E. Plot of the model results

E-1. Format of the stored results in magnetic tape

i) First record.

System constants, such as NX, NY, NZ, DX,,, VALIN,KZIN are stored. For the detailed format, see sub.STMTC1 in mem.CVTIOS (see Table E-1).

Table E-1 Program list of sub "STMTC1".

```
     STMTC1              SOURCE LISTING              90-11-02   08:44:15
 ISN   SOURCE STATEMENT

     C
     C
   1        SUBROUTINE STMTC1(  MT, JTIME,MES)
   2        COMMON /CON1/ CP, RDVCP, CV, RD, RV, CVDVCP, HLATNT,
          1  TKELVN
   3        COMMON /CON2/ REARTH, G , OMEGA, FCORI
   4        COMMON /CON3/ PAI1, PAI2
   5        COMMON /CONGRD/ NX,NY,NZ,IXMAX,IXST,IXEN,JYMAX,JYST,JYEN,KZMAX,
          1  KZST,KZEN,NKX,NKY
   6        COMMON /PAR2/ CSTBL(64)
   7        COMMON /PAR4/ IT, RDX,RDY,RDZ,RDX2,RDY2,RDZ2,EKBACK,RKMKH
   8        COMMON /PAR1/ DT,DX,DY,DZ,   PTRF , PRESRF,
          1  EKMHRF, EKMZRF, EKTHRF, EKTZRF,  UGRF   , PTDIS
     C
   9        COMMON /PAR6/ KZIN(24,6),VALIN(36,6)
  10        COMMON /PAR7/VRDX(514),VRDX2(514),VRDY(514),VRDY2(514),VRDZ(514),
          1      VRDZ2(514),MSWSYS(20)
  11        COMMON /PAR1N/ RESERV(26)
  12        DIMENSION  DTC(12),ICON(14)
  13        EQUIVALENCE( DTC(1),DT),(ICON(1),NX)
  14        DIMENSION MES(20,3)
     C
  15  8000 CONTINUE
  16        REWIND MT
  17        WRITE(MT) JTIME,
          1     DT,DX,DY,DZ,   PTRF , PRESRF,
          2  EKMHRF, EKMZRF, EKTHRF, EKTZRF,  UGRF   , PTDIS
          3     , NX,NY,NZ,IXMAX,IXST,IXEN,JYMAX,JYST,JYEN,KZMAX,
          4  KZST,KZEN,NKX,NKY ,
          5       RDX,RDY,RDZ,RDX2,RDY2,RDZ2,EKBACK,RKMKH
          6       ,KZIN      ,VALIN,MES
          7      , VRDX     ,VRDX2     , VRDY     ,VRDY2     ,VRDZ     ,
          8      VRDZ2     ,MSWSYS,ISTRMT,ICHMT,RESERV
  18        RETURN
     C
  19        ENTRY   STMTC2(  MT, JTIME,MES,ISTRMT,ICHMT)
  20        GO TO 8000
     C
  21        ENTRY LOADC2( MT ,MES,ISTRMT,ICHMT)
  22        REWIND MT
  23        READ(MT) JTIME,
          1  DT,DX,DY,DZ,   PTRF , PRESRF,
          2  EKMHRF, EKMZRF, EKTHRF, EKTZRF,  UGRF   , PTDIS
          3     , NX,NY,NZ,IXMAX,IXST,IXEN,JYMAX,JYST,JYEN,KZMAX,
          4  KZST,KZEN,NKX,NKY ,
          5   RDX,RDY,RDZ,RDX2,RDY2,RDZ2,EKBACK,RKMKH
          6   ,KZIN      ,VALIN,MES
```

```
            7      , VRDX     ,VRDX2     , VRDY     ,VRDY2     ,VRDZ     ,
            8      VRDZ2     ,MSWSYS,ISTRMT,ICHMT,RESERV
   24        RETURN
             END
```

---

ii) Second, Third... and N-th record

Results of numerical simulation at the time step of (N–1)×ISTRMT are stored. For the detailed format, see sub.STRMNG in mem.CVTIONG. (see Table E-2).

