# APCC Operational Forecast Training 1

**Lecturer : Lee, Doo Young**

## RUNNING INSTRUCTIONS

FORECAST case：

A script and source program files for running MME-I for issued season are available at the directories**.** The script "**mme1_main.f.csh**" is a UNIX C shell script. To execute the MME-I forecast, the following steps may be used:

1. Change the options in the USER DEFINE of script. The descriptions of each option are following;
   - **model** How many models are used ?
   - **tyear** How many years ?
   - **syer** starting year
   - **eyer** ending year
   - **tsea** selected season (MAM or JJA or SON or DJF)
   - **fsea** selected first month (MAR or JUN or SEP or DEC)
   - **numse** first month (3, 6, 9, 12)
   - **ordir** basic files directory
   - **HDIR** Directory of hindcast data for training
   - **WDIR** Mother directory for working
   - **period** hindcast period

2. Run the script
3. Check the output in mother-directory/**fcst**. You obtain 4 output data sets and ctl files :

**- Bias Corrected data sets :**

**Anomaly**

MME_I.monthly.2006.ano.gdat.ctl, MME_I.monthly.2006.ano.gdat

**Total**

MME_I.monthly.2006..gdat.ctl, MME_I.monthly.2006.gdat

**Climate**

MME_I.monthly.clim.gdat.ctl, MME_I.monthly.clim..gdat

**- Biased anomaly data sets :**

MME_I_B.monthly.2006.ano.gdat.ctl, MME_I_b.monthly.2006.ano.gdat

**- Observation :**

obs.monthly.clim.gdat

**Shell Script** - **mme1_main.f.csh**

You need to correct the parts of the blue and bold character

---

```
#!/bin/csh -f
#
###############################################################################
# For Multi-Model Ensemble I in terms of Seasonal Forecast
# D. Y. Lee - Feb. 7, 2006
###############################################################################
#           USER DEFINE I : START
#     model = How many models are used ?
#     tyear = How many years ?
#     syer    = starting year
#     eyer    = ending year
#     tsea = selected season (MAM or JJA or SON or DJF)
#     fsea = selected first month    (MAR or JUN or SEP or DEC)
#     numse = first month    (3, 6, 9, 12)
#     ordir = basic file directory
#     HDIR = Directory of hindcast data for training
#     WDIR = Mother Directory for working
#     period = hindcast period
#     filelist = used model information
###############################################################################
set model = 12            # num of model
set tyear = 2006          # forecast year
set syer    = 1983        # starting year of hindcast data
```

```
set eyer    = 2003          # ending year of hindcast data
set tsea = JJA              # marking the season
set fsea = JUN              # marking the 1st month of season
set numse = 6               # marking the 1st month of season (as number)
set ordir = '/apcc01/OPER/SEASON/BASIC'
set HDIR = '/apcc01/OPER/SEASON/MME_IN/2006/JJA'
set WDIR = '/apcc01/OPER/SEASON/WORK/DMME/AUTO/MME1/FORECAST'
set period = 83-03
########################################################################## MME-I
cd $WDIR
rm -rf WORK fcst
mkdir -p WORK
mkdir -p fcst
#
cd $WDIR/WORK
#
cat > filelist << EOFN
${HDIR}/OBS.${tsea}.$period.prec.bin
${HDIR}/OBS.${tsea}.$period.t850.bin
${HDIR}/OBS.${tsea}.$period.z500.bin
${HDIR}/OBS.${tsea}.$period.ts.bin
${HDIR}/OBS.${tsea}.$period.t2m.bin
${HDIR}/OBS.${tsea}.$period.u850.bin
${HDIR}/OBS.${tsea}.$period.v850.bin
${HDIR}/OBS.${tsea}.$period.u200.bin
${HDIR}/OBS.${tsea}.$period.v200.bin
${HDIR}/OBS.${tsea}.$period.slp.bin
${HDIR}/OBS.${tsea}.$period.olr.bin
EOFN
#
cat > INFORMATION.h << EOF
          data cap_mod /'CWB', 'GCPS', 'GDAPS_F', 'GDAPS_O', 'HMC', 'IRIF',
       &                    'IRI', 'JMA',    'METRI', 'MGO', 'NCC', 'NCEP'/
EOF
########################################################################
# If variables exist, you can count. if not, write down zero(0).    #
```

```
#########################################################################
cat > INFORMATION_0.h << EOF
        data ip      /1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12/
        data it      /1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12/
        data iz      /1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12/
        data its    /1, 2, 0, 0, 5, 6, 7, 0, 0, 10,    0, 12/
        data it2m /1, 0, 0, 0, 5, 6, 7, 8, 0, 10,    0, 12/
        data iu8    /1, 2, 3, 4, 5, 6, 7, 8, 9, 10,    0, 12/
        data iv8    /1, 2, 3, 4, 5, 6, 7, 8, 9, 10,    0, 12/
        data iu2    /1, 2, 3, 4, 5, 6, 7, 8, 0, 10,    0, 12/
        data iv2    /1, 2, 3, 4, 5, 6, 7, 8, 0, 10,    0, 12/
        data islp    /1, 2, 3, 4, 5, 6, 7, 8, 9, 10,    0, 12/
        data iolr    /0, 2, 0, 0, 5, 6, 7, 0, 0, 10,    0, 12/
EOF
#
cd $WDIR/src
# Old version ##########################################################################################
#chmod +x make_mme1_forecast_kang.csh
#./make_mme1_forecast_kang.csh $model $tyear $syer $eyer $tsea $fsea $numse $ordir $HDIR $WDIR
# New version ##########################################################################################
chmod +x make_mme1_forecast_dylee.csh
./make_mme1_forecast_dylee.csh $model $tyear $syer $eyer $tsea $fsea $numse $ordir $HDIR $WDIR
#
```

