ENDDO
C
C                 QFLUX(*,2)
C
       DO10 J=1,IMJM

       C=PD(J)*RES(J)
       K=LMH(J)
       IF(K.EQ.0)THEN
       QFLUX(J,2)=0.
       QFLUX(J,1)=0.
       ELSE
       PSUR=PT+AETA(K+KMIN)*C
       TEM=TT(J,K,2)
       ROP=PSUR/(RGAS*TEM)
```

```
       DZ=ZZ(J,K,2)-ZZ(J,K+1,2)
       QFLUX(J,2)=QFLUX(J,1)/(ROP*DZ)
       ENDIF

 10    CONTINUE
C
      RETURN
      END
C& RDBUF
      SUBROUTINE RDBUF(NU,ISTEP,IREC,BUFI,FIRE,IMJM)
      DIMENSION BUFI(IMJM,2),FIRE(IMJM)
      DIMENSION INX(30), ALPHA(4)
      DATA INX/1,1,1,1,1,1,1,2,2,2,2,2,2,2,2,
     *        3,3,3,3,3,3,3,4,4,4,4,4,4,4,4/
      DATA ALPHA/0.47,0.53,0.56,0.44/

      IDAY   = (ISTEP-1)/30+1      !           day
      TIME   = (IDAY-1)*24.*60.    !     min   time

      ISTED  = MOD(ISTEP-1,30)+1   !           inner day step
      TIMED  = ISTED*48.           !     min   inner time

          IF(ISTED.EQ.1.OR.ISTED.EQ.16)THEN        !  new
C                                  15              !  old
         READ(NU,rec=IREC)(BUFI(J,1),J=1,IMJM)

      WRITE(66,*)
     *'FIRE AREA OF IDAY=',IDAY,' HOURE=',TIME,' IREC=',IREC,' /#'
         IREC=IREC+1

         IF(IREC.EQ.3)IREC=1          !  new   Next day is percisten (second)

         ENDIF

             IA=INX(ISTED)                 !  new
             ALP=ALPHA(IA)                 !  new

             DO J=1,IMJM
             FIRE(J)=ALP*BUFI(J,1)         !  new
             ENDDO

      RETURN
      END
C& WRSUR
      SUBROUTINE WRSUR(NU,IREC,AA,HZM,BB,CON)
      PARAMETER (IM=111,JM=221,LM=38,LSM=19)
      PARAMETER (LP1=LM+1)
      PARAMETER (IMJM = IM*JM - JM/2)
      PARAMETER (JM2=JM/2+1,IMT=IM*2-1)
      PARAMETER (NPOINT=25)
      PARAMETER (IMAX=51, JMAX=51)
C
      DIMENSION AA(IMJM),HZM(IMJM),BB(IMAX,JMAX)
      COMMON/ETAGRD/
     * XB,DEX,YB,DEY,
     * COSETA(JM),XETA(IMT),YETA(JM),
     * ITMP(NPOINT),JTMP(NPOINT),KTMP(NPOINT)
C-----------------------------------------------
       C O M M O N /MAPOT/
     & LSL,IXM,IYM
     &,ISHDE(49)
     &,R,PT,TSPH
     &,WBD,SBD,TLM0D,TPH0D,DLMD,
     & DPHD,CMLD,DP30,X1P,Y1P
     &,DISLP,Z0SLP,SPL(LSM),ALSL(LSM)
     &,DETA(LM),AETA(LM),ETA(LP1),TSHDE(49)
     &,ERLAM0,CPHI0,SPHI0
     &,KUNIT,LUNIT,MUNIT,IUNIT,NUNIT
C------------------------------------------------
```



```
       C O M M O N /VRBLS/
     & PD(IMJM),RES(IMJM),FIS(IMJM)
C
     &,U(IMJM,LM),V(IMJM,LM),
     & T(IMJM,LM),Q(IMJM,LM)
C---------------------------------------------
      DATA ERAD /6370000./
C
      ICL=0
C
       RADDEG=3.14159265/180.
       DEG=180./3.14159265
C
       DPHI=DPHD*RADDEG   !   in radian
       DLAM=DPHD*RADDEG   !   in radian

       GLON0=TLM0D*RADDEG
       GLAT0=TPH0D*RADDEG

       DLON=1.0
       DLAT=1.0

       DO J=1,JMAX
       YJ=-40.0+(J-1)*DLAT
       GLAT=YJ*RADDEG
       DO I=1,IMAX
       XI=-80.0+(I-1)*DLON
       GLON=XI*RADDEG

       CALL ToETA(GLON,GLAT,
     * ELON,ELAT,GLON0,GLAT0)

       XE=ELON*DEG
       YE=ELAT*DEG

       IF(
     * XE.GE.XETA(3).AND.XE.LE.XETA(IMT-2)
     *               .AND.
     * YE.GE.YETA(3).AND.YE.LE.YETA(JM-2)
     *   )THEN

       CALL AV25P(XE,YE,AA,HZM,IMJM,CON,QP)

       BB(I,J)=QP

       ELSE
C
C      OUT MODEL AREA
C
       BB(I,J)=CON

       ENDIF


       ENDDO     ! I loop
       ENDDO     ! J loop
C
C     FILTR
C
      DO J=1,JMAX
      DO I=1,IMAX
      IF(ABS(BB(I,J)).LT.1.E-20)
     * BB(I,J)=0.
      ENDDO
      ENDDO