Table E-2 Program list of sub "STRMNG".

```
      STRMNG              SOURCE LISTING              90-11-02    08:44:15
ISN    SOURCE STATEMENT

     C-----
     C-----
  1         SUBROUTINE STRMNG( U, V, W, PT, PAI,PRECIP,SMQS,SMQH,
           1      QV, QC, QR, ETURB,EDDYCO,
     CCI   2  VPCOND,RNEVAP,QCI,QS,QH,RSTVW ,
           2  QCI,QS,QH, PQV,PQCW,PQR,PQCI,PQS,PQH,
           3   ZS, G2, PPT, G23, DNSG2,
           3   QNCI,QNS,QNH,PQNCI,PQNS,PQNH,
           4  AS,LAS,BS,LBS, A1,LA1,AW1,LAW1, B1,LB1, TLDATA,TLDTPR,TLDTPC,
           5  IDLIST, ITDT,MT ,ITSTR )
  2         COMMON/CONGR1/JYSTM1,JYENP1,JYMXP1,JYMXP2,JYTD,JYTST,JYTEN,
           1  JCMAX,NYNY,NYNYM2,NYNYP2,JYSTM2,JYENP2,JYTSM1,JYTEP1,
           2  JYTSM2,JYTEP2,JA(8)
  3         COMMON /CONGRD/ NX,NY,NZ,IXMAX,IXST,IXEN,JYMAX,JYST,JYEN,KZMAX,
           1  KZST,KZEN,NKX,NKY
  4         COMMON /PAR7/VRDX(514),VRDX2(514),VRDY(514),VRDY2(514),VRDZ(514),
           1      VRDZ2(514),MSWSYS(20)
  5         DIMENSION  TLDATA(NX,NYNY,NZ,2),TLDTPR(NX,NYNY,NZ),TLDTPC(NX,NYNY)
  6         DIMENSION KD(28),IDLIST(28)
  7         DATA KD/1,2,3,4,5,6,7,8,9,10,  11,12,13,14,15,16,17,18,19,20,
           1    21,22,23,24,25,26,27,28 /
  8         DATA KDU,KDV,KDW,KDOMW,KDPT,KDQV,KDQC,KDQR,KDETU,KDEDY,KDPRS,
           1  KDSMRN,KDPREC,KDDNS,KDZS /
           2 201,202,203,204,205,206,207,208,209,210,211,601,602,104,501/
  9         DIMENSION  U(NX,NY,NZ,2),V(NX,NY,NZ,2),W(NX,NY,NZ,2),
           2  PT(NX,NY,NZ,2),PRECIP(NX,NY),PAI(NX,NY,NZ),QV(NX,NY,NZ,2),
           3  QC(NX,NY,NZ,2), QR(NX,NY,NZ,2),EDDYCO(NX,NY,NZ,2),
           4  QCI(NX,NY,NZ,2),QS(NX,NY,NZ,2),QH(NX,NY,NZ,2),
           5  SMQS(NX,NY),SMQH(NX,NY),
     C     6  RSTUV(NX,NY,NZ,2)
           4  ETURB(NX,NY,NZ,2),PQV(NX,NY,NZ),PQCW(NX,NY,NZ),PQR(NX,NY,NZ),
           5  PQCI(NX,NY,NZ),PQS(NX,NY,NZ),PQH(NX,NY,NZ)
 10         DIMENSION  QNCI(NX,NY,NZ,2),QNS(NX,NY,NZ,2),
           1  PQNCI(NX,NY,NZ),PQNS(NX,NY,NZ  ),
           2  QNH(NX,NY,NZ,2),PQNH(NX,NY,NZ  )
 11         DIMENSION ZS(NX,NY), G2(NX,NY), PPT(NX,NY,NZ),
