EnKF Instructional Session
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Scripts overview, configuration and running the EnKF system

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Outline

- EnKF Overview and Theory
- Downloading and building the EnKF system
- **Scripts overview, configuration, and running the EnKF system**
  - Input data required to run EnKF
  - Running a regional EnKF and GSI observer using released run scripts
  - Set up data usage through GSI observer
  - Introduction to files in successful regional EnKF run directory
- EnKF Diagnostics

Before you run...

Obtain input data

Understand GSI observer and EnKF run scripts

Set up data usage

This talk follows EnKF User's Guide Chapter 3

Input data required to run EnKF

- **Ensemble mean and members**
  - Ensemble mean and members used as the background for the EnKF analysis:

```
firstguess.mem001
firstguess.mem002
        …
firstguess.ensmean
```

For regional EnKF

  - Ensemble members can be generated using methods such as:
    - Global/regional ensemble forecasts
    - Ensemble forecasts generated using multi-physics, multi-models, or adding random perturbations drawn from climatology
    - For cycling assimilation, using ensemble forecasts initialized from previous ensemble analyses generated by EnKF
  - This EnKF can use any of the following:
    - ARW forecast (NetCDF)
    - NMM forecast (NetCDF)
    - GFS forecast
- Observation Innovation
- Fixed files

Input data required to run EnKF

- Ensemble mean and members
- **Observation Innovation**
  - Need innovations of ensemble priors to all observations to run EnKF
  - Observation innovations of ensemble priors generated by running GSI observation forward operators w/ ensemble members as background

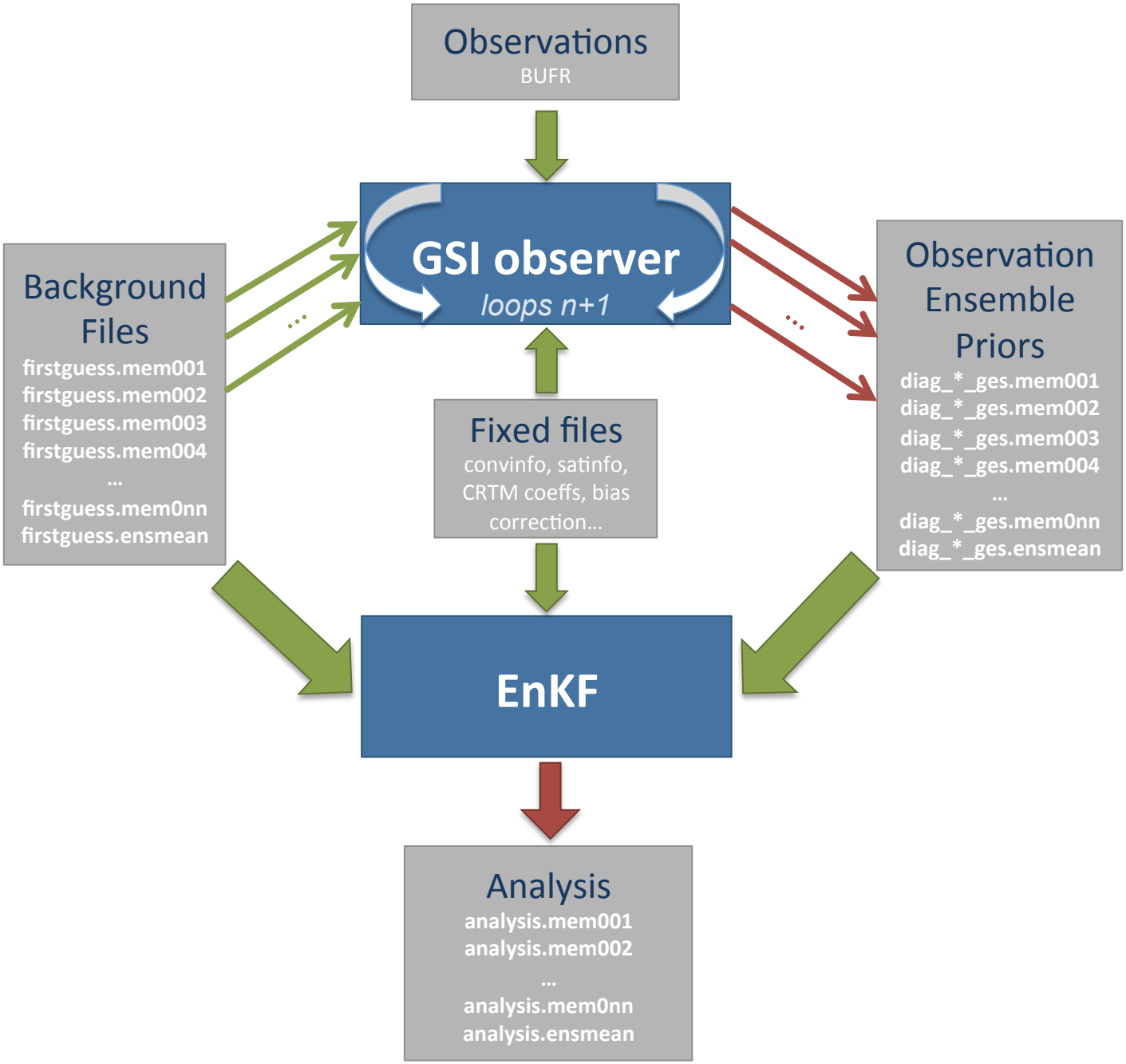
```
diag_conv_ges.mem001          diag_instrument_satellite_ges.mem001
…                             …
diag_conv_ges.ensmean         diag_instrument_satellite_ges.ensmean
```

  - Preparation of observations for EnKF assimilation done within GSI
    - Quality control
    - Selection of observation types for assimilation
    - Observation error tuning
    - Bias correction (for radiance assimilation)
- Fixed files

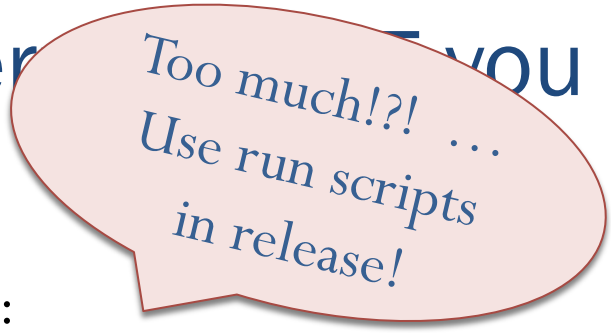
Input data required to run EnKF

- Ensemble mean and members
- Observation Innovation
- **Fixed files**
  - EnKF uses same fixed files as GSI to setup the analysis configurations
    - Observation control:
      - **convinfo** (convention data)
      - **ozinfo** (ozone retrieval info file)
    - Adaptive bias correction for satellite radiance assimilation:
      - **satinfo** (satellite channel info file)
      - **satbias_in** (satellite bias correction coefficient file)
      - **satbias_angle** (satellite angle dependent file)
    - For namelist parameter `readin_localization=.true.`:
      - **hybens_locinfo** (customized localization values varying by model level)

More details on fixed files in GSI User's Guide Chapter 3


Observations
BUFR
GSI observer
loops n+1
Background Files
firstguess.mem001
firstguess.mem002
firstguess.mem003
firstguess.mem004
...
firstguess.mem0nn
firstguess.ensmean
Fixed files
convinfo, satinfo, CRTM coeffs, bias correction…
Observation Ensemble Priors
diag_*_ges.mem001
diag_*_ges.mem002
diag_*_ges.mem003
diag_*_ges.mem004
...
diag_*_ges.mem0nn
diag_*_ges.ensmean
EnKF
Analysis
analysis.mem001
analysis.mem002
...
analysis.mem0nn
analysis.ensmean

Before running GSI observer or EnKF you need to know:



- GSI observer:
  - Location and names of background files
  - Location and names of observation files
  - Location of the Fix directory
  - Location of the CRTM coefficients directory
  - Successful compilation of GSI
  - GSI observer run directory
  - Analysis times
  - Observation data types used
  - Computer resources
- EnKF:
  - Location and names of ensemble priors
  - Location and names of observation innovation files
  - Location of the Fix directory
  - Location of the CRTM coefficients directory
  - Successful compilation of EnKF
  - EnKF run directory
  - Analysis times
  - Observation data types used
  - Computer resources

Before you run...

Obtain input data

Understand GSI observer and EnKF run scripts

Set up data usage

Two sample run scripts are provided in the release:

- GSI observer
- EnKF

*For regional cases – global case will be added for official release!