      IREC=IREC+1
      WRITE(NU,rec=IREC)
     * ((BB(I,J),I=1,IMAX),J=1,JMAX)
```

```fortran
        RETURN
        END
C& SUBTRA
      SUBROUTINE SUBTRA(A,B,M,C)
C     CALL SUBTRA(APRC(1,2),APRC(1,1),IMJM,DPREC)
      DIMENSION A(M), B(M), C(M)
      DO J=1,M
      C(J)=A(J)-B(J)
      ENDDO
      RETURN
      END
C& WRH6VR          !!!!!!!!!!!!!!!!!! nvp
      SUBROUTINE WRH6VR(NU,IREC,QQ,RO,ZZ,AU,AV,
     * HTM,HZM,VTM,LMH,PLEV1,PLEV2,BB,BU,BV,WA,KMAX,CON)
      PARAMETER (IM=111,JM=221,LM=38,LSM=19)
      PARAMETER (LP1=LM+1)
      PARAMETER (IMJM = IM*JM - JM/2)
      PARAMETER (JM2=JM/2+1,IMT=IM*2-1)
      PARAMETER (IMAX=51, JMAX=51)
      DIMENSION HTM(IMJM,KMAX),HZM(IMJM,KMAX+1),
     * VTM(IMJM,KMAX),LMH(IMJM)
      DIMENSION QQ(IMJM,KMAX),RO(IMJM,KMAX),ZZ(IMJM,KMAX+1),
     * AU(IMJM,KMAX),AV(IMJM,KMAX),
     * BB(IMAX,JMAX,6),
     * BU(IMAX,JMAX,6),BV(IMAX,JMAX,6),WA(IMJM,KMAX),
     * PLEV1(KMAX),PLEV2(KMAX+1)
      COMMON/ETAREA/CAREA(IMJM)
C ---------------------------------------------
CX      PARAMETER (LEVS = 6)
CX      PARAMETER (NEL3 = 4)
CX      PARAMETER (NEL2 = 2)
CX      PARAMETER (NSTEP = 9)
C ----------------------------------------------
C     0   12  24  36  48  60  72  84  96  hours
C     x---o---x---o---x---o---x---o---x
C     1   2   3   4   5   6   7   8   9   step
C ----------------------------------------------
CX      PARAMETER (MAXREC=(LEVS*NEL3+NEL2)*NSTEP)
C ---------------------------------------------
CX      IREST=MOD(IREC,MAXREC)
CX      IF(IREST.EQ.0)THEN
CX
CX      WRITE(66,*)'FIRST HISTORY: IREC=',IREC,' MAXREC=',MAXREC,' #/'
CX
CX      IREC=0
CX      ELSE
CX      IREC=IREST
CX      ENDIF

      WRITE(66,*)'START HISTORY RECORD=',IREC,' #/'
      WRITE(0 ,*)'START HISTORY RECORD=',IREC,' #/'
CX         LOOKHP(NU,NAME,A,M,KMAX,HTM)
CX      CALL LOOKHP(66,'RO',RO,IMJM,KMAX,HTM)
CX      CALL LOOKHP(66,'QQ',QQ,IMJM,KMAX,HTM)

      DO K=1,KMAX
      DO J=1,IMJM

CX      IF(QQ(J,K).NE.CON.AND.RO(J,K).NE.CON)THEN
CX      WA(J,K)=QQ(J,K)*RO(J,K)*1000.0      !  mikro g / m*3
CX      ELSE
CX      WA(J,K)=CON
CX      ENDI
      C1=1./(CAREA(J)*(ZZ(J,K)-ZZ(J,K+1)))
      WA(J,K)=QQ(J,K)*RO(J,K)*1000.0*HTM(J,K)*C1      !  mikro g / m*3

      ENDDO
      ENDDO
```



```fortran
      CALL LOOKHP(66,'rho_a',WA,IMJM,KMAX,HTM)

      CALL WROUT(NU,IREC,WA,HTM,HZM,
     * PLEV1,KMAX,BB,CON)
      CALL EXTRAC(BB(1,1,3),IMAX*JMAX,
     * AMEAN,AMIN,AMAX,-999.0,NCON)
      WRITE(0,*)'QQ(1,1,3)=',AMEAN,AMIN,AMAX,-999.0,NCON
      WRITE(0,*)'FINISH WROUT(...,QQ... mikro g / m*3'

      DO J=1,IMJM
      KSURF=LMH(J)
      QSURF=WA(J,KSURF)
      WA(J,1)=QSURF
      ENDDO

      CALL LOOKHP(66,'QS',WA,IMJM,1,HZM)

      CALL WROUT(NU,IREC,ZZ,HZM,HZM,
     * PLEV2,KMAX+1,BB,CON)
      CALL EXTRAC(BB(1,1,3),IMAX*JMAX,
     * AMEAN,AMIN,AMAX,-999.0,NCON)
      WRITE(0,*)'ZZ(1,1,3)=',AMEAN,AMIN,AMAX,-999.0,NCON

      WRITE(0,*)'FINISH WROUT(...,ZZ'

      CALL WROUV(NU,IREC,AU,AV,VTM,HZM,PLEV1,KMAX,
     *              BU,BV,CON)

      CALL WRSUR(NU,IREC,WA,HZM,BB,CON)

      CALL EXTRAC(BU(1,1,3),IMAX*JMAX,
     * AMEAN,AMIN,AMAX,-999.0,NCON)
      WRITE(0,*)'UU(1,1,3)=',AMEAN,AMIN,AMAX,-999.0,NCON
      CALL EXTRAC(BV(1,1,3),IMAX*JMAX,
     * AMEAN,AMIN,AMAX,-999.0,NCON)
      WRITE(0,*)'VV(1,1,3)=',AMEAN,AMIN,AMAX,-999.0,NCON
      WRITE(0,*)'FINISH WROUV(...,AU,AV'

      CALL EXTRAC(BB,IMAX*JMAX,
     * AMEAN,AMIN,AMAX,-999.0,NCON)
      WRITE(0,*)'QSURF=',AMEAN,AMIN,AMAX,-999.0,NCON
      WRITE(0,*)'FINISH WRSUR(...,WA'