           1  G23(NX,NY,NZ), DNSG2(NX,NY,NZ)
 12         DIMENSION AS(NX,NY,NZ,LAS),BS(NX,NY,LBS),A1(NX,NY,NZ,2,LA1),
           1  B1(NX,NY,LB1)
 13         DIMENSION MESD( 8 )
 14         DATA  MESD / '*I S','TRMT','I  M','T=,I','T=  '  /
 15         DATA NT /2 /
     C
```

```
      WRITE(6,200)   ITDT
  200 FORMAT( ' *I   STRMT  ', I12 )
      MTOUT=MT
      IF (ITDT.GT.600) MTOUT=MT+1
      WRITE(6,100)
  100 FORMAT( ' *I   STRMTI    ' )
C-----------------------------------------------------------------
C     REWIND MT
  150 CONTINUE
      IF (NY.EQ.NYNY) THEN
      WRITE( MTOUT )ITDT,KD(1), U
      WRITE( MTOUT )ITDT,KD(2), V
      WRITE( MTOUT )ITDT,KD(3), W
      WRITE( MTOUT )ITDT,KD(4), PT
      WRITE( MTOUT )ITDT,KD(5), QV
      WRITE( MTOUT )ITDT,KD(6), QC
      WRITE( MTOUT )ITDT,KD(7), QR
      WRITE( MTOUT )ITDT,KD(8), ETURB
      WRITE( MTOUT )ITDT,KD(9), EDDYCO
      WRITE( MTOUT )ITDT,KD(10), PAI,PRECIP,SMQS,SMQH
CI    WRITE( MTOUT )ITDT,KD(11), RSTUU
      WRITE( MTOUT )ITDT,KD(11), PQV,PQCW,PPT
CI    WRITE( MTOUT )ITDT,KD(12), RSTVV
      WRITE( MTOUT )ITDT,KD(12), PQR,PQCI
      WRITE( MTOUT )ITDT,KD(13), QCI
      WRITE( MTOUT )ITDT,KD(14), QS
      WRITE( MTOUT )ITDT,KD(15), QH
      WRITE( MTOUT )ITDT,KD(16), PQS,PQH
      WRITE( MTOUT )ITDT,KD(17), DNSG2,ZS
      WRITE( MTOUT )ITDT,KD(18), QNCI
      WRITE( MTOUT )ITDT,KD(19), QNS
      WRITE( MTOUT )ITDT,KD(20), PQNCI,PQNS
      WRITE( MTOUT )ITDT,KD(21), QNH
      WRITE( MTOUT )ITDT,KD(22), PQNH,PQNS
C     WRITE( MTOUT )IT, U, V, W, PT, PAI, QV, QC, QR, ETURB,EDDYCO,
C    1  RSTUU,RSTVV,RSTWW,RSTUV,RSTUW,RSTVW
      ELSE
C     X-Z SLICING MODE
      KT=1
      KTN=2
      CALL TLDRED(TLDATA,NX,NYNY,NZ,NT,1 ,2,1 ,IDLIST,KDU)
C     WRITE( MTOUT )ITDT,KD(17), DNSG2,ZS
      END IF
      WRITE(6,951) ITDT,MTOUT
  951 FORMAT(1H ,'*I   STRMTS: DATA ARE STORED. IT,MT==',2I10)
      ENCODE(12, 955, MESD(6 ) ) MT,   ITDT
  955 FORMAT( I4,I8 )
CCI   CALL DISPLY( 1, 32, MESD )
      IF (ITDT.LT.600) RETURN
      IF (ITDT.GT.600) RETURN
      ENDFILE MTOUT
      RETURN
      END
```