# APCC Operational Forecast Training 2

**Lecturer : Kyong-Hee An**

## Forecast Procedure of Regression and Synthetic

**REGRESSION**

REGRESSION procedure adopted at APCC is based on point-wise regression, which is carried out using SVD technique Yun et al. (2003). Method of zeroing of smaller singular values is applied. Weights for each member model are computed, so that the error variance is the minimum during training period.

**SYNTHETIC**

SYNTHETIC is based on application of regression technique on synthetically generated data. The synthetic data are constructed from model prediction based on some selected number of EOF modes from model predictions.

If you want to produce the forecast of REGRESSION and SYNTHETIC, you just pass through one procedure. There are one main-shell script (synth.sh), two sub-shell scripts (change1.sh and combx.sh) and 11 fortran source programs. You can execute to obtain the forecast date as following steps.

### RUNNING INSTRUCTION

1. Make the directory of forecast variable (here, precipitation).
2. Copy all script files and source program file to the directory of forecast variable.
3. Change the option in synth.sh shell script.
   *USER DEFINE*

- **for year in #  the number of issued year (If we have 21 years hindcast period, we can put 22 as #)**

4. Change the options in change1.sh shell script.

   *USER DEFINE*

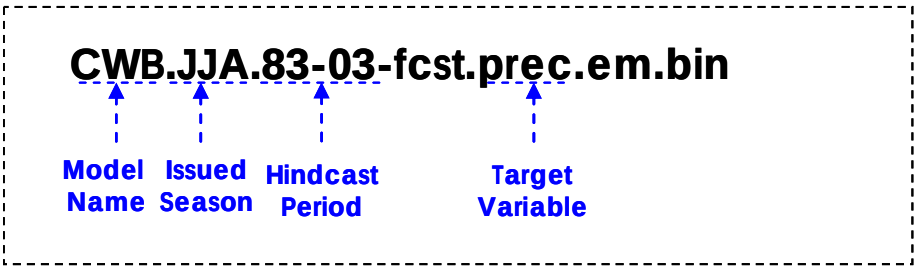
   - **time_length  the number of total months (If we have 21 years hindcast period and one year forecast period, we can put 88)**
   - **time_length1  the number of hindcast months**
   - **num_models  the number of model**
   - **num_nx  the number of longitude**
   - **num_ny  the number of latitude**
   - **num_sing  the number of singular vetor (We usually put the half of model number)**
   - **num_mod  the number of EOF mode (We usually use 25 EOF mode.)**

5. Change the options in combx.sh shell script.

   *USER DEFINE*

   - **CASE  which case? (We produce only em case.)**
   - **cat > filelist << EOFN (We should check and fix the data name in filelist statement.)**

     **<Example>**




6. Run the synth.sh shell script.

- >./synth.sh

7. You will find the total and anomaly field output data in the directory (out).
8. If you want to produce other variables(t850, z500), you can try same procedure of precipitation except variable name.
9. To reformat the data files which can be used for graphics, write.ano.gs and write.total.gs should be executed.

   *USER DEFINE*

   - We just check the variable name and forecast year.