      WRITE(66,*)'FINISH HISTORY RECORD=',IREC,' #/'
      WRITE( 0,*)'FINISH HISTORY RECORD=',IREC,' #/'

CX      STOP

      RETURN
      END
C& LOOKHP
      SUBROUTINE LOOKHP(NU,NAME,A,M,KMAX,HTM)
      DIMENSION A(M,KMAX),HTM(M,KMAX)
      CHARACTER*(*) NAME
      WRITE(NU,*)'ARRAY ',NAME
      DO K=1,KMAX

      S1=0.
      N1=0      !   points with value
      N2=0      !   points without value
      DO J=1,M
        IF(HTM(J,K).EQ.1.)THEN
            IF(N1.EQ.0)THEN
            AMN=A(J,K)
            AMX=A(J,K)
            ENDIF
        S1=S1+A(J,K)
        IF(A(J,K).LT.AMN)AMN=A(J,K)
```

```
          IF(A(J,K).GT.AMX)AMX=A(J,K)
          N1=N1+1
          ELSE
          N2=N2+1
          ENDIF
        ENDDO     !   Loop M
        IF(N1.NE.0)THEN
        AMEAN=S1/FLOAT(N1)
        ELSE
        AMEAN=0.
        ENDIF
        AMIN=AMN
        AMAX=AMX
        NCON=N2
        WRITE(NU,100)K,AMEAN,AMIN,AMAX,NCON
        ENDDO     !   Loop KMAX
        RETURN
100     FORMAT(I3,1X,3(1X,G12.4),2X,I4)
        END
C& SFLXD
        SUBROUTINE SFLXD(NU,NAME,QFLUX,EFIREA,CAREA,HZM,
       *   IMJM,QFLX,DTT)
        DIMENSION QFLUX(IMJM),EFIREA(IMJM),CAREA(IMJM),HZM(IMJM)
        CHARACTER*(*) NAME
C
        WRITE(NU,*)' '
        WRITE(NU,*)'Distribution Source Diagnosis ',NAME

        CALL EXTRAC(QFLUX,IMJM,AMEAN,AMIN,AMAX,0.,NULL)
        CONV1=1.E4*86400.*1.E-6    !  Convert from (m**2 s) to (ha day)

        WRITE(NU,*)'AMEAN=',AMEAN*1.E-6,
       *' AMIN=',AMIN*1.E-6,' AMAX=',AMAX*1.E-6,' kg/m**2/s'
        WRITE(NU,*)'NULL=',NULL,' #/'
        WRITE(NU,*)'AMEAN=',AMEAN*CONV1,
       *' AMIN=',AMIN*CONV1,' AMAX=',AMAX*CONV1,' kg/ha/day'

        CALL SCLINP(QFLUX,CAREA,HZM,IMJM,1.E-6,SUMFLX)
        WRITE(66,*)'1] DISTRIBUTED FLUX FROM SURFACE=',SUMFLX/1000.,
       * ' t/s'

        WRITE(NU,*)'2] DISTRIBUTED FLUX FROM SURFACE=',
       * DTT*SUMFLX/1000.0,' t/step  1 step=',DTT,' sec'

        QFLUX0=DTT*QFLX*1.E+6
        CALL SCLINP(EFIREA,HZM,HZM,IMJM,QFLUX0,SUMFX1)
        WRITE(NU,*)'3] DISTRIBUTED FLUX FROM SURFACE=',
       * SUMFX1/1000.,' t/step'

        CALL SCLINP(EFIREA,HZM,HZM,IMJM,1.,SUMFX2)
        WRITE(NU,*)'4] FIRE AREA=',SUMFX2,' km**2 ',SUMFX2*1.E6,' m**2'

        RETURN
        END
C& CLMDOM
        SUBROUTINE CLMDOM(Q,H,RES,PD,DETA,KMAX,
       *      COLCON,COLAIR)
C
C       COLUMN DENSITY OF MASS
C       COLCON   - column mass density of q in kg x 1.E+6
C       COLAIR   - column mass density of air in kg x 1.E+6
C
        PARAMETER (IM=111,JM=221,LM=38,LSM=19)
        PARAMETER (IMJM = IM*JM - JM/2)
        PARAMETER (LP1=LM+1)
        PARAMETER (IMAX=2*IM-1   , JMAX=JM)

        DIMENSION Q(IMJM,KMAX),H(IMJM,KMAX),RES(IMJM),DETA(KMAX),
       *          PD(IMJM),
```



```
       *          COLCON(IMJM), COLAIR(IMJM)
        COMMON/INNERP/IPN,INP(IMJM),IINP(IMJM),JINP(IMJM)
C
        DATA G /9.81/
C
        DO J=1,IPN
        JP=INP(J)

           AV=0.
           AM=0.

           C=RES(JP)*PD(JP)