Outline of run scripts:

Steps follow community GSI scripts close… for more detail refer to GSI User's Guide

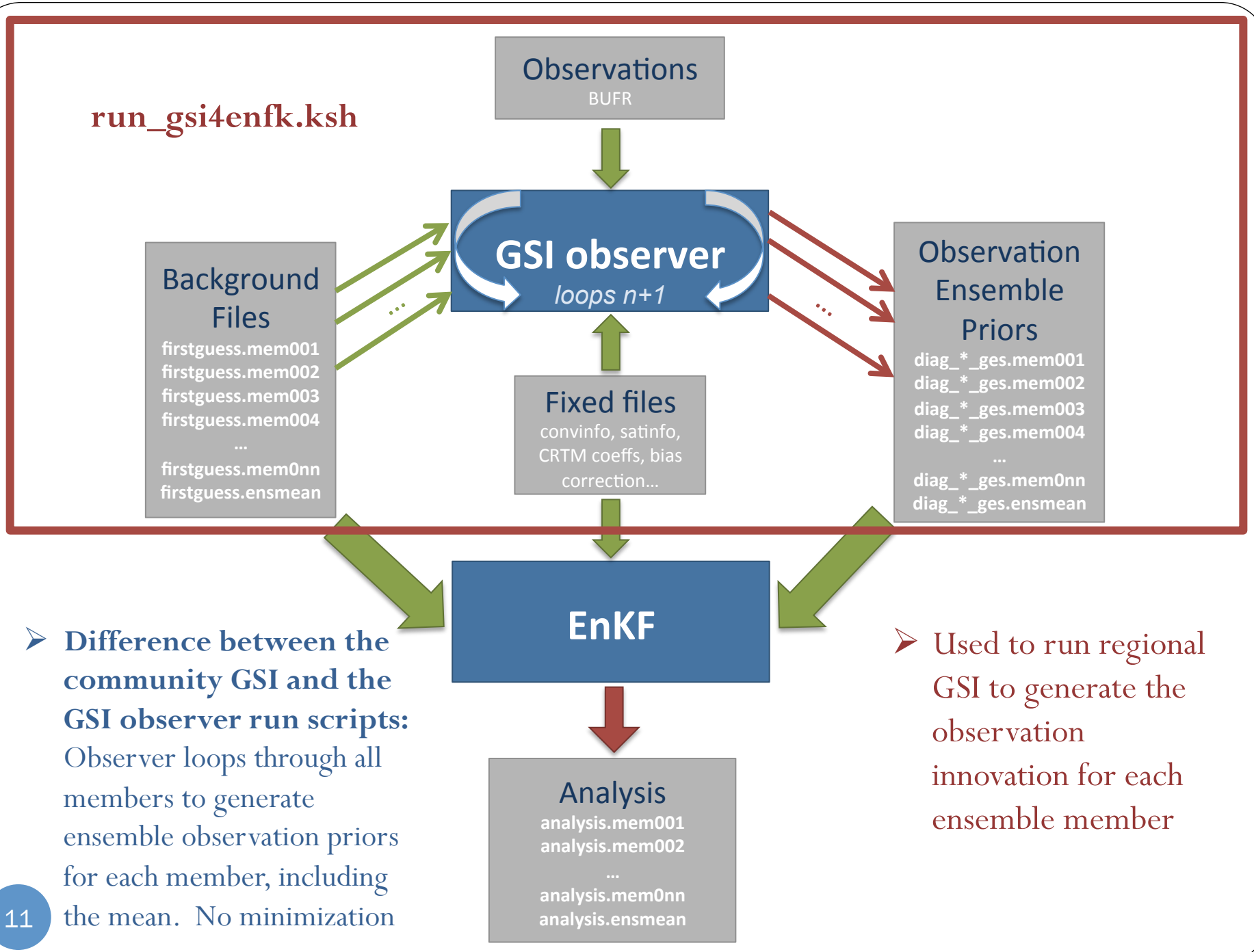
Setup

- Request computer resources to run GSI/EnKF.
- Set environment variables for the machine architecture.
- ✔ Set experiment variables (such as experiment name, analysis time, background, and observation).
- Check the definitions of required variables.

Prepare run directory

- Generate a run directory for GSI/EnKF
- Copy the GSI/EnKF **executable** to the run directory.
- Copy/Link the **background file/ensemble files** to the run directory.
- ✔ Link **observations** to the run directory.
- Link **fixed files** (statistic, control, and coefficient files) to the run directory.
- ✔ Generate **namelist** for GSI/EnKF.

- ✔ Run the GSI/EnKF executable.
- ✔ Post-process: save analysis results, generate diagnostic files, clean run directory.



- **Difference between the community GSI and the GSI observer run scripts:** Observer loops through all members to generate ensemble observation priors for each member, including the mean. No minimization

- Used to run regional GSI to generate the observation innovation for each ensemble member

GSI observer run script

- Set experiment variables

```
###############################################
# case set up (users should change this part)
###############################################
#
# ANAL_TIME= analysis time  (YYYYMMDDHH)
# WORK_ROOT= working directory, where GSI runs
# PREPBURF = path of PreBUFR conventional obs
# BK_FILE  = path and name of background file
# OBS_ROOT = path of observations files
# FIX_ROOT = path of fix files
# GSI_EXE  = path and name of the gsi executable
  ANAL_TIME=2012102506
  WORK_ROOT=…/enkf/regional/gsidiag_nmm
  OBS_ROOT=…/enkf/enkfdata/nmm/obs
  PREPBUFR=${OBS_ROOT}/nam.t18z.prepbufr.tm00.nr
  BK_ROOT=…/enkf/enkfdata/nmm/bk
  BK_FILE=${BK_ROOT}/firstguess.ensmean
  CRTM_ROOT=…/gsi/CRTM_REL-2.1.3
  GSI_ROOT=…/enkf/code/comGSI_EnKF_v3.3
  FIX_ROOT=${GSI_ROOT}/fix
  GSI_EXE=${GSI_ROOT}/run/gsi.exe
  GSI_NAMELIST=${GSI_ROOT}/run/comgsi_namelist.sh
```

Location of input data

Location of GSI system

New options for GSI observer script

Note background set to ensemble mean

GSI observer run script

- Set experiment variables

```
#-----------------------------------------------
# bk_core= which WRF core is used as background (NMM or ARW)
# bkcv_option= which background error covariance and parameter will be used
#              (GLOBAL or NAM)
# if_clean = clean  : delete temporary files in working directory (default)
#            no     : leave running directory as is (this is for debug only)
  bk_core=NMM
  bkcv_option=NAM
  if_clean=clean
# if_observer = Yes  : only used as observation operator for enkf
# no_member     number of ensemble members
# BK_FILE_mem   path and base for ensemble members
  if_observer=Yes
  no_member=20
  BK_FILE_mem=${BK_ROOT}/firstguess.mem
```

Indicates this GSI run is for the generation of observation ensemble priors (Yes) vs. GSI analysis (No)

Path and name of ensembles (w/o member ID)

Number of ensemble members

GSI observer run script

- Generate a run directory for GSI/EnKF
- Copy the GSI/EnKF **executable** to the run directory.
- Copy/Link the **background file/ensemble files** to the run directory.
- Link **observations** to the run directory
- Link **fixed files** (statistic, control, and coefficient files) to the run directory
- Generate **namelist** for GSI

```
# Link to the prepbufr data
ln -s ${PREPBUFR} ./prepbufr

# Link to the radiance data
 ln -s ${OBS_ROOT}/gdas1.t06z.1bamua.tm00.bufr_d amsuabufr
# ln -s ${OBS_ROOT}/nam.t18z.1bamub.tm00.bufr_d amsubbufr
# ln -s ${OBS_ROOT}/nam.t18z.1bhrs3.tm00.bufr_d hirs3bufr
 ln -s ${OBS_ROOT}/gdas1.t06z.1bhrs4.tm00.bufr_d hirs4bufr
 ln -s ${OBS_ROOT}/nam.t18z.1bmhs.tm00.bufr_d mhsbufr
 ln -s ${OBS_ROOT}/nam.t18z.gpsro.tm00.bufr_d gpsrobufr
```

```
if [ ${if_observer} = Yes ] ;
then
   nummiter=0
   if_read_obs_save='.true.'
   if_read_obs_skip='.false.'
else
   nummiter=2
   if_read_obs_save='.false.'
   if_read_obs_skip='.false.'
fi

# Build the GSI namelist on-the-fly
. $GSI_NAMELIST
cat << EOF > gsiparm.anl

 $comgsi_namelist

EOF
```

outer loops=0 to skip minimization iterations

GSI observer run script

- As of this point, the run script is nearly the same as the GSI analysis system (without minimization)
- For observer, save a copy of diag file from ensemble mean and build a new namelist for other ensemble members:

```
##############################################
# start to calculate diag files for each member
##############################################
#
if [ ${if_observer} = Yes ] ; then
  string=ges
  for type in $listall; do
    count=0
    if [[ -f diag_${type}_${string}.${ANAL_TIME} ]]; then
       mv diag_${type}_${string}.${ANAL_TIME} diag_${type}_${string}.ensmean
    fi
  done
  mv wrf_inout wrf_inout_ensmean

# Build the GSI namelist on-the-fly for each member
  nummiter=0
  if_read_obs_save='.false.'
  if_read_obs_skip='.true.'
. $GSI_NAMELIST
cat << EOF > gsiparm.anl

 $comgsi_namelist
EOF
```