In the magnetic tape designated by FT12.000, the first record and the results whose time step is less than or equal to 600 is stored. To the magnetic tape designated by FT13.000, the results whose time step is greater than 600 are stored.

E-2. Plot of the (x-z; y-z; x-y) cross sections at the fixed time

i) Set (NX, NY, NZ) in the parameter statement of the main program PLPMN to be the same as those of the numerical model whose results you want to plot.

ii) Determine the size of the plotted picture. Set tha parameters which relate the real canvas to virtural canvas.

iii) Designate the time step, kind of data, contour interval of the plot (integer), cross section, the portion of area.

x-y cross section	1
x-z cross section	2
y-z cross section	3

Data kind

1 . . u-v	m/s	in vector arrow representation
2 . . u-w	m/s	in vector arrow representation
3 . . v-w	m/s	in vector arrow representation
4 . . PT	0.1K	potential temperature
5 . . QV	0.1g/kg	mixing ratio of water vapor
6 . . QCW	0.1g/kg	mixing ratio of cloud water
7 . . QR	0.1g/kg	mixing ratio of rain
8 . . E.T	joul/m^3	eddy kinetic energy
9 . . E.C	m^2/s	eddy diffusional coefficient
10 . . TOT.PRCP	0.1kg/m^3	total precipitation
11 . . W	cm/s	vertical velocity
12 . . DIV	$10^{-4}/s$	divergence
13 . . VOR	$10^{-4}/s$	vorticity
14 . . TILT	$10^{-6}/s^2$	tilting term in vorticity equation
15 . . STRC	$10^{-6}/s^2$	stretching term in vorticity equation
16 . . PRES	Pascal	pressure
17 . . DPDZ	cm/s^2	$\partial p/\partial z$
18 . . TQ.BUOY	cm/s^2	total buoyancy

19 . . DRAG	10^{-3}m/s^2	buoyancy component due to water loading
20 . . DWDT	cm/s^2	$\partial w/\partial t$
21 . . LWC	0.1g/kg	$Qc + Qr$
22 . . EQPT	K	equivalent potential temperature
23 . . EMAGRAM		vertical profiles of horizontally averaged quantities
24 . . EMAG		
25 . . ANU	m/s	u of analytic linear mountain waves
26 . . ANW	m/s	w of analytic linear mountain waves
27 . . ANPT	K	Θ of analytic linear mountain waves
28 . . ANUW	m/s	$u - w$ of analytic linear mountain waves
29 . . ANP. RESS	Pascal	pressure of analytic linear mountain waves
30 . .		
31 . . PQV	0.1mg/kg/s	total production rate of Qv due to cloud microphysical processes
32 . . PQR	0.1mg/kg/s	total production rate of Qr due to cloud microphysical processes
33 . . U	m/s	velocity component in the x-direction
34 . . V	ms/	velocity component in the y-direction
35 . . PRS.BUOY	cm/s^2	
36 . . QCI	10^{-9}kg/kg	mixing ratio of cloud ice
37 . . SNOW	0.1g/kg	mixing ratio of snow
38 . . GRAUPEL	0.1g/kg	mixing ratio of graupel
39 . . PQCW	0.1mg/kg/s	total production rate of Qc due to cloud microphysical processes
40 . . PQCI	0.1mg/kg/s	total production rate of Qi due to cloud microphysical processes
41 . . PQS	0.1mg/kg/s	total production rate of Qs due to cloud microphysical processes
42 . . PQG	0.1mg/kg/s	total production rate of Qg due to cloud microphysical processes
43 . . RH	Percent	relative humidity
44 . . PPT	10^{-4}K/s	total heating rate of Θ due to cloud microphysical