           DO K=1,KMAX
           DM=H(JP,K)*DETA(K)*C
           AM=AM+DM
           AV=AV+Q(JP,K)*DM
           ENDDO

        COLCON(JP)=1.E-6*AV/G    !  kg/m^2
        COLAIR(JP)=AM/G          !  kg/m^2

        ENDDO

        RETURN
        END
C& SITIOS
        SUBROUTINE SITIOS(NU,WA)    !
        PARAMETER (NS=8)
        PARAMETER (IM=111,JM=221,LM=38,LSM=19)
        PARAMETER (LP1=LM+1)
        PARAMETER (IMJM = IM*JM - JM/2)
        PARAMETER (JM2=JM/2+1,IMT=IM*2-1)
        PARAMETER (IMAX=IMT)
        PARAMETER (NPOINT=25)
        PARAMETER (KKMAX=LM)
        PARAMETER (KMAX=KKMAX)
        PARAMETER (KMIN = LM-KKMAX)
        PARAMETER (KTOP = KMIN + 1)
C
        DIMENSION WA(IMJM,KKMAX)
C
        COMMON/ETAGRD/
       * XB,DEX,YB,DEY,
       * COSETA(JM),XETA(IMT),YETA(JM),
       * ITMP(NPOINT),JTMP(NPOINT),KTMP(NPOINT)
C----------------------------------------------
         C O M M O N /MAPOT/
       & LSL,IXM,IYM
       &,ISHDE(49)
       &,R,PT,TSPH
       &,WBD,SBD,TLM0D,TPH0D,DLMD,
       & DPHD,CMLD,DP30,X1P,Y1P
       &,DISLP,Z0SLP,SPL(LSM),ALSL(LSM)
       &,DETA(LM),AETA(LM),ETA(LP1),TSHDE(49)
       &,ERLAM0,CPHI0,SPHI0
       &,KUNIT,LUNIT,MUNIT,IUNIT,NUNIT
C-----------------------------------------------
                                      C O M M O N /MASKS/
       & HBM2  (IMJM),VBM2  (IMJM),VBM3  (IMJM),SM    (IMJM),SICE (IMJM)
C
       &,HTM   (IMJM,LM),VTM   (IMJM,LM)
C ---------------------------------------------------------------------
         C O M M O N /VRBLS/
       & PD(IMJM),RES(IMJM),FIS(IMJM)
C
       &,U(IMJM,LM),V(IMJM,LM),
       & T(IMJM,LM),Q(IMJM,LM)
C---------------------------------------------
```

```
      COMMON/ETATRN/
     * QQL(IMJM,KKMAX),QQH(IMJM,KKMAX),
     * PS(IMJM,2), QQ(IMJM,KKMAX,2),
     * UU(IMJM,KKMAX,2), VV(IMJM,KKMAX,2),
     * WW(IMJM,KKMAX,2), RO(IMJM,KKMAX,2),
     * TT(IMJM,KKMAX,2), ZZ(IMJM,KKMAX+1,2),
     * ALFA(IMJM,KKMAX,2),
     * DIFQ(IMJM,KKMAX),
     * AKH(IMJM,KKMAX,2),AKHS(IMJM,2),
     * TOPG(IMJM)
     *,PREC(IMJM,2),ACPR(IMJM,2)
C
      COMMON/CBT1T2/HINTG(IMJM), HINN(IMJM,KMAX),
     *              HZM(IMJM,KMAX+1),BUFI(IMJM,2),
     *              QFLUX(IMJM,2) ,EFIREA(IMJM,4),
     *              QSOUR(10),ISOUR(10),JSOUR(10),
     *              XSOUR(10),YSOUR(10),
     *              QFIL(IMJM,KKMAX,2),
     *              IDATCP(3)
C ---------------------------------------------------------------------
C |
C |                         Latitude  Longitude  Altitude
C |                     (S)        (W)         (m)
C |
C | Fazenda Boa Sorte  5.17      48.75       170
C | Fazenda Dimona     2.32      60.32       120
C | Fazenda N.S.
C | Aparecida         10.75      62.37       220
C | Mina Potossi       9.27      62.87        80
C | Reserva Ducke      2.95      59.95        80
C | Reserva Jarú      10.08      61.92       120
C | Reserva Vale do
C | Rio Doce           5.75      49.17       150
C |
      DIMENSION X(NS),Y(NS),ALT(NS),WA1(NS),HMSK(NS),OD(NS),
     *          WC(NS),WPP(NS),WP(NS),WCD(LM,NS)
      CHARACTER*27 SITE(NS)
      DATA  X/-48.75,-60.32,-62.37,-62.87,-59.95,-61.92,-49.17,0./
      DATA  Y/ -5.17, -2.32,-10.75, -9.27, -2.95,-10.08, -5.75,0./
      DATA ALT/170.,  120.,  220.,   80.,   80.,  120.,  150., 0. /
      DATA SITE/
     *'Fazenda Boa Sorte       ',
     *'Fazenda Dimona Fazenda N.S.',
     *'Aparecida               ',
     *'Mina Potossi            ',
     *'Reserva Ducke           ',
     *'Reserva Jarú            ',
     *'Reserva Vale do Rio Doce  ',
     *'Point with maximal concent.'/
C      123456789 123456789 1234567'
C23456
      DATA ERAD /6370000./
      DATA G /9.81/
C ------------------------------------
C
C           CALCULATION
C
C ------------------------------------
      QMAX=0.
      JMAX=1

      DO J=1,IMJM
      WA(J,2)=(PS(J,1)-PT)*RES(J)       !  N/m^2
      ENDDO

      DO J=1,IMJM
      PPS=(PS(J,1)-PT)*RES(J)
      C1=1.E-3*PPS/G
      S=0.
```



```
      DO K=1,KKMAX
      S=S+C1*QQ(J,K,1)*DETA(K)*HTM(J,K)
      ENDDO

      DO K=1,KKMAX
          IF(QQ(J,K,1).GT.QMAX)THEN
          JMAX=J
          QMAX=QQ(J,K,1)
          ENDIF
      ENDDO                              !  g/m^2

      WA(J,1)=S

      ENDDO  !   END of PRESSURE WA(*,2) and COLUMN MASS WA(*,1)
C
      ICL=0
C
       RADDEG=3.14159265/180.
       DEG=180./3.14159265
C
       DPHI=DPHD*RADDEG   !   in radian
       DLAM=DPHD*RADDEG   !   in radian

       GLON0=TLM0D*RADDEG
       GLAT0=TPH0D*RADDEG


      DO J=1,NS-1

      YJ=Y(J)
      GLAT=YJ*RADDEG
      XI=X(J)
      GLON=XI*RADDEG

      CALL ToETA(GLON,GLAT,
     *ELON,ELAT,GLON0,GLAT0)