2nd part of script only runs if set to "Yes"

Diag files from ensemble mean saved

Namelist for all other ensemble members

GSI observer run script

```
# Loop through each member
   loop="01"
   ensmem=1
   while [[ $ensmem -le $no_member ]];do
      rm pe0*
      print "\$ensmem is $ensmem"
      ensmemid=`printf %3.3i $ensmem`

# get new background for each member
      if [[ -f wrf_inout ]]; then
        rm wrf_inout
      fi
      BK_FILE=${BK_FILE_mem}${ensmemid}
      echo $BK_FILE
      ln -s $BK_FILE wrf_inout

#  run  GSI
…
#  run time error check and save run time file status
…
# generate diag files
      for type in $listall; do
            count=`ls pe*${type}_${loop}* | wc -l`
         if [[ $count -gt 0 ]]; then
            cat pe*${type}_${loop}* > diag_${type}_${string}.mem${ensmemid}
         fi
      done
# next member
      (( ensmem += 1 ))
   done
fi
```

Loops through each ensemble member

- Run GSI observer for each member to create diag files for each member

Remove old ensemble member and link new member

Run GSI observer – for each member

Create diag file for each member

Run results: GSI observer

```
amsuabufr
amsubbufr
anavinfo
berror_stats
convinfo
diag_amsua_n15_ges.ensmean
diag_amsua_n15_ges.mem001
diag_amsua_n15_ges.mem002
diag_amsua_n15_ges.mem003
diag_amsua_n15_ges.mem004
diag_amsua_n15_ges.mem005
diag_conv_ges.ensmean
diag_conv_ges.mem001
diag_conv_ges.mem002
diag_conv_ges.mem003
diag_conv_ges.mem004
diag_conv_ges.mem005
diag_hirs4_n19_ges.ensmean
diag_hirs4_n19_ges.mem001
diag_hirs4_n19_ges.mem002
diag_hirs4_n19_ges.mem003
diag_hirs4_n19_ges.mem004
diag_hirs4_n19_ges.mem005
diag_mhs_n19_ges.ensmean
diag_mhs_n19_ges.mem001
diag_mhs_n19_ges.mem002
diag_mhs_n19_ges.mem003
diag_mhs_n19_ges.mem004
diag_mhs_n19_ges.mem005
errtable
fit_p1.2013091218
fit_q1.2013091218
fit_rad1.2013091218
fit_t1.2013091218
fit_w1.2013091218
fort.201
fort.202
fort.203
fort.204
fort.205
fort.206
fort.207
fort.208
fort.213
fort.214
fort.215
fort.217
fort.218
fort.219
fort.220
fort.221
gpsrobufr
gsi.exe
gsiparm.anl
hirs3bufr
hirs4bufr
l2rwbufr
list_run_directory
list_run_directory_mem001
list_run_directory_mem002
list_run_directory_mem003
list_run_directory_mem004
list_run_directory_mem005
mhsbufr
ozinfo
pcpbias_out
pcpinfo
prepbufr
prepobs_prep.bufrtable
sigf03
stdout
stdout.anl.2013091218
stdout_mem001
stdout_mem002
stdout_mem003
stdout_mem004
stdout_mem005
wrfanl.2013091218
wrf_inout
wrf_inout_ensmean
```

Diag files of conventional observations for ensemble mean and members

Run results: GSI observer

amsuabufr
amsubbufr
anavinfo
berror_stats
convinfo
diag_amsua_n15_ges.ensmean
diag_amsua_n15_ges.mem001
diag_amsua_n15_ges.mem002
diag_amsua_n15_ges.mem003
diag_amsua_n15_ges.mem004
diag_amsua_n15_ges.mem005
diag_conv_ges.ensmean
diag_conv_ges.mem001
diag_conv_ges.mem002
diag_conv_ges.mem003
diag_conv_ges.mem004
diag_conv_ges.mem005
diag_hirs4_n19_ges.ensmean
diag_hirs4_n19_ges.mem001
diag_hirs4_n19_ges.mem002
diag_hirs4_n19_ges.mem003
diag_hirs4_n19_ges.mem004
diag_hirs4_n19_ges.mem005
diag_mhs_n19_ges.ensmean
diag_mhs_n19_ges.mem001
diag_mhs_n19_ges.mem002
diag_mhs_n19_ges.mem003
diag_mhs_n19_ges.mem004
diag_mhs_n19_ges.mem005
errtable
fit_p1.2013091218
fit_q1.2013091218
fit_rad1.2013091218
fit_t1.2013091218
fit_w1.2013091218
fort.201
fort.202
fort.203
fort.204
fort.205
fort.206
fort.207
fort.208
fort.209
fort.214
fort.215
fort.217
fort.218
fort.219
fort.220
fort.221
gpsrobufr
gsi.exe
gsiparm.anl
hirs3bufr
hirs4bufr
l2rwbufr
list_run_directory
list_run_directory_mem001
list_run_directory_mem002
list_run_directory_mem003
list_run_directory_mem004
list_run_directory_mem005
mhsbufr
ozinfo
pcpbias_out
pcpinfo
prepbufr
prepobs_prep.bufrtable
satbias_angle
stdout
stdout.anl.2013091218
stdout_mem001
stdout_mem002
stdout_mem003
stdout_mem004
stdout_mem005
wrfanl.2013091218
wrf_inout
wrf_inout_ensmean

Diag files of satellite radiance observations for ensemble mean and members

Run results: GSI observer

List of files in the run directory after the GSI observer finished for a particular ensemble member

```
amsuabufr
amsubbufr
anavinfo
diag_amsua_n15_ges.mem001
diag_amsua_n15_ges.mem002
diag_amsua_n15_ges.mem003
diag_amsua_n15_ges.mem004
diag_amsua_n15_ges.mem005
diag_conv_ges.ensmean
diag_conv_ges.mem001
diag_conv_ges.mem002
diag_conv_ges.mem003
diag_conv_ges.mem004
diag_conv_ges.mem005
diag_hirs4_n19_ges.ensmean
diag_hirs4_n19_ges.mem001
diag_hirs4_n19_ges.mem002
diag_hirs4_n19_ges.mem003
diag_hirs4_n19_ges.mem004
diag_hirs4_n19_ges.mem005
diag_mhs_n19_ges.ensmean
diag_mhs_n19_ges.mem001
diag_mhs_n19_ges.mem002
diag_mhs_n19_ges.mem003
diag_mhs_n19_ges.mem004
diag_mhs_n19_ges.mem005
errtable
fit_p1.2013091218
fit_q1.2013091218
fit_rad1.2013091218
fort.202
fort.203
fort.204
fort.205
fort.206
fort.207
fort.208
fort.209
fort.210
fort.211
fort.212
fort.213
fort.214
fort.215
fort.217
fort.218
fort.219
fort.220
fort.221
gpsrobufr
gsi.exe
gsiparm.anl
hirs3bufr
hirs4bufr
l2rwbufr
list_run_directory
list_run_directory_mem001
list_run_directory_mem002
list_run_directory_mem003
list_run_directory_mem004
list_run_directory_mem005
mhsbufr
ozinfo
pcpbias_out
pcpinfo
prepbufr
prepobs_prep.bufrtable
satbias_angle
satbias_in
satbias_out
satinfo
sigf03
stdout
stdout.anl.2013091218
stdout_mem001
stdout_mem002
stdout_mem003
stdout_mem004
stdout_mem005
wrfanl.2013091218
wrf_inout
wrf_inout_ensmean
```