10. Finally, you can obtain the forecast data.

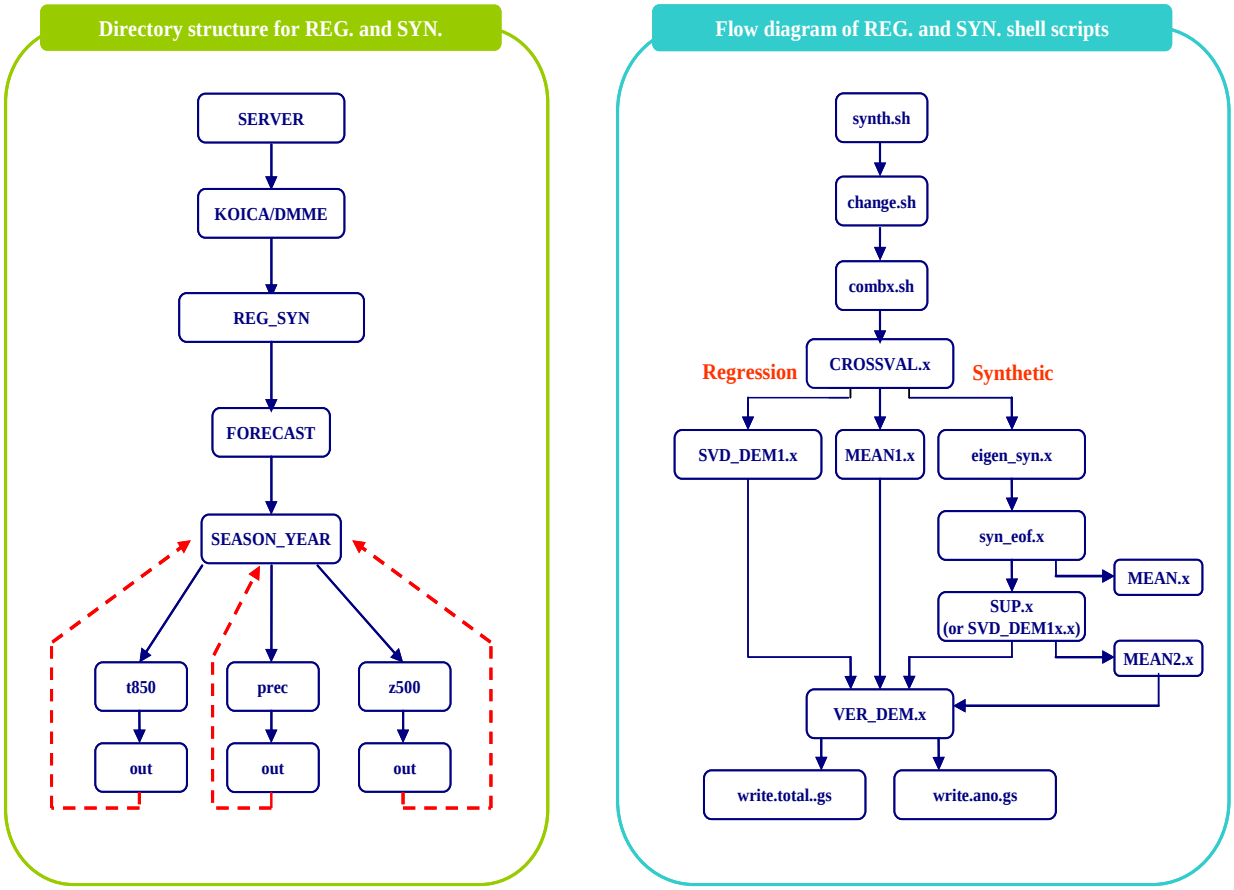



**Fig. 1. Directory Structure and Flow Diagram.**

# Main and Sub Script files

## 1. synth.sh

```
#! /bin/sh -f

sh change1.sh

rm -rf tmp out
mkdir tmp out
cd tmp

#####################################################################
#    SYNTHETIC SUPER-ENSEMBLE CROSS-VALIDATION Batchjob
#####################################################################
for year in 22 ;do

      echo $year
      export year

      KYEAR=$year                    #    for Cross validation
      NBEGIN=1

cat > WHICH1 << EOFN
 &CVYEAR
      KYEAR=$KYEAR, NBEGIN=$NBEGIN/
 &END
EOFN

      cp ../combx.sh .
      sh combx.sh

cp -f SRC/yanog.ctl out/.
cp -f SRC/ytotg.ctl out/.
done
exit
```