		processes
45 . . IWC	0.1g/kg	ice water content $(Qi + Qs + Qg)$
46 . . LIWC	0.1g/kg	water content $(Qc + Qr + Qi + Qs + Qg)$
47 . . DBZ	$10 \times \log_{10}(Z)$	radar reflectivity
48 . .		
49 . .		
50 . . PBUOY	0.1Pascl	pressure component due to buoyancy
51 . . PDRAG	0.1Pascl	pressure component due to water loading
52 . . PDYNA	0.1Pascl	pressure component due to dynamical parts
53 . . PDADVU	0.1Pascl	pressure component due to advection terms of u
54 . . PDADVW	0.1Pascl	pressure component due to advection terms of w
55 . . PRCPr	0.1kg/m^2	accumulated precipitation amount of rain
56 . . PRCPs	0.1kg/m^2	accumulated precipitation amount of snow
57 . . PRCPg	0.1kg/m^2	accumulated precipitation amount of graupel
58 . . Ni	$10 \times \log_{10}(\text{Ni})$	number concentration of cloud ice (m^{-3})
59 . . Ns	$10 \times \log_{10}(\text{NS})$	number concentration of cloud snow (m^{-3})
60 . . Ng	$10 \times \log_{10}(\text{Ng})$	number concentration of graupel (m^{-3})
61 . . Nos	$10 \times \log_{10}(\text{Nos})$	intercept parameter of size distribution function of snow (m^{-4})
62 . . Nog	$10 \times \log_{10}(\text{Nog})$	intercept parameter of size distribution function of graupel (m^{-4})

For more detail, see the program PLPMN.

The unit of the contour interval for f is determined in the program by SCLDT and ICONT as follows:

$$\text{"unit of } f\text{"} \times \text{SCLDT} \times \text{ICONT},$$

where unit of f is the unit used in the numberical model (ex. u m/s; Θ, K; pressure, Pascal; Qv, kg/kg). For example, SCLDT for Qv is 1000.0, and if you set ICONT=2 for Qv, the contour is drawn at intervals of 2g/kg.

E-3. Plot of the (x-t; y-t; z-t) cross sections at the fixed plane

i) Set (NX, NY, NZ) in the parameter statement of the main program PLPMN to be the same as those of the numerical model whose results you want to plot.

ii) Determine the size of the plotted picture. Set the parameters which relate the real canvas to virtual canvas.

iii) Designate the plane, kind of data, contour interval of the plot (integer), cross section, portion of area.

x-t cross section	1
y-t cross section	2
z-t cross section	3

Data kind the same as E-2.

E-4. An example of input parameter list for the program "PLPMN"

This is shown in Table E-3.