Run results: GSI observer

```
amsuabufr
amsubbufr
anavinfo
berror_stats
convinfo
diag_amsua_n15_ges.ensmean
diag_amsua_n15_ges.mem001
diag_amsua_n15_ges.mem002
diag_amsua_n15_ges.mem003
diag_amsua_n15_ges.mem004
diag_amsua_n15_ges.mem005
diag_conv_ges.ensmean
diag_conv_ges.mem001
diag_conv_ges.mem002
diag_conv_ges.mem003
diag_conv_ges.mem004
diag_conv_ges.mem005
diag_hirs4_n19_ges.ensmean
diag_hirs4_n19_ges.mem001
diag_hirs4_n19_ges.mem002
diag_hi
diag_hi
diag_mh
diag_mhs_n19_ges.mem001
diag_mhs_n19_ges.mem002
diag_mhs_n19_ges.mem003
diag_mhs_n19_ges.mem004
diag_mhs_n19_ges.mem005
errtable
fit_p1.2013091218
fit_q1.2013091218
fit_rad1.2013091218
fit_t1.2013091218
fit_w1.2013091218
fort.201
fort.202
fort.203
fort.204
fort.205
fort.206
fort.207
fort.208
fort.209
fort.210
fort.211
fort.212
fort.213
fort.214
fort.215
fort.221
gpsrobufr
gsi.exe
gsiparm.anl
hirs3bufr
hirs4bufr
l2rwbufr
list_run_directory
list_run_directory_mem001
list_run_directory_mem002
list_run_directory_mem003
list_run_directory_mem004
list_run_directory_mem005
mhsbufr
ozinfo
pcpbias_out
pcpinfo
prepbufr
prepobs_prep.bufrtable
satbias_angle
satbias_in
satbias_out
satinfo
sigf03
stdout
stdout.anl.2013091218
stdout_mem001
stdout_mem002
stdout_mem003
stdout_mem004
stdout_mem005
wrfanl.2013091218
wrf_inout
wrf_inout_ensmean
```

Standard output from GSI observer run for a particular ensemble member

Run results: GSI observer

```
amsuabufr
amsubbufr
anavinfo
berror_stats
convinfo
diag_amsua_n15_ges.ensmean
diag_amsua_n15_ges.mem001
diag_amsua_n15_ges.mem002
diag_amsua_n15_ges.mem003
diag_amsua_n15_ges.mem004
diag_amsua_n15_ges.mem005
diag_conv_ges.ensmean
diag_conv_ges.mem001
diag_conv_ges.mem002
diag_conv_ges.mem003
diag_conv_ges.mem004
diag_conv_ges.mem005
diag_hirs4_n19_ges.ensmean
diag_hirs4_n19_ges.mem001
diag_hirs4_n19_ges.mem002
diag_hirs4_n19_ges.mem003
diag_hirs4_n19_ges.mem004
diag_hirs4_n19_ges.mem005
diag_mhs_n19_ges.ensmean
diag_mhs_n19_ges.mem001
diag_mhs_n19_ges.mem002
diag_mhs_n19_ges.mem003
diag_mhs_n19_ges.mem004
diag_mhs_n19_ges.mem005
errtable
fit_p1.2013091218
fit_q1.2013091218
fit_rad1.2013091218
fit_t1.2013091218
fit_w1.2013091218
fort.201
fort.202
fort.203
fort.204
fort.205
fort.206
fort.207
fort.208
fort.209
fort.210
fort.211
fort.212
fort.213
fort.214
fort.215
fort.217
fort.218
fort.219
fort.220
fort.221
gpsrobufr
gsi.exe
gsiparm.anl
hirs3bufr
hirs4bufr
l2rwbufr
list_run_directory
list_run_directory_mem001
list_run_directory_mem002
list_run_directory_mem003
list_run_directory_mem004
list_run_directory_mem005
mhsbufr
ozinfo
pcpbias_out
pcpinfo
prepbufr
prepobs_prep.bufrtable
satbias_angle
satbias_in
satbias_out
satinfo
sigf03
stdout
stdout.anl.2013091218
stdout_mem001
stdout_mem002
stdout_mem003
stdout_mem004
stdout_mem005
wrfanl.2013091218
wrf_inout
wrf_inout_ensmean
```

Linked observation BUFR files

Run results: GSI observer

```
amsuabufr
amsubbufr
anavinfo
berror_stats
convinfo
diag_amsua_n15_ges.ensmean
diag_amsua_n15_ges.mem001
diag_amsua_n15_ges.mem002
diag_amsua_n15_ges.mem003
diag_amsua_n15_ges.mem004
diag_amsua_n15_ges.mem005
diag_conv_ges.ensmean
diag_conv_ges.mem001
diag_conv_ges.mem002
diag_conv_ges.mem003
diag_conv_ges.mem004
diag_conv_ges.mem005
diag_hirs4_n19_ges.ensmean
diag_hirs4_n19_ges.mem001
diag_hirs4_n19_ges.mem002
diag_hirs4_n19_ges.mem003
diag_hirs4_n19_ges.mem004
diag_hirs4_n19_ges.mem005
diag_mhs_n19_ges.ensmean
diag_mhs_n19_ges.mem001
diag_mhs_n19_ges.mem002
diag_mhs_n19_ges.mem003
diag_mhs_n19_ges.mem004
diag_mhs_n19_ges.mem005
errtable
fit_p1.2013091218
fit_q1.2013091218
fit_rad1.2013091218
fit_t1.2013091218
fit_w1.2013091218
fort.201
fort.202
fort.203
fort.204
fort.205
fort.206
fort.207
fort.208
fort.209
fort.210
fort.211
fort.212
fort.213
fort.214
fort.215
fort.217
fort.218
fort.219
fort.220
fort.221
gpsrobufr
gsi.exe
gsiparm.anl
hirs3bufr
hirs4bufr
l2rwbufr
list_run_directory
list_run_directory_mem001
list_run_directory_mem002
list_run_directory_mem003
list_run_directory_mem004
list_run_directory_mem005
mhsbufr
ozinfo
pcpbias_out
pcpinfo
prepbufr
prepobs_prep.bufrtable
satbias_angle
satbias_in
satbias_out
satinfo
sigf03
stdout
stdout.anl.2013091218
stdout_mem001
stdout_mem002
stdout_mem003
stdout_mem004
stdout_mem005
wrfanl.2013091218
wrf_inout
wrf_inout_ensmean
```

Bias correction coefficients

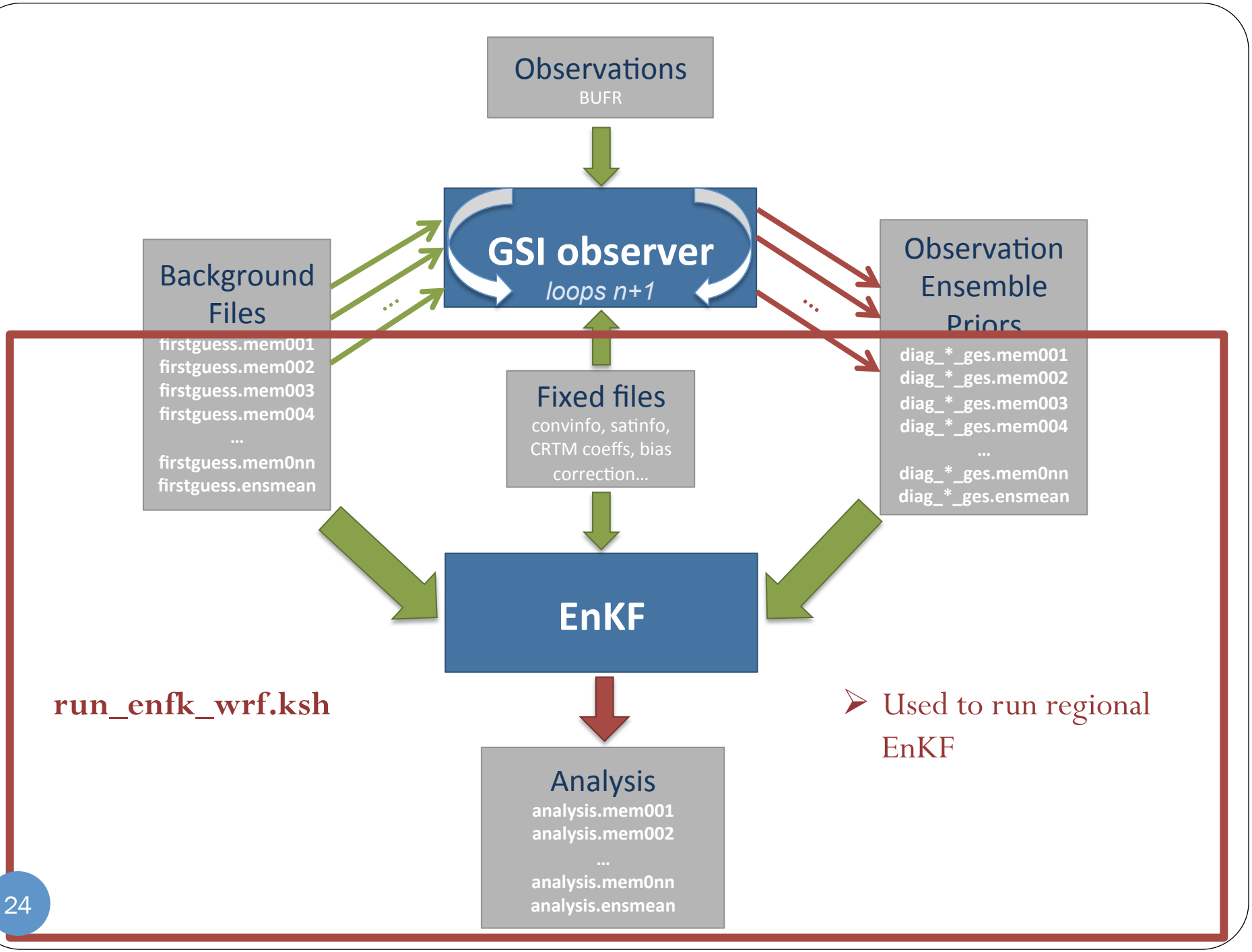
Run results: GSI observer

```
amsuabufr
amsubbufr
anavinfo
berror_stats
convinfo
diag_amsua_n15_ges.ensmean
diag_amsua_n15_ges.mem001
diag_amsua_n15_ges.mem002
diag_amsua_n15_ges.mem003
diag_amsua_n15_ges.mem004
diag_amsua_n15_ges.mem005
diag_conv_ges.ensmean
diag_conv_ges.mem001
diag_conv_ges.mem002
diag_conv_ges.mem003
diag_conv_ges.mem004
diag_conv_ges.mem005
diag_hirs4_n19_ges.ensmean
diag_hirs4_n19_ges.mem001
diag_hirs4_n19_ges.mem002
diag_hirs4_n19_ges.mem003
diag_hirs4_n19_ges.mem004
diag_hirs4_n19_ges.mem005
diag_mhs_n19_ges.ensmean
diag_mhs_n19_ges.mem001
diag_mhs_n19_ges.mem002
diag_mhs_n19_ges.mem003
diag_mhs_n19_ges.mem004
diag_mhs_n19_ges.mem005
errtable
```

```
fit_p1.2013091218
fit_q1.2013091218
fit_rad1.2013091218
fit_t1.2013091218
fit_w1.2013091218
fort.201
fort.202
fort.203
fort.204
fort.205
fort.206
fort.207
fort.208
fort.209
fort.210
fort.211
fort.212
fort.213
fort.214
fort.215
fort.217
fort.218
fort.219
fort.220
fort.221
gpsrobufr
gsi.exe
gsiparm.anl
hirs3bufr
hirs4bufr
```