## 2. change1.sh

```
set -x
time_length='88'
time_length1='84'
num_models='12'
num_nx='144'
num_ny='73'
num_sing='6'
num_mod='25'

cp -f SRC/season_gen.f tmp.f
sed "s/time_length/$time_length/"<tmp.f >season.f
cp -f season.f tmp.f
sed "s/num_models/$num_models/"<tmp.f >season.f



cp -f SRC/CROSSVAL_gen.f tmp.f
sed "s/time_length/$time_length/"<tmp.f >CROSSVAL.f
cp -f CROSSVAL.f tmp.f
sed "s/num_models/$num_models/"<tmp.f >CROSSVAL.f
#
#
cp -f SRC/MEAN1_gen.f tmp.f
sed "s/time_length/$time_length/"<tmp.f >MEAN1.f
cp -f MEAN1.f tmp.f
sed "s/num_models/$num_models/"<tmp.f >MEAN1.f
#
#
cp -f SRC/MEAN2_gen.f tmp.f
sed "s/time_length/$time_length/"<tmp.f >MEAN2.f
cp -f MEAN2.f tmp.f
sed "s/num_models/$num_models/"<tmp.f >MEAN2.f
cp -f MEAN2.f tmp.f
sed "s/num_nx/$num_nx/"<tmp.f>MEAN2.f
cp -f MEAN2.f tmp.f
sed "s/num_ny/$num_ny/"<tmp.f>MEAN2.f
```

```
#
#
cp -f SRC/MEAN_gen.f tmp.f
sed "s/time_length/$time_length/"<tmp.f >MEAN.f
cp -f MEAN.f tmp.f
sed "s/num_models/$num_models/"<tmp.f >MEAN.f
cp -f MEAN.f tmp.f
sed "s/num_nx/$num_nx/"<tmp.f>MEAN.f
cp -f MEAN.f tmp.f
sed "s/num_ny/$num_ny/"<tmp.f>MEAN.f
#
#
cp -f SRC/eigen_syn_gen.f tmp.f
sed "s/time_length1/$time_length1/"<tmp.f >eigen_syn.f
cp -f eigen_syn.f tmp.f
sed "s/num_nx/$num_nx/"<tmp.f>eigen_syn.f
cp -f eigen_syn.f tmp.f
sed "s/num_ny/$num_ny/"<tmp.f>eigen_syn.f
#
#
cp -f SRC/SVD_DEM1_gen.f tmp.f
sed "s/time_length/$time_length/"<tmp.f >SVD_DEM1.f
cp -f SVD_DEM1.f tmp.f
sed "s/num_models/$num_models/"<tmp.f >SVD_DEM1.f
cp -f SVD_DEM1.f tmp.f
sed "s/num_nx/$num_nx/"<tmp.f>SVD_DEM1.f
cp -f SVD_DEM1.f tmp.f
sed "s/num_ny/$num_ny/"<tmp.f>SVD_DEM1.f
cp -f SVD_DEM1.f tmp.f
sed "s/num_sing/$num_sing/"<tmp.f>SVD_DEM1.f
#
#
cp -f SRC/SVD_DEM1x_gen.f tmp.f
sed "s/time_length/$time_length/"<tmp.f >SVD_DEM1x.f
cp -f SVD_DEM1x.f tmp.f
sed "s/num_models/$num_models/"<tmp.f >SVD_DEM1x.f
```

```
#
#
cp -f SRC/syn_eof_gen.f tmp.f
sed "s/time_length/$time_length/"<tmp.f >syn_eof.f
cp -f syn_eof.f tmp.f
sed "s/num_models/$num_models/"<tmp.f >syn_eof.f
cp -f syn_eof.f tmp.f
sed "s/num_nx/$num_nx/"<tmp.f>syn_eof.f
cp -f syn_eof.f tmp.f
sed "s/num_ny/$num_ny/"<tmp.f>syn_eof.f
cp -f syn_eof.f tmp.f
sed "s/num_sing/$num_sing/"<tmp.f>syn_eof.f
cp -f syn_eof.f tmp.f
sed "s/num_mod/$num_mod/"<tmp.f>syn_eof.f
#
#
cp -f SRC/VER_DEM_gen.f tmp.f
sed "s/time_length/$time_length/"<tmp.f >VER_DEM.f
cp -f VER_DEM.f tmp.f
sed "s/num_models/$num_models/"<tmp.f >VER_DEM.f
```