      XE=ELON*DEG
      YE=ELAT*DEG

      ICL=1
      CON=-999.0
      CALL LI2D(XE,YE,WA,HZM,'H',Z0,IC)
      WA1(J)=Z0
      HMSK(J)=IC
      CALL LI2D(XE,YE,WA(1,2),HZM,'H',Z0,IC)
      WPP(J)=Z0
      ENDDO

      WA1(NS)=WA(JMAX,1)
      WPP(NS)=WA(JMAX,2)

C     END of COLUMN MASS at ALL SITES

      CALL INDEXS(JMAX,IMAX,IM,IP,JP)
      XP=XB+DEX*(IP-1)
      YP=YB+DEY*(JP-1)
      ELON=XP*RADDEG
      ELAT=YP*RADDEG

      CALL FromETA(ELON,ELAT,GLON,GLAT,GLON0,GLAT0)

      X(NS)=GLON*DEG
      Y(NS)=GLAT*DEG

C     END of MAXIMAL POINT COORDINATES
C
C     Continue of Calculation
```

```
C
      DO J=1,IMJM
      C1=1000.*WA(J,2)/G
      DO K=1,LM
      DZ=(ZZ(J,K,1)-ZZ(J,K+1,1))
      WA(J,K)=C1*QQ(J,K,1)*HTM(J,K)*DETA(K)/DZ  ! mikro g/m^3
      ENDDO
      ENDDO

C     END of DIMENSIONAL CONCENTRATION, micro g/m^3

      DO J=1,NS-1

      YJ=Y(J)
      GLAT=YJ*RADDEG
      XI=X(J)
      GLON=XI*RADDEG

      CALL ToETA(GLON,GLAT,
     *ELON,ELAT,GLON0,GLAT0)

      XE=ELON*DEG
      YE=ELAT*DEG

      DO K=1,LM
      CALL LI2D(XE,YE,WA(1,K),HZM,'H',Z0,IC)         !  mikro g/m^3
      WCD(K,J)=Z0
      ENDDO

      ENDDO

      DO K=1,KMAX
      WCD(K,NS)=WA(JMAX,K)
      ENDDO

      DO J=1,NS
      CMAX=0.
      LMAX=1

      DO K=1,LM
      IF(WCD(K,J).GT.CMAX)THEN
      CMAX=WCD(K,J)
      LMAX=K
      ENDIF
      ENDDO

      WC(J)=CMAX
      WP(J)=0.01*(PT+AETA(LMAX)*WPP(J))
      ENDDO

      GAM=2.73

      WRITE(NU,100)GAM

      WRITE(NU,*)
     *'       Site              ',
     *'Lon  Lat   CM     OD     MC     LV'

      DO J=1,NS
      OD(J)=WA1(J)*GAM
      WRITE(NU,102)J,SITE(J),X(J),Y(J),WA1(J),OD(J),WC(J),WP(J)       ! ,HMSK(J)
      ENDDO
C23456789 123456789 123456789 123456789 123456789 123456789 123456789 12
      WRITE(NU,*)'  '
      WRITE(NU,*)'     CM – Column mass, g/m^2'
      WRITE(NU,*)'     OD – Optical depth'
      WRITE(NU,*)'     MX – Maximum concentration in column,',
     *                                        ' micro g/m^3'
      WRITE(NU,*)'     LV – Level with maximum concentration, hPa'
```



```
      WRITE(NU,*)'  '
      WRITE(NU,*)'  Vertical Distribution (micro g/m^3)'

      DO K=1,LM
      WRITE(NU,103)K,(WCD(K,J),J=1,NS)
      ENDDO


      RETURN
100   FORMAT(10X,
     *        'Aerosol Mass (g/m^2) and Optical Depth for gamma=',
     *         F5.1,' m^2/g')

102   FORMAT(5X,I2,1X,A27,2(1X,F5.1),1X,2(1X,F7.4),2(1X,F7.1))
103   FORMAT(1X,I2,1X,10(1X,F6.1))
      END
C& ATMOSM
      SUBROUTINE ATMOSM(NU,PS,ATM1,ATM2)
C
C     ATMOSPHERE MASS FOR TWO MOMENT (K,K-1)
C     IN CALCULATE POINT
C
      PARAMETER (IM=111,JM=221,LM=38,LSM=19)
      PARAMETER (IMJM = IM*JM - JM/2)
      PARAMETER (KMAX = LM)
      PARAMETER (KKMAX = KMAX)

      DIMENSION PS(IMJM,2)

      COMMON/ETAVEG/IHVEG(IMJM)
      COMMON/CBT1T2/HINTG(IMJM), HINN(IMJM,KMAX),
     *              HZM(IMJM,KMAX+1),BUFI(IMJM,2),
     *              QFLUX(IMJM,2) ,EFIREA(IMJM,4),
     *              QSOUR(10),ISOUR(10),JSOUR(10),
     *              XSOUR(10),YSOUR(10),
     *              QFIL(IMJM,KKMAX,2),
     *              IDATCP(3)
      COMMON/ETAREA/CAREA(IMJM)
      DATA G/9.81/

      SAM1=0.      !  total mass of air
      SAM2=0.      !  total mass of air

      DO J=1,IMJM
      C=HINTG(J)**CAREA(J)/G
      SAM1=SAM1+C*PS(J,1)           ! kg
      SAM2=SAM2+C*PS(J,2)           ! kg
      ENDDO