Fixed files

```
l2rwbufr
list_run_directory
list_run_directory_mem001
list_run_directory_mem002
list_run_directory_mem003
list_run_directory_mem004
list_run_directory_mem005
mhsbufr
ozinfo
pcpbias_out
pcpinfo
prepbufr
prepobs_prep.bufrtable
satbias_angle
satbias_in
satbias_out
satinfo
sigf03
stdout
stdout.anl.2013091218
stdout_mem001
stdout_mem002
stdout_mem003
stdout_mem004
stdout_mem005
wrfanl.2013091218
wrf_inout
wrf_inout_ensmean
```


Observations
BUFR
GSI observer
loops n+1
Background Files
firstguess.mem001
firstguess.mem002
firstguess.mem003
firstguess.mem004
...
firstguess.mem0nn
firstguess.ensmean
Fixed files
convinfo, satinfo, CRTM coeffs, bias correction…
Observation Ensemble Priors
diag_*_ges.mem001
diag_*_ges.mem002
diag_*_ges.mem003
diag_*_ges.mem004
...
diag_*_ges.mem0nn
diag_*_ges.ensmean
EnKF
Analysis
analysis.mem001
analysis.mem002
...
analysis.mem0nn
analysis.ensmean
run_enfk_wrf.ksh
Used to run regional EnKF

EnKF run script

- Set experiment variables

- Closely matches GSI observer script … should setup based on options in GSI observer scripts

```
###############################################################
# case set up (users should change this part)
###############################################################
#
# ANAL_TIME= analysis time  (YYYYMMDDHH)
# WORK_ROOT= working directory, where GSI runs
# PREPBURF = path of PreBUFR conventional obs
# BK_FILE  = path and name of background file
# OBS_ROOT = path of observations files
# FIX_ROOT = path of fix files
# GSI_EXE  = path and name of the gsi executable
```

Location of input data

Location of GSI/EnKF code

```
ANAL_TIME=2013091218
WORK_ROOT=/glade/scratch/${USER}/enkf/regional/enkf_nmm
diag_ROOT=/glade/scratch/${USER}/enkf/regional/gsidiag_nmm
BK_ROOT=/glade/p/work/${USER}/enkf/enkfdata/nmm/bk
BK_FILE=${BK_ROOT}/firstguess.ensmean
GSI_ROOT=/glade/p/work/${UESR}/enkf/code/comGSI_EnKF_v3.3
FIX_ROOT=${GSI_ROOT}/fix
ENKF_EXE=${GSI_ROOT}/src/main/enkf/wrf_enkf
CRTM_ROOT=/glade/p/work/${USER}/gsi/CRTM_REL-2.1.3
ENKF_NAMELIST=${GSI_ROOT}/run/enkf_wrf_namelist.sh
```

GSI observer run directory

EnKF exe in GSI source code

Path to EnKF namelist

EnKF run script

- Set experiment variables

- Closely matches GSI observer script … should setup based on options in GSI observer scripts

```
###################################################
# case set up (users should change this part)
###################################################
#
# ANAL_TIME= analysis time  (YYYYMMDDHH)
# WORK_ROOT= working directory, where GSI runs
# PREPBURF = path of PreBUFR conventional obs
# BK_FILE  = path and name of background file
# OBS_ROOT = path of observations files
# FIX_ROOT = path of fix files
# GSI_EXE  = path and name of the gsi executable

  ANAL_TIME=2013091218
  WORK_ROOT=/glade/scratch/${USER}/enkf/regional/enkf_nmm
  diag_ROOT=/glade/scratch/${USER}/enkf/regional/gsidiag_nmm
  BK_ROOT=/glade/p/work/${USER}/enkf/enkfdata/nmm/bk
  BK_FILE=${BK_ROOT}/firstguess.ensmean
  GSI_ROOT=/glade/p/work/${UESR}/enkf/code/comGSI_EnKF_v3.3
  FIX_ROOT=${GSI_ROOT}/fix
  ENKF_EXE=${GSI_ROOT}/src/main/enkf/wrf_enkf
  CRTM_ROOT=/glade/p/work/${USER}/gsi/CRTM_REL-2.1.3
  ENKF_NAMELIST=${GSI_ROOT}/run/enkf_wrf_namelist.sh
```

Make sure this location has enough space to hold ensemble members and EnKF analysis results!

GSI observer run directory

EnKF exe in GSI source code

Path to EnKF namelist

EnKF run script

- Several values set in the run script populate the EnKF namelist (**enfk.nml**)

```
# ANAL_TIME= analysis time  (YYYYMMDDHH)
```

&nam_enkf
datain: analysis time
datapath: path to data directory (./)

```
# ensemble parameters
#
  NMEM_ENKF=20
  BK_FILE_mem=${BK_ROOT}/wrfarw
  NLONS=111
  NLATS=111
  NLEVS=56
  IF_ARW=.true.
  IF_NMM=.false.
```

&nam_enkf
regional: true, perform regional analysis using either ARW or NMM
nlons: grid pts in longitude of model bk
nlats: grid pts in latitude of model bk
nlevs: vertical levels of model bk
nanls: number of ensemble members

&nam_wrf
arw: true, use WRF ARW
nmm: true, use WRF NMM

```
  list="conv amsua_n18 hirs4_n19"
#  list="conv amsua_n18 mhs_n19 hirs4_n19"
#
```

List of observation types that EnKF will use in analysis (based files generated from GSI observer)

EnKF run script

- Users can run simple EnKF cases without changing remainder of script.

```
# Given the analysis date, compute the date from which the
# first guess comes.  Extract cycle and set prefix and suffix
# for guess and observation data files
# gdate=`$ndate -06 $adate`
gdate=$ANAL_TIME
YYYYMMDD=`echo $adate | cut -c1-8`
HH=`echo $adate | cut -c9-10`

# Fixed files
# CONVINFO=${FIX_ROOT}/global_convinfo.txt
# SATINFO=${FIX_ROOT}/global_satinfo.txt
# SCANINFO=${FIX_ROOT}/global_scaninfo.txt
# OZINFO=${FIX_ROOT}/global_ozinfo.txt
CONVINFO=${diag_ROOT}/convinfo
SATINFO=${diag_ROOT}/satinfo
SCANINFO=${diag_ROOT}/scaninfo
OZINFO=${diag_ROOT}/ozinfo
# LOCINFO=${FIX_ROOT}/global_hybens_locinfo.l64.txt

# Set up workdir
rm -rf $WORK_ROOT
mkdir -p $WORK_ROOT
cd $WORK_ROOT
```

Workdir cleaned before each run, save files from previous run!