### 3. combx.sh

```
#!/bin/sh

set -x
CASE=em
CASE1=comb

#####################################################################
rm fort.*
################################################
rm filelist
cat > filelist << EOFN
/apcc02/DATA/APCN_DATA/HINDCAST_V06/SUMMER/OBS.JJA.83-03.prec.bin
/apcc02/DATA/APCN_DATA/HINDCAST_V06/SUMMER/CWB.JJA.83-03-fcst.prec.em.bin
```

```
/apcc02/DATA/APCN_DATA/HINDCAST_V06/SUMMER/MGO.JJA.83-03-fcst.prec.em.bin
/apcc02/DATA/APCN_DATA/HINDCAST_V06/SUMMER/NCEP.JJA.83-03-fcst.prec.em.bin
/apcc02/DATA/APCN_DATA/HINDCAST_V06/SUMMER/JMA.JJA.83-03-fcst.prec.em.bin
/apcc02/DATA/APCN_DATA/HINDCAST_V06/SUMMER/NCC.JJA.83-03-fcst.prec.em.bin
/apcc02/DATA/APCN_DATA/HINDCAST_V06/SUMMER/IRI.JJA.83-03-fcst.prec.em.bin
/apcc02/DATA/APCN_DATA/HINDCAST_V06/SUMMER/IRIF.JJA.83-03-fcst.prec.em.bin
/apcc02/DATA/APCN_DATA/HINDCAST_V06/SUMMER/HMC.JJA.83-03-fcst.prec.em.bin
/apcc02/DATA/APCN_DATA/HINDCAST_V06/SUMMER/GDAPS_F.JJA.83-03-fcst.prec.em.bin
/apcc02/DATA/APCN_DATA/HINDCAST_V06/SUMMER/GDAPS_O.JJA.83-03-fcst.prec.em.bin
/apcc02/DATA/APCN_DATA/HINDCAST_V06/SUMMER/METRI.JJA.83-03-fcst.prec.em.bin
/apcc02/DATA/APCN_DATA/HINDCAST_V06/SUMMER/GCPS.JJA.83-03-fcst.prec.em.bin
EOFN
cat filelist
#########################################################################
    II=1
    IL=144
    JJ=1
    JL=73
#
cat > WHICH << EOFN
 &WAS
   II=$II,IL=$IL,JJ=$JJ,JL=$JL/
 &END
EOFN

#########################################################################
cp ../season.f .
f77 season.f -o season.x
./season.x
#########################################################################

rm filelist
cat > filelist << EOFN
fort.40
fort.41
fort.42
```

```
fort.43
fort.44
fort.45
fort.46
fort.47
fort.48
fort.49
fort.50
fort.51
fort.52
EOFN

#########################################################################
cp ../CROSSVAL.f .
f77 CROSSVAL.f -o CROSSVAL.x
./CROSSVAL.x
#########################################################################
rm filelist
cat > filelist << EOFN
fort.40
fort.41
fort.42
fort.43
fort.44
fort.45
fort.46
fort.47
fort.48
fort.49
fort.50
fort.51
fort.52
EOFN
############################################## Make ensemble mean
rm MEANM MEAN1
cp ../MEAN1.f .
```

```
f77 MEAN1.f -o MEAN1.x
./MEAN1.x
cp MEANM MEAN1
################ output: MEANM, EOF.D
#########################################################################
rm filelist
cat > filelist << EOFN
EOF.D
fort.41
fort.42
fort.43
fort.44
fort.45
fort.46
fort.47
fort.48
fort.49
fort.50
fort.51
fort.52
EOFN
########################################## Run SVD Superensemble#
rm SUPERSVD SUPER1
cp ../SVD_DEM1.f .
f77 SVD_DEM1.f -o SVD_DEM1.x
./SVD_DEM1.x
cp SUPERSVD SUPER1
###################################################### EOF Analysis
cp ../eigen_syn.f .
f77 eigen_syn.f -o eigen_syn.x
./eigen_syn.x
cp EOF.DAT EOF1
#cp EOF1 ./out/EOF1_$year
################################################### EOF Weights
cp ../syn_eof.f .
f77 syn_eof.f -o syn_eof.x
```

```
./syn_eof.x
rm filelist
cat > filelist << EOFN
fort.40
fort.61
fort.62
fort.63
fort.64
fort.65
fort.66
fort.67
fort.68
fort.69
fort.70
fort.71
fort.72
EOFN
##########    Make ensemble mean
rm MEAN MEANE
cp ../MEAN.f .
f77 MEAN.f -o MEAN.x
./MEAN.x
#cp MEAN MEANE
#cp MEANE ./out/MEANE_$year
############################## Increase the data set