      ATM1=SAM1
      ATM2=SAM2

      WRITE(NU,*)'ATMOSPHERE MASS FOR TWO MOMENT',
     *              ' (K,K-1) IN CALCULATE POINT'
      WRITE(NU,*)'ATM(K-1)=',SAM1,' ATM(K)=',SAM2,' #/'
      RETURN
      END
C& WTSCA
      SUBROUTINE WTSCA(Q,S,ACPR,DQDT,HTM,KMAX,DTT)
C
C           Wet scavenging (22/01/2001)
C
      PARAMETER (IM=111,JM=221,LM=38,LSM=19)
      PARAMETER (IMJM = IM*JM - JM/2)
      PARAMETER (LP1=LM+1, LM1=LM-1)
      PARAMETER (KKMAX=LM)
      DIMENSION Q(IMJM,KMAX),HTM(IMJM,KMAX),
     *          ACPR(IMJM,2),DQDT(IMJM,KMAX)
      COMMON/INNERP/IPN,INP(IMJM),IINP(IMJM),JINP(IMJM)
```

```
CX
      COMMON/CBT1T2/HINTG(IMJM), HINN(IMJM,KKMAX),
     *              HZM(IMJM,KKMAX+1),BUFI(IMJM,2),
     *              QFLUX(IMJM,2) ,EFIREA(IMJM,4),
     *              QSOUR(10),ISOUR(10),JSOUR(10),
     *              XSOUR(10),YSOUR(10),
     *              QFIL(IMJM,KKMAX,2),
     *              IDATCP(3)
      COMMON/ETAREA/CAREA(IMJM)
      DIMENSION R(IMJM,2)
      DATA SOLD/0.0046/   !     2)
C     ----------------------------------------
C      DATA S/0.00046/    !     1)
C      DATA S/0.0046/     !     2)
C     S=1 1/cm = 0.1 1/mm
C     ----------------------------------------
C     Wet sedimentation rate R= S*(dP/dt)
C     (dP/dt) in mm/step;  1 step = 2880 sec
C     ACPR is accumulated precipitation in mm (kg/m**2)
C     S = 1/mm
C     ----------------------------------------
      S1=S
      DO5100 KK=1,IPN
      K=INP(KK)

      DQ=S1*(ACPR(K,2)-ACPR(K,1))      ! *1.E+6      !   into ppm
      DQOLD=SOLD*DTT*(ACPR(K,2)-ACPR(K,1))

      R(K,1)=DQ
      R(K,2)=DQOLD

      DO L=1,KMAX

CX      DQ=S1*(ACPR(K,2)-ACPR(K,1))*HTM(K,L)*1.E+6
CX      DQOLD=SOLD*DTT*(ACPR(K,2)-ACPR(K,1))*HTM(K,L)

      QP=HTM(K,L)*Q(K,L)
      QNEW=(QP-DQ)*HTM(K,L)
      QQ=AMAX1(QNEW,0.)
      DQ1=QP-QQ
      DQDT(K,L)=HTM(K,L)*DQ1
      Q(K,L)=HTM(K,L)*QQ

      ENDDO

5100  CONTINUE

      CON =-999.0
      CALL AVSUR(R(1,1),HINTG,CON,RINT1,RAVE1)
      CALL AVSUR(R(1,2),HINTG,CON,RINT2,RAVE2)
      WRITE(66,*)' '
      WRITE(66,*)' Removal Rate (1/step)'
      WRITE(66,*)'S   =',S         ,' 1/mm'
      WRITE(66,*)'Old S =',SOLD*DTT,'   '
      WRITE(66,*)'RINT1=',RINT1,' RAVE1=',
     *                     RAVE1,' ppm/step (x 1.E+6)'
      WRITE(66,*)'RINT2=',RINT2,' RAVE2=',
     *                     RAVE2,' ppm/step (old)'

      CALL EXTR2M(66,
     * 'SCAVENING PER STEP (ppm/step)',
     * DQDT,HTM,HINTG,IMJM,KMAX,1)

C      CALL EXTR2M(66,'ETADOT', WW(1,1,2),HTM(1,KTOP),HINTG,
C     *          IMJM,KMAX,1)
      RETURN
      END
C
C             One fire subroutines
```



```
C
C& TRANXY
      SUBROUTINE TRANXY(HX,X1,X2,X3,HY,Y1,Y2,Y3,FLON,FLAT)
      FLON=HX*(X1+X2/60.+X3/3600.)
      FLAT=HY*(Y1+Y2/60.+Y3/3600.)
      RETURN
      END
C& ONEFIR
      SUBROUTINE ONEFIR(EFIREA,ARFKM2,FLON,FLAT)
      PARAMETER (IM=111,JM=221,LM=38,LSM=19)
      PARAMETER (IMJM = IM*JM - JM/2)
      PARAMETER (LENT=1000)

      DIMENSION EFIREA(IMJM,4)


      RADDEG=3.14159265/180.
      DEG=180./3.14159265

      CALL CGLOB(GLON0,GLAT0)

      WRITE(66,*)'ONEFIR: FLON, FLAT =',FLON,FLAT
      WRITE(66,*)'ONEFIR: GLON0,GLAT0=',GLON0,GLAT0


      FLON1=FLON*RADDEG
      FLAT1=FLAT*RADDEG
      CALL ToETA(FLON1,FLAT1,ELON1,ELAT1,GLON0,GLAT0)
      ELON=ELON1*DEG
      ELAT=ELAT1*DEG
      IPOINT=INDEXC(ELON,ELAT)
      WRITE(66,*)'ONEFIR:    IPOINT=',IPOINT


        IF(IPOINT.LT.1.OR.IPOINT.GT.IMJM)THEN
        WRITE(6,*)'ERROR:'
        WRITE(6,*)'FLON=',FLON,' FLAT=',FLAT
        WRITE(6,*)'ELON=',ELON,' ELAT=',ELAT
        WRITE(6,*)'IPOINT=',IPOINT
        STOP 'POINT ERROR'
        ENDIF