Analysis time from which the first guess comes

Location of fixed files

Creates working directory for EnKF to run

EnKF run script

Copy or Link:

```
cp $ENKF_EXE        ./enkf.x

cp $CONVINFO        ./convinfo
cp $SATINFO         ./satinfo
cp $SCANINFO        ./scaninfo
cp $OZINFO          ./ozinfo
# cp $LOCINFO         ./hybens_locinfo

cp $diag_ROOT/satbias_in ./satbias_in
cp $diag_ROOT/satbias_angle ./satbias_angle

# get mean
ln -s ${BK_FILE_mem}.ensmean ./firstguess.ensmean
for type in $list; do
   ln -s $diag_ROOT/diag_${type}_ges.ensmean .
done

# get each member
imem=1
while [[ $imem -le $NMEM_ENKF ]]; do
   member="mem"`printf %03i $imem`
   ln -s ${BK_FILE_mem}.${member} ./firstguess.${member}
   for type in $list; do
      ln -s $diag_ROOT/diag_${type}_ges.${member} .
   done
   (( imem = $imem + 1 ))
done
```

EnKF executable

Fixed files

Bias correction coefficients

Background ensemble mean

diag files (observation) – ens mean

Background ensemble members

diag files (observation) – members

EnKF run script

```
# Build the GSI namelist on-the-fly
. $ENKF_NAMELIST
cat << EOF > enkf.nml

 $enkf_namelist
EOF

# make analysis files
cp firstguess.ensmean analysis.ensmean
# get each member
imem=1
while [[ $imem -le $NMEM_ENKF ]]; do
   member="mem"`printf %03i $imem`
   cp firstguess.${member} analysis.${member}
   (( imem = $imem + 1 ))
done
#####################################################
#  run  EnKF
#####################################################
echo ' Run EnKF'

${RUN_COMMAND} ./enkf.x < enkf.nml > stdout 2>&1

#####################################################################
#  run time error check
#####################################################################
error=$?
if [ ${error} -ne 0 ]; then
  echo "ERROR: ${ENKF_EXE} crashed  Exit status=${error}"
  exit ${error}
fi
```

Script: `enkf_wrf_namelist.sh` provided in run directory generates EnKF namelist in the working directory

Copy ensemble bk files to working directory and rename as analysis

Run EnKF – update analysis files

Run results: EnKF

```
analysis.ensmean
analysis.mem001
analysis.mem002
analysis.mem003
analysis.mem004
analysis.mem005
convinfo
covinflate.dat
diag_amsua_n18_ges.ensmean
diag_amsua_n18_ges.mem001
diag_amsua_n18_ges.mem002
diag_amsua_n18_ges.mem003
diag_amsua_n18_ges.mem004
diag_amsua_n18_ges.mem005
diag_conv_ges.ensmean
diag_conv_ges.mem001
diag_conv_ges.mem002
diag_conv_ges.mem003
diag_conv_ges.mem004
diag_conv_ges.mem005
diag_gome_metop-a_ges.ensmean
diag_gome_metop-b_ges.ensmean
diag_hirs4_n19_ges.ensmean
diag_hirs4_n19_ges.mem001
diag_hirs4_n19_ges.mem002
diag_hirs4_n19_ges.mem003
diag_hirs4_n19_ges.mem004
diag_hirs4_n19_ges.mem005
diag_omi_aura_ges.ensmean
diag_sbuv2_n16_ges.ensmean
diag_sbuv2_n17_ges.ensmean
diag_sbuv2_n18_ges.ensmean
diag_sbuv2_n19_ges.ensmean
enkf.log
enkf.nml
enkf.x
firstguess.ensmean
firstguess.mem001
firstguess.mem002
firstguess.mem003
firstguess.mem004
firstguess.mem005
Ozinfo
satbias_angle
satbias_in
satinfo
stdout
```

Binary diag files for conventional and GPSRO observations. Contains observations and their priors.

Run results: EnKF

```
analysis.ensmean
analysis.mem001
analysis.mem002
analysis.mem003
analysis.mem004
analysis.mem005
convinfo
covinflate.dat
diag_amsua_n18_ges.ensmean
diag_amsua_n18_ges.mem001
diag_amsua_n18_ges.mem002
diag_amsua_n18_ges.mem003
diag_amsua_n18_ges.mem004
diag_amsua_n18_ges.mem005
diag_conv_ges.ensmean
diag_conv_ges.mem001
diag_conv_ges.mem002
diag_conv_ges.mem003
diag_conv_ges.mem004
diag_conv_ges.mem005
diag_gome_metop-a_ges.ensmean
diag_gome_metop-b_ges.ensmean
diag_hirs4_n19_ges.ensmean
diag_hirs4_n19_ges.mem001
diag_hirs4_n19_ges.mem002
diag_hirs4_n19_ges.mem003
diag_hirs4_n19_ges.mem004
diag_hirs4_n19_ges.mem005
diag_omi_aura_ges.ensmean
diag_sbuv2_n16_ges.ensmean
diag_sbuv2_n17_ges.ensmean
diag_sbuv2_n18_ges.ensmean
diag_sbuv2_n19_ges.ensmean
enkf.log
enkf.nml
enkf.x
firstguess.ensmean
firstguess.mem001
firstguess.mem002
firstguess.mem003
firstguess.mem004
firstguess.mem005
Ozinfo
satbias_angle
satbias_in
satinfo
stdout
```

Binary diag files for satellite radiance observations. Contains observations and their priors

Run results: EnKF

```
analysis.ensmean
analysis.mem001
analysis.mem002
analysis.mem003
analysis.mem004
analysis.mem005
convinfo
covinflate.dat
diag_amsua_n18_ges.ensmean
diag_amsua_n18_ges.mem001
diag_amsua_n18_ges.mem002
diag_amsua_n18_ges.mem003
diag_amsua_n18_ges.mem004
diag_amsua_n18_ges.mem005
diag_conv_ges.ensmean
diag_conv_ges.mem001
diag_conv_ges.mem002
diag_conv_ges.mem003
diag_conv_ges.mem004
diag_conv_ges.mem005
diag_gome_metop-a_ges.ensmean
diag_gome_metop-b_ges.ensmean
diag_hirs4_n19_ges.ensmean
diag_hirs4_n19_ges.mem001
diag_hirs4_n19_ges.mem002
diag_hirs4_n19_ges.mem003
diag_hirs4_n19_ges.mem004
diag_hirs4_n19_ges.mem005
diag_omi_aura_ges.ensmean
diag_sbuv2_n16_ges.ensmean
diag_sbuv2_n17_ges.ensmean
diag_sbuv2_n18_ges.ensmean
diag_sbuv2_n19_ges.ensmean
enkf.log
enkf.nml
enkf.x
firstguess.ensmean
firstguess.mem001
firstguess.mem002
firstguess.mem003
firstguess.mem004
firstguess.mem005
Ozinfo
satbias_angle
satbias_in
satinfo
stdout
```

Ensemble analysis (same format as bk)

Run results: EnKF

```
analysis.ensmean
analysis.mem001
analysis.mem002
analysis.mem003
analysis.mem004
analysis.mem005
convinfo
covinflate.dat
diag_amsua_n18_ges.ensmean
diag_amsua_n18_ges.mem001
diag_amsua_n18_ges.mem002
diag_amsua_n18_ges.mem003
diag_amsua_n18_ges.mem004
diag_amsua_n18_ges.mem005
diag_conv_ges.ensmean
diag_conv_ges.mem001
diag_conv_ges.mem002
diag_conv_ges.mem003
diag_conv_ges.mem004
diag_conv_ges.mem005
diag_gome_metop-a_ges.ensmean
diag_gome_metop-b_ges.ensmean
diag_hirs4_n19_ges.ensmean
diag_hirs4_n19_ges.mem001
diag_hirs4_n19_ges.mem002
diag_hirs4_n19_ges.mem003
diag_hirs4_n19_ges.mem004
diag_hirs4_n19_ges.mem005
diag_omi_aura_ges.ensmean
diag_sbuv2_n16_ges.ensmean
diag_sbuv2_n17_ges.ensmean
diag_sbuv2_n18_ges.ensmean
diag_sbuv2_n19_ges.ensmean
enkf.log
enkf.nml
enkf.x
firstguess.ensmean
firstguess.mem001
firstguess.mem002
firstguess.mem003
firstguess.mem004
firstguess.mem005
Ozinfo
satbias_angle
satbias_in
satinfo
stdout
```

Background ensemble members (mean)