Table E-3 An example of input parameter list for the program "PLPMN".

```
1MI04.JCL.CNTL

  //E01MI04   JOB ([redacted]),NOTIFY=E01MI04,CLASS=B,REGION=9800K,
  //*E01MI04   JOB ([redacted]),NOTIFY=E01MI04,CLASS=F,REGION=4096K,
  //          TIME=30
  /*JOBPARM PAGELIM=2800
  //*FORT   EXEC FORTEC,PARM='RDLINK,DCOM,COMARY,OPT(3)',REGION=4096K
  //FORT   EXEC FORT7CLG,PARM.FORT='SOURCE,OPT(3),NODCOM',
  //            PARM.LKED=(MAP,XREF,LIST,LET,ZCLEAR),
  //            COND.LKED=(12,LT,FORT),
  //            COND.GO=((12,LT,FORT),(12,LT,LKED))
  //*FORT EXEC PGM=JMKFORT,
  //*     PARM='NOIAP,SOURCE,SYMDBG,SUBCHK,OPT(0)',REGION=512K
  //SYSPRINT  DD   SYSOUT=A,DCB=BLKSIZE=3429
  //SYSPUNCH DD DUMMY
  //SYSLIN  DD DSN=&SYSLIN,DISP=(MOD,PASS),UNIT=VIRT,
  //       SPACE=(3120,(300,15)),DCB=BLKSIZE=3120
  //SYSUT2  DD    DSN=&SYSUT2,UNIT=VIRT,SPACE=(2048,(10,10))
  //*FORT.SYSLIB   DD   DSN=SLIB13.FORT,DISP=SHR
  //FORT.SYSLIB   DD   DSN=SLSFX.FORT,DISP=SHR
  //FORT.SYSIN   DD  *
  *STARTC PLPMN
  /*
  //*GO.SYSLIB   DD   DSN=SYS1.FORTHLIB,DISP=SHR
  //LKED.SYSLIB   DD
  //               DD
  //               DD
  //               DD
  //               DD
  //               DD DSN=SYS1.GPSL.M24.LOAD,DISP=SHR
  //               DD DSN=OPL26A.LOAD,DISP=SHR
  //         DD   DSN=SYS1.SYSLIB.M24.BGSP,DISP=SHR
  //         DD   DSN=SYS1.TELCMLIB,DISP=SHR
  //GO.STEPLIB DD
  //              DD DSN=SYS1.GPSL.M24.LOAD,DISP=SHR
  //GO.FILE01 DD DSN=SYS1.GPSL.MOJI.TABLE,DISP=SHR
  //GO.SYSDBOUT DD SYSOUT=A
  //GO.FT11F001  DD DSN='E01MI04.@SNG33',DISP=(SHR,KEEP)
  //GO.FT12F001  DD DSN='E01MI04.@SNG34',DISP=(SHR,KEEP)
  //GO.FT13F001  DD DUMMY
  //GO.FT14F001  DD DUMMY
  //GO.FT20F001  DD DSN=@XY.SKT3,UNIT=SHRT,DISP=(SHR,CATLG),
  //      DCB=(RECFM=VS,BLKSIZE=488),
  //*     DCB=(RECFM=VS,BLKSIZE=488),VOL=SER=MSS550,
  //       SPACE=(CYL,(4,4))
  //*      SPACE=(CYL,(4,4))
  //*FT20F001  DD DUMMY
  //*FT31F001  DD SYSIN
  //GO.FT06F001  DD SYSOUT=A
  //GO.FT32F001  DD SYSOUT=A
  //GO.FT34F001  DD DSN=LYRAN.DATA(SFN4),DISP=(SHR,KEEP)
  //*GO.FT34F001  DD DUMMY
```

```
//GO.FT31F001 DD *
4        DEVISE(2--XY,4--GLASER)(240,50 --200,30)   (150,100:100,120)
 24000 16000  60  40       CANVAS   180 120  160,80  180,120  150,30,90
3200                       TIME SET     (220,120---160,100..SFN)
23                         DATA KIND   EMAGRAM (150,90 ---- 120,70..SFX)
   0                       INTVAL   ( IX )           MEAN
0 0                        POSITION (ISECT==JY ) ICROSS.EQ.0 OR ISECT=0
@
2                          CHANGE PARAMETER
16                          PRESS
   2                        5  1
213      1   26   1   26                IXBW, IXBE; JYBS,JYBN
@
2
 1                         DATA KIND  U-V
   1
1 3      1   26   1   26                IXBW, IXBE; JYBS,JYBN
@
2
 1                         DATA KIND   U-V
   1
114      1   26   1   26                IXBW, IXBE; JYBS,JYBN
@
2
 2                         DATA KIND   U-W
   1
213      1   26   1   26                IXBW, IXBE; JYBS,JYBN
@
2
 4                         DATA KIND PT
   1
1 2      1   26   1   26                IXBW, IXBE; JYBS,JYBN
@
2
 4                         DATA KIND PT
  10
213      1   26   1   26                IXBW, IXBE; JYBS,JYBN
@
2
 4                         DATA KIND PT
   1
1 3      1   26   1   26                IXBW, IXBE; JYBS,JYBN
@
2
11                         DATA KIND W
  50                        2
213      1   26   1   26                IXBW, IXBE; JYBS,JYBN
@
2
11                         DATA KIND W
  50                        2
310      1   26   1   26                IXBW, IXBE; JYBS,JYBN.
@
2
11                         DATA KIND W
  50                        2
114      1   26   1   26                IXBW, IXBE; JYBS,JYBN
@
2
11                         DATA KIND W
  50                        2
1 3      1   26   1   26                IXBW, IXBE; JYBS,JYBN
@
6
```

- 50 → contour interval (cm/s)
- 2 (in "213") → x-z cross section at jy=13
- 3 (in "310") → y-z cross section at ix=10
- 1 (in "114") → x-y cross section at kz=14
- 6 ← end of input parameters