      EFIREA(IPOINT,1)=EFIREA(IPOINT,1)+ARFKM2

      RETURN
      END
C& CGLOB
      SUBROUTINE CGLOB(GLON0,GLAT0)
      PARAMETER (IM=111,JM=221,LM=38,LSM=19)
      PARAMETER (LP1=LM+1)
      PARAMETER (IMJM = IM*JM - JM/2)
      PARAMETER (JM2=JM/2+1,IMT=IM*2-1)
      PARAMETER (NPOINT=25)
      PARAMETER (IMAX=51, JMAX=51)
C
      COMMON/ETAGRD/
     *      XB,DEX,YB,DEY,
     *      COSETA(JM),XETA(IMT),YETA(JM),
     *      ITMP(NPOINT), JTMP(NPOINT), KTMP(NPOINT)
C-----------------------------------------------------
                                 C O M M O N /MAPOT/
     & LSL,IXM,IYM
     &,ISHDE(49)
     &,R,PT,TSPH
     &,WBD,SBD,TLM0D,TPH0D,DLMD,DPHD,CMLD,DP30,X1P,Y1P
     &,DISLP,Z0SLP,SPL(LSM),ALSL(LSM)
     &,DETA(LM),AETA(LM),ETA(LP1),TSHDE(49)
     &,ERLAM0,CPHI0,SPHI0
```

```
     &,KUNIT,LUNIT,MUNIT,IUNIT,NUNIT
C-------------------------------------------------------
      DATA ERAD /6370000./
C
       RADDEG=3.14159265/180.
       DEG=180./3.14159265
C
       DPHI=DPHD*RADDEG   !   in radian
       DLAM=DPHD*RADDEG   !   in radian

       GLON0=TLM0D*RADDEG
       GLAT0=TPH0D*RADDEG
       RETURN
       END
C& FLUXON
      SUBROUTINE FLUXON(ICLF1,QFLUX,QFLX,EFIREA)
C
C     SURFACE FLUX
C
      PARAMETER (IM=111,JM=221,LM=38,LSM=19)
      PARAMETER (IMJM = IM*JM - JM/2)
      PARAMETER (LP1=LM+1)
      PARAMETER (JAM=6+2*(JM-10))
      PARAMETER (IMAX=2*IM-1  , JMAX=JM)
      PARAMETER (KKMAX=LM)
      PARAMETER (KMAX=KKMAX)
      PARAMETER (KMIN = LM-KKMAX)


      DIMENSION QFLUX(IMJM,2),EFIREA(IMJM,4)
C-------------------------------------------------------------------------
                               C O M M O N /LOOPS/
     & KHLA  (JAM),KHHA  (JAM),KVLA  (JAM),KVHA  (JAM)
C
     &,KHL2  (JM),KHH2  (JM),KVL2  (JM),KVH2  (JM)
C
     &,LMH   (IMJM),LMV   (IMJM)
C--------------------------------------------------------------------------
                                C O M M O N /MAPOT/
     & LSL,IXM,IYM
     &,ISHDE(49)
     &,R,PT,TSPH
     &,WBD,SBD,TLM0D,TPH0D,DLMD,DPHD,CMLD,DP30,X1P,Y1P
     &,DISLP,Z0SLP,SPL(LSM),ALSL(LSM)
     &,DETA(LM),AETA(LM),ETA(LP1),TSHDE(49)
     &,ERLAM0,CPHI0,SPHI0
     &,KUNIT,LUNIT,MUNIT,IUNIT,NUNIT
C-------------------------------------------------------------------------
                               C O M M O N /VRBLS/
     & PD(IMJM),RES(IMJM),FIS(IMJM)
C
     &,U(IMJM,LM),V(IMJM,LM),T(IMJM,LM),Q(IMJM,LM)
C-------------------------------------------------------------------------
      COMMON/ETATRN/
     * QQL(IMJM,KKMAX),QQH(IMJM,KKMAX),
     * PS(IMJM,2), QQ(IMJM,KKMAX,2),
     * UU(IMJM,KKMAX,2), VV(IMJM,KKMAX,2),
     * WW(IMJM,KKMAX,2), RO(IMJM,KKMAX,2),
     * TT(IMJM,KKMAX,2), ZZ(IMJM,KKMAX+1,2),
     * ALFA(IMJM,KKMAX,2),
     * DIFQ(IMJM,KKMAX),
     * AKH(IMJM,KKMAX,2),AKHS(IMJM,2),
     * TOPG(IMJM)
     *,PREC(IMJM,2),ACPR(IMJM,2)
C-------------------------------------------------------------------------
C
      COMMON/ETAREA/CAREA(IMJM)
C
      DATA RGAS/287.04/
```



```
C------------------------------------------------------------------------

      IF(ICLF1.GT.1)THEN
      WRITE(66,*)'Error in FLUXON: ICLF1=',ICLF1
      STOP
      ENDIF
C
C                 QFLUX(*,1)
C
C
C     EFIREA(J) in km**2
C     CAREA(J)  in m**2
C
      C1=QFLX*1.E6  ! For converting EFIREA(J) to m**2
      C2=C1*1.E6    ! For converting to ppm
      DO J=1,IMJM
      QFLUX(J,1)=ICLF1*QFLUX(J,1)+C2*EFIREA(J,1)/CAREA(J)
      EFIREA(J,2)=0.
      EFIREA(J,3)=0.
      EFIREA(J,4)=0.
      ENDDO
C
C                 QFLUX(*,2)
C
       DO10 J=1,IMJM

       C=PD(J)*RES(J)
       K=LMH(J)
       IF(K.EQ.0)THEN
       QFLUX(J,2)=0.
       QFLUX(J,1)=0.
       ELSE
       PSUR=PT+AETA(K+KMIN)*C
       TEM=TT(J,K,2)
       ROP=PSUR/(RGAS*TEM)
       DZ=ZZ(J,K,2)-ZZ(J,K+1,2)
       QFLUX(J,2)=QFLUX(J,1)/(ROP*DZ)
       ENDIF