Run results: EnKF

```
analysis.ensmean
analysis.mem001
analysis.mem002
analysis.mem003
analysis.mem004
analysis.mem005
convinfo
covinflate.dat
diag_amsua_n18_ges.ensmean
diag_amsua_n18_ges.mem001
diag_amsua_n18_ges.mem002
diag_amsua_n18_ges.mem003
diag_amsua_n18_ges.mem004
diag_amsua_n18_ges.mem005
diag_conv_ges.ensmean
diag_conv_ges.mem001
diag_conv_ges.mem002
diag_conv_ges.mem003
diag_conv_ges.mem004
diag_conv_ges.mem005
diag_gome_metop-a_ges.ensmean
diag_gome_metop-b_ges.ensmean
diag_hirs4_n19_ges.ensmean
diag_hirs4_n19_ges.mem001
diag_hirs4_n19_ges.mem002
diag_hirs4_n19_ges.mem003
diag_hirs4_n19_ges.mem004
diag_hirs4_n19_ges.mem005
diag_omi_aura_ges.ensmean
diag_sbuv2_n16_ges.ensmean
diag_sbuv2_n17_ges.ensmean
diag_sbuv2_n18_ges.ensmean
diag_sbuv2_n19_ges.ensmean
enkf.log
enkf.nml
enkf.x
firstguess.ensmean
firstguess.mem001
firstguess.mem002
firstguess.mem003
firstguess.mem004
firstguess.mem005
Ozinfo
satbias_angle
satbias_in
satinfo
stdout
```

Info files for controlling data usage

Run results: EnKF

```
analysis.ensmean
analysis.mem001
analysis.mem002
analysis.mem003
analysis.mem004
analysis.mem005
convinfo
covinflate.dat
diag_amsua_n18_ges.ensmean
diag_amsua_n18_ges.mem001
diag_amsua_n18_ges.mem002
diag_amsua_n18_ges.mem003
diag_amsua_n18_ges.mem004
diag_amsua_n18_ges.mem005
diag_conv_ges.ensmean
diag_conv_ges.mem001
diag_conv_ges.mem002
diag_conv_ges.mem003
diag_conv_ges.mem004
diag_conv_ges.mem005
diag_gome_metop-a_ges.ensmean
diag_gome_metop-b_ges.ensmean
diag_hirs4_n19_ges.ensmean
diag_hirs4_n19_ges.mem001
diag_hirs4_n19_ges.mem002
diag_hirs4_n19_ges.mem003
diag_hirs4_n19_ges.mem004
diag_hirs4_n19_ges.mem005
```

3d multiplicative inflation factor fields

```
diag_omi_aura_ges.ensmean
diag_sbuv2_n16_ges.ensmean
diag_sbuv2_n17_ges.ensmean
diag_sbuv2_n18_ges.ensmean
diag_sbuv2_n19_ges.ensmean
enkf.log
enkf.nml
enkf.x
firstguess.ensmean
firstguess.mem001
firstguess.mem002
firstguess.mem003
firstguess.mem004
firstguess.mem005
Ozinfo
satbias_angle
satbias_in
satinfo
stdout
```

EnKF namelist

EnKF executable

Bias correction coefficients

Run results: EnKF

```
analysis.ensmean
analysis.mem001
analysis.mem002
analysis.mem003
analysis.mem004
analysis.mem005
convinfo
covinflate.dat
diag_amsua_n18_ges.ensmean
diag_amsua_n18_ges.mem001
diag_amsua_n18_ges.mem002
diag_amsua_n18_ges.mem003
diag_amsua_n18_ges.mem004
diag_amsua_n18_ges.mem005
diag_conv_ges.ensmean
diag_conv_ges.mem001
diag_conv_ges.mem002
diag_conv_ges.mem003
diag_conv_ges.mem004
diag_conv_ges.mem005
diag_gome_metop-a_ges.ensmean
diag_gome_metop-b_ges.ensmean
diag_hirs4_n19_ges.ensmean
diag_hirs4_n19_ges.mem001
diag_hirs4_n19_ges.mem002
diag_hirs4_n19_ges.mem003
diag_hirs4_n19_ges.mem004
diag_hirs4_n19_ges.mem005
diag_omi_aura_ges.ensmean
diag_sbuv2_n16_ges.ensmean
diag_sbuv2_n17_ges.ensmean
diag_sbuv2_n18_ges.ensmean
diag_sbuv2_n19_ges.ensmean
enkf.log
enkf.nml
enkf.x
firstguess.ensmean
firstguess.mem001
firstguess.mem002
firstguess.mem003
firstguess.mem004
firstguess.mem005
Ozinfo
satbias_angle
satbias_in
satinfo
stdout
```

Text file with standard output

Run results: EnKF

```
analysis.ensmean
analysis.mem001
analysis.mem002
analysis.mem003
analysis.mem004
analysis.mem005
convinfo
covinflate.dat
diag_amsua_n18_ges.ensmean
diag_amsua_n18_ges.mem001
diag_amsua_n18_ges.mem002
diag_amsua_n18_ges.mem003
diag_amsua_n18_ges.mem004
diag_amsua_n18_ges.mem005
diag_conv_ges.ensmean
diag_conv_ges.mem001
diag_conv_ges.mem002
diag_conv_ges.mem003
diag_conv_ges.mem004
diag_conv_ges.mem005
diag_gome_metop-a_ges.ensmean
diag_gome_metop-b_ges.ensmean
diag_omi_aura_ges.ensmean
diag_sbuv2_n16_ges.ensmean
diag_sbuv2_n17_ges.ensmean
diag_sbuv2_n18_ges.ensmean
diag_sbuv2_n19_ges.ensmean
enkf.log
enkf.nml
enkf.x
firstguess.ensmean
firstguess.mem001
firstguess.mem002
firstguess.mem003
firstguess.mem004
firstguess.mem005
Ozinfo
satbias_angle
satbias_in
satinfo
stdout
```

Text file with standard output

Details on the EnKF diagnostics, interpretation and tuning options discussed in following talk

```
diag_hirs4_n19_ges.mem004
diag_hirs4_n19_ges.mem005
```

Setting up data usage in GSI

1. Link observation files
2. Set namelist
3. Set conventional observations
4. Set radiance observations

More information can be found in the GSI User's Guide (section 4.3)

Additionally: detailed GSI usage and tuning covered in GSI residential (coming next summer!) and online tutorials

(1): link observation files

- Link the observation files into run directory

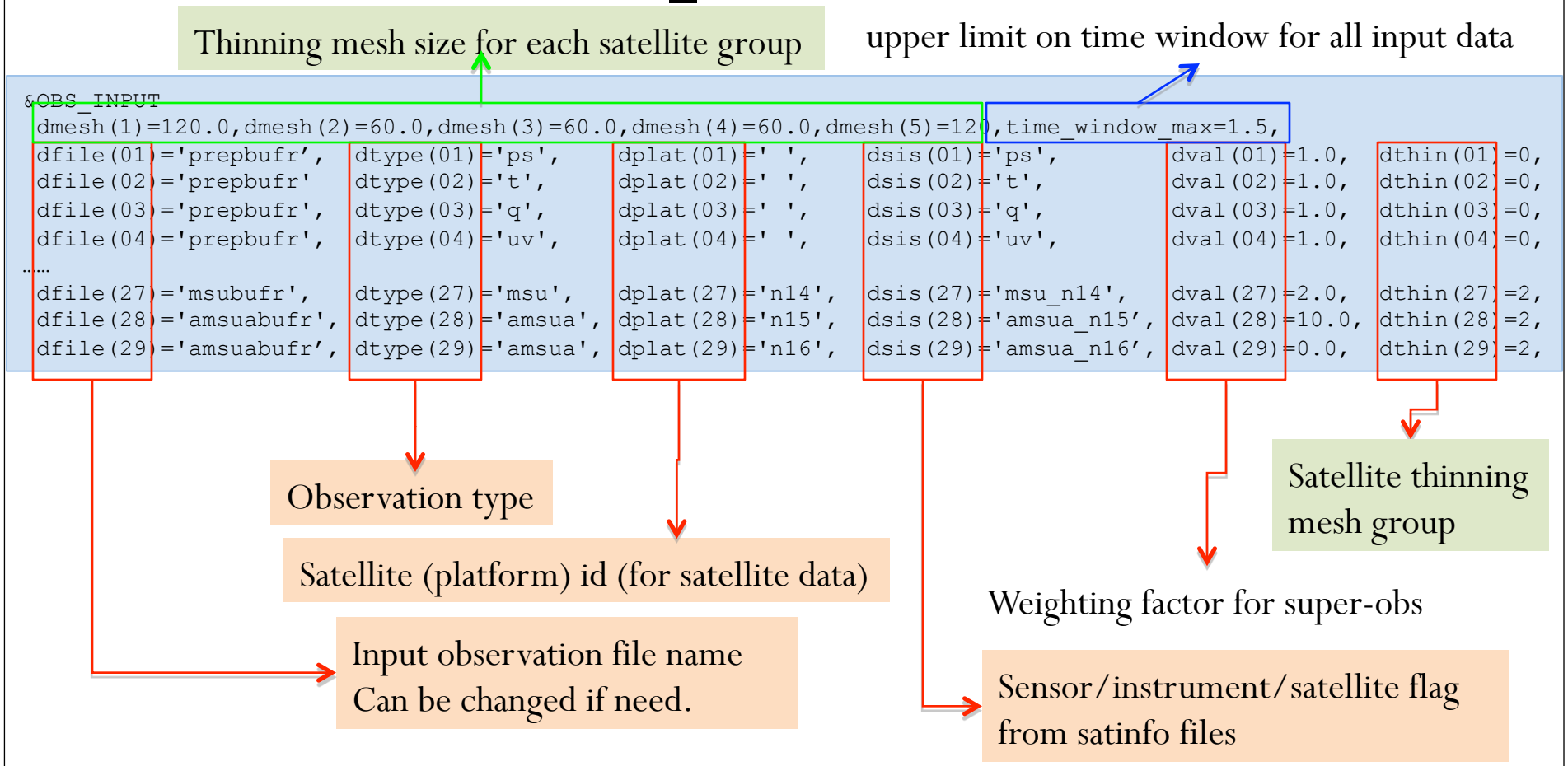
```
# Link to the prepbufr data
ln -s ${PREPBUFR} ./prepbufr

# Link to the radiance data
# ln -s ${OBS_ROOT}/gdas1.t12z.1bamua.tm00.bufr_d amsuabufr
# ln -s ${OBS_ROOT}/gdas1.t12z.1bhrs4.tm00.bufr_d hirs4bufr
# ln -s ${OBS_ROOT}/gdas1.t12z.1bmhs.tm00.bufr_d  mhsbufr
```