#    for PRECI: fort.61-66
rm filelist_new
cat > filelist_new << EOFN
EOF.D
fort.61
fort.62
fort.63
fort.64
fort.65
fort.66
fort.67
```

```
fort.68
fort.69
fort.70
fort.71
fort.72
SUPER1
MEAN1
MEANE
EOFN
#####################################################################
#cp ../SUP.f .
#f77 SUP.f -o SUP.x
#./SUP.x
#cp SUPERSFST ../out/SUPERSFST.$year
cp filelist_new filelist
cp ../SVD_DEM1x.f .
f77 SVD_DEM1x.f -o SVD_DEM1x.x
./SVD_DEM1x.x
cp SUPERSVD SUPERSFST
#cp SUPERSFST ../out/SUPERSFST.$year
################# output : SUPERSFST
#####################################################################
rm MEANM SUPERSVD
cp ../MEAN2.f .
f77 MEAN2.f -o MEAN2.x
./MEAN2.x
cp MEANM SUPERSVD
#cp SUPERSVD ./out/SUPERSVD_$year
#####################################################################
rm filelist1
cat > filelist1 << EOFN
fort.41
fort.42
fort.43
fort.44
fort.45
```

```
fort.46
fort.47
fort.48
fort.49
fort.50
fort.51
fort.52
EOFN
#########################################################################
rm filelist
cat > filelist << EOFN
fort.40
fort.41
fort.42
fort.43
fort.44
fort.45
fort.46
fort.47
fort.48
fort.49
fort.50
fort.51
fort.52
EOFN

echo 'chk'

#########################################################################
# VERIFICATION
#########################################################################
# for Global    II=1    IL=144, JJ=1    JL=73
# for NH            II=1    IL=144, JJ=37 JL=73
# for SH            II=1    IL=144, JJ=1    JL=37
# for ASIA        II=28 IL=60 , JJ=37 JL=61 (Eq -60N, 70E-150E)
# for Tropics II=20 IL=60 , JJ=25 JL=49 (30S-30N, 50E-150E)
```

```
# for Amerika II=88 IL=120, JJ=37 JL=61 (EQ -60N, 140W-60W)
# for Amerika II=84 IL=116, JJ=39 JL=53 (5N-40N, 150W-50W)
# extra tropi II=1    IL=144, JJ=47 JL=57 (25N-50N)
# North Africa (10N-40N, 20W-50E)    :II=136, IL=20 , JJ=41 ,JL=53
# eq. Africa      (10S-10N, 20W-50E)    :II=136, IL=20 , JJ=33 ,JL=41
# South Africa (30S-10S, 10E-40E)    :II= 4 , IL=16 , JJ=25 ,JL=33
# India               (5N-30N, 70E-100E)    :II=28 , IL=40 , JJ=39 ,JL=49
# East Asia        (25N-45N, 110E-145E):II=44 , IL=58 , JJ=47 ,JL=55
# Australia        (35S-10S, 115E-155E):II=46 , IL=62 , JJ=23 ,JL=33
# S. Amerika      (40S-10N, 35E-80E)    :II=14 , IL=32 , JJ=21 ,JL=41
# N. America      (25N-50N, 125W-75W) :II=94 , IL=102 , JJ=47 ,JL=57
#-----------------------------------------------------------------#
#####################################################################
     II=1
     IL=144
     JJ=1
     JL=73
#
cat > WHAT << EOFN
  &REGI
    II=$II,IL=$IL,JJ=$JJ,JL=$JL/
  &END
EOFN
#####################################################################
cp ../VER_DEM.f .
f77 VER_DEM.f -o VER_DEM.x
./VER_DEM.x
#####################################################################
cp fort.62 ../out/RMSG_$CASE1.$year
cp fort.66 ../out/ACG_$CASE1.$year
cp YANO ../out/YANOG_$CASE1.$year
cp YTOT ../out/YTOTG_$CASE1.$year
#cp fort.61 ./out/ANOMEANG_$CASE1.$year
################################### EA(10N-60N 80E-180E)
     II=33
     IL=73
```

```
     JJ=41
     JL=61
#
cat > WHAT << EOFN
  &REGI
    II=$II,IL=$IL,JJ=$JJ,JL=$JL/
  &END
EOFN
./VER_DEM.x
####################################
cp fort.62 ../out/RMSEA_$CASE1.$year
cp fort.66 ../out/ACEA_$CASE1.$year
exit
```