 10    CONTINUE
C
      RETURN
      END
C& RDBUFx
      SUBROUTINE RDBUFx(NU,ISTEP,IREC,BUFI,FIRE,IMJM)
      DIMENSION BUFI(IMJM,2),FIRE(IMJM)
      DIMENSION INX(30), ALPHA(4)
      DATA INX/1,1,1,1,1,1,1,2,2,2,2,2,2,2,2,
     *         3,3,3,3,3,3,3,4,4,4,4,4,4,4,4/
      DATA ALPHA/0.47,0.53,0.56,0.44/

      IDAY   = (ISTEP-1)/30+1      !            day
      TIME   = (IDAY-1)*24.*60.    !      min    time

      ISTED  = MOD(ISTEP-1,30)+1   !            inner day step
      TIMED  = ISTED*48.           !      min    inner time
      WRITE(66,*)'RDBUF: ISTEP=',ISTEP,' step'
      WRITE(66,*)'RDBUF: IDAY =',IDAY, ' day'
      WRITE(66,*)'RDBUF: TIME =',TIME, ' min'
      WRITE(66,*)'RDBUF: ISTED=',ISTED,' inner day, step'
      WRITE(66,*)'RDBUF: TIMED=',TIMED,' inner time, min'

          IF(ISTED.EQ.1.OR.ISTED.EQ.16)THEN        !  new
!                                   15             !  old
         READ(NU,rec=IREC)(BUFI(J,1),J=1,IMJM)
      WRITE(66,*)'RDBUFx: read IREC=',IREC,' to BUFI(J,1)'

      WRITE(66,*)
     *'FIRE AREA OF IDAY=',IDAY,' HOURE=',TIME,
```

```
     * ' IREC=',IREC,' /#'
         IREC=IREC+1

         IF(IREC.EQ.3)IREC=1     !  new   Next day is percisten (second)

         ENDIF


             IA=INX(ISTED)         !  new
             ALP=ALPHA(IA)         !  new

             DO J=1,IMJM
             FIRE(J)=ALP*BUFI(J,1)   !  new
             ENDDO

      RETURN
      END
C& LOADMS
      SUBROUTINE LOADMS(NU,QFLUX,EFIREA,IMJM,DT)
      DIMENSION  QFLUX(IMJM),EFIREA(IMJM)
      REAL SLOAD,S
      S=0.
      AREA=0.
      DO J=1,IMJM
      S=S+QFLUX(J)*EFIREA(J)
      AREA=AREA+EFIREA(J)
      ENDDO


      SLOAD=S*1.E6*DT  !    (1.E6 transforms km**2 to m**2)

      WRITE(NU,100)SLOAD,DT,AREA
      RETURN
C23456
100   FORMAT(' Loaded mass=',E12.5,' kg, during ',F7.1,' sec, from ',
     & F10.5,' km**2')
      END
C& EXDIAG
      SUBROUTINE EXDIAG(NU,NAME,A,IMJM,KMAX)
      PARAMETER (LM=38)
      DIMENSION A(IMJM,KMAX)
      CHARACTER*(*) NAME
      DIMENSION B1(LM),B2(5),K1(LM),K2(5)
      CHARACTER*6 LEV(5)
      DATA LEV/'   1','  2-13',' 14-25',' 26-37','   38'/
C                    S T A R T
      WRITE(66,*)'EXDIAG for 1d ',NAME
      IF(KMAX.GT.LM)THEN
      WRITE(66,*)'Error in EXDIAG: KMAX=',KMAX,' > 38'
      STOP
      ENDIF

      DO K=1,KMAX                    !  DO 1000
      B1(K)=0.
      K1d=0
      S1d=0.

      DO J=1,IMJM                    !  DO 1001
      S1d=S1d+A(J,K)
      K1d=K1d+1
      END DO                         !   1001 END DO

      S1d=S1d/FLOAT(K1d)
      B1(K)=S1d
      K1(K)=K1d
      END DO                         ! 1000 END DO

      IF(KMAX.EQ.1)THEN
      WRITE(66,100)1,' 1d= ',K1(1),B1(1),' IMJM=',IMJM
```



```
      RETURN
      ENDIF

      IF(KMAX.EQ.38)THEN
         DO K=2,4
         B2(K)=0.
         K2(K)=0
         ENDDO

      C1=1./12.
      B2(1)=B1(1)
      B2(5)=B1(38)
      K2(1)=K1(1)
      K2(5)=K1(38)

      DO K=1,12
      B2(2)=B2(2)+B1(1+K)*C1
      B2(3)=B2(3)+B1(13+K)*C1
      B2(4)=B2(4)+B1(25+K)*C1
      K2(2)=K2(2)+K1(1+K)
      K2(3)=K2(3)+K1(13+K)
      K2(4)=K2(4)+K1(25+K)
      ENDDO

         DO K=2,4
         K2(K)=K2(K)/12
         ENDDO

      DO K=1,5
      WRITE(66,101)LEV(K),' 1d= ',K2(K),B2(K),' IMJM=',IMJM
      ENDDO

      RETURN
      ENDIF

      IF(KMAX.NE.1.AND.KMAX.NE.38)THEN
      DO K=1,KMAX
      WRITE(66,100)K,' 1d= ',K1(K),B1(K),' IMJM=',IMJM
      ENDDO
      ENDIF

      RETURN
100   FORMAT(I3,4X,A5,I6,1X,E11.4,A6,3(1X,I5))
101   FORMAT(A6,1X,A5,I6,1X,E11.4,A6,3(1X,I5))
      END
```