GSI Name	Content	Example file names
prepbufr	Conventional observations, including ps, t, q, pw, uv, spd, dw, sst, from observation platforms such as METAR, sounding, et al.	gdas1.t12z.prepbufr
amsuabufr	AMSU-A 1b radiance (brightness temperatures) from satellites NOAA-15, 16, 17,18, 19 and METOP-A	gdas1.t12z.1bamua.tm00.bufr_d
amsubbufr	AMSU-B 1b radiance (brightness temperatures) from satellites NOAA15, 16,17	gdas1.t12z.1bamub.tm00.bufr_d
radarbufr	Radar radial velocity Level 2.5 data	ndas.t12z. radwnd. tm12.bufr_d
gpsrobufr	GPS radio occultation observation	gdas1.t12z.gpsro.tm00.bufr_d
ssmirrbufr	Precipitation rate observations from SSM/I	gdas1.t12z.spssmi.tm00.bufr_d
tmirrbufr	Precipitation rate observations from TMI	gdas1.t12z.sptrmm.tm00.bufr_d
sbuvbufr	SBUV/2 ozone observations from satellite NOAA16, 17, 18, 19	gdas1.t12z.osbuv8.tm00.bufr_d

(2): set namelist

- Set namelist section &**OBS_INPUT**



The details on data thinning can be found in the GSI User's Guide

(3): set conventional observations

- *convinfo*
  - control the usage of conventional data (t, q, ps, wind, …) and GPS RO refractivity and bending angle based on data type.
  - User's Guide section 4.3 for more details

!otype	type	sub	iuse	twindow	numgrp	ngroup	nmiter	gross	ermax	ermin	var_b	var_pg	ithin	rmesh	pmesh
ps	120	0	1	3.0	0	0	0	4.0	3.0	1.0	4.0	0.000300	0	0.	0.
ps	180	0	1	3.0	0	0	0	4.0	3.0	1.0	4.0	0.000300	0	0.	0.
ps	181	0	1	3.0	0	0	0	3.6	3.0	1.0	3.6	0.000300	0	0.	0.
ps	183	0	-1	3.0	0	0	0	4.0	3.0	1.0	4.0	0.000300	0	0.	0.
t	120	0	1	3.0	0	0	0	8.0	5.6	1.3	8.0	0.000001	0	0.	0.
t	126	0	-1	3.0	0	0	0	8.0	5.6	1.3	8.0	0.001000	0	0.	0.
t	130	0	1	3.0	0	0	0	7.0	5.6	1.3	7.0	0.001000	0	0.	0.
t	131	0	1	3.0	0	0	0	7.0	5.6	1.3	7.0	0.001000	0	0.	0.
t	180	0	1	3.0	0	0	0	7.0	5.6	1.3	7.0	0.004000	0	0.	0.
t	181	0	-1	3.0	0	0	0	7.0	5.6	1.3	7.0	0.004000	0	0.	0.

iuse=1: use data
iuse=0: do not use data
iuse=-1: monitor data

Gross Check Parameters

Data thinning Parameters

The last column npred has been deleted to fit the table in a page

(4): set radiance observations

- *Satinfo* (User's Guide section 4.3 for more details)
- Control the usage of satellite radiance data (AMSU-A, AMSU-B, HIRS3, …) based on platform and channels.

!sensor/instr/sat	chan	iuse	error	error_cld	ermax	var_b	var_pg	icld_det
amsua_n15	1	1	3.000	9.100	4.500	10.000	0.000	1
amsua_n15	2	1	2.000	13.500	4.500	10.000	0.000	1
amsua_n15	3	1	2.000	7.100	4.500	10.000	0.000	1
amsua_n15	4	1	0.600	1.300	2.500	10.000	0.000	1
•••••								
amsua_n15	14	-1	2.000	1.400	4.500	10.000	0.000	-1
amsua_n15	15	1	3.000	10.000	4.500	10.000	0.000	1
hirs3_n17	1	-1	2.000	0.000	4.500	10.000	0.000	-1

`iuse`

=-2: do not use

=-1: monitor if diagnostics produced

=0: monitor and use in QC only

=1: use data with complete quality control

=2 use data with no airmass bias correction

=3 use data with no angle dependent bias correction

=4 use data with no bias correction

`ermax`: max error (for QC)

`error`: variance for each satellite channel

Setting up data usage: summary

- Link the observation files

```
ln -s ${PREPBUFR} ./prepbufr
ln -s ${OBS_ROOT}/gdas1.t12z.1bamua.tm00.bufr_d amsuabufr
```

- Set namelist section &*OBS_INPUT*

```
&OBS_INPUT
 dmesh(1)=120.0,dmesh(2)=60.0,dmesh(3)=60.0,dmesh(4)=60.0,dmesh(5)=120,time_window_max=1.5,
 dfile(01)='prepbufr',   dtype(01)='ps',     dplat(01)=' ',     dsis(01)='ps',         dval(01)=1.0,   dthin(01)=0,
 dfile(02)='prepbufr'    dtype(02)='t',      dplat(02)=' ',     dsis(02)='t',          dval(02)=1.0,   dthin(02)=0,
 dfile(03)='prepbufr',   dtype(03)='q',      dplat(03)=' ',     dsis(03)='q',          dval(03)=1.0,   dthin(03)=0,
 dfile(28)='amsuabufr', dtype(28)='amsua', dplat(28)='n15',  dsis(28)='amsua_n15',  dval(28)=10.0, dthin(28)=2,
 dfile(29)='amsuabufr', dtype(29)='amsua', dplat(29)='n16',  dsis(29)='amsua_n16',  dval(29)=0.0,   dthin(29)=2,
```

- Set *info* file

```
!otype    type   sub  iuse  twindow  numgrp  ngroup  nmiter  gross  ermax  ermin  var_b     var_pg  ithin  rmesh   pmesh
 ps        120     0     1      3.0       0       0       0    4.0    3.0    1.0    4.0   0.000300      0     0.      0.
 ps        180     0     1      3.0       0       0       0    4.0    3.0    1.0    4.0   0.000300      0     0.      0.
 ps        181     0     1      3.0       0       0       0    3.6    3.0    1.0    3.6   0.000300      0     0.      0.
 ps        183     0    -1      3.0       0       0       0    4.0    3.0    1.0    4.0   0.000300      0     0.      0.
 t         120     0     1      3.0       0       0       0    8.0    5.6    1.3    8.0   0.000001      0     0.      0.
 t         126     0    -1      3.0
 t         130     0     1      3.0
 t         131     0     1      3.0
 t         180     0     1      3.0
 t         181     0    -1      3.0
```

```
!sensor/instr/sat      chan  iuse  error  error_cld  ermax
 amsua_n15               2     1  2.000     13.500    4.500
 amsua_n15               3     1  2.000      7.100    4.500
 amsua_n15               4     1  0.600      1.300    2.500
 amsua_n15              14    -1  2.000      1.400    4.500
 amsua_n15              15     1  3.000     10.000    4.500
 hirs3_n17               1    -1  2.000      0.000    4.500
```

Questions??