Running Global Model Parallel Experiments

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1. Introduction

So you'd like to run a GFS experiment? This page will help get you going and provide what you need to know to run an experiment with the GFS, whether it be on Zeus or WCOSS. Before continuing, some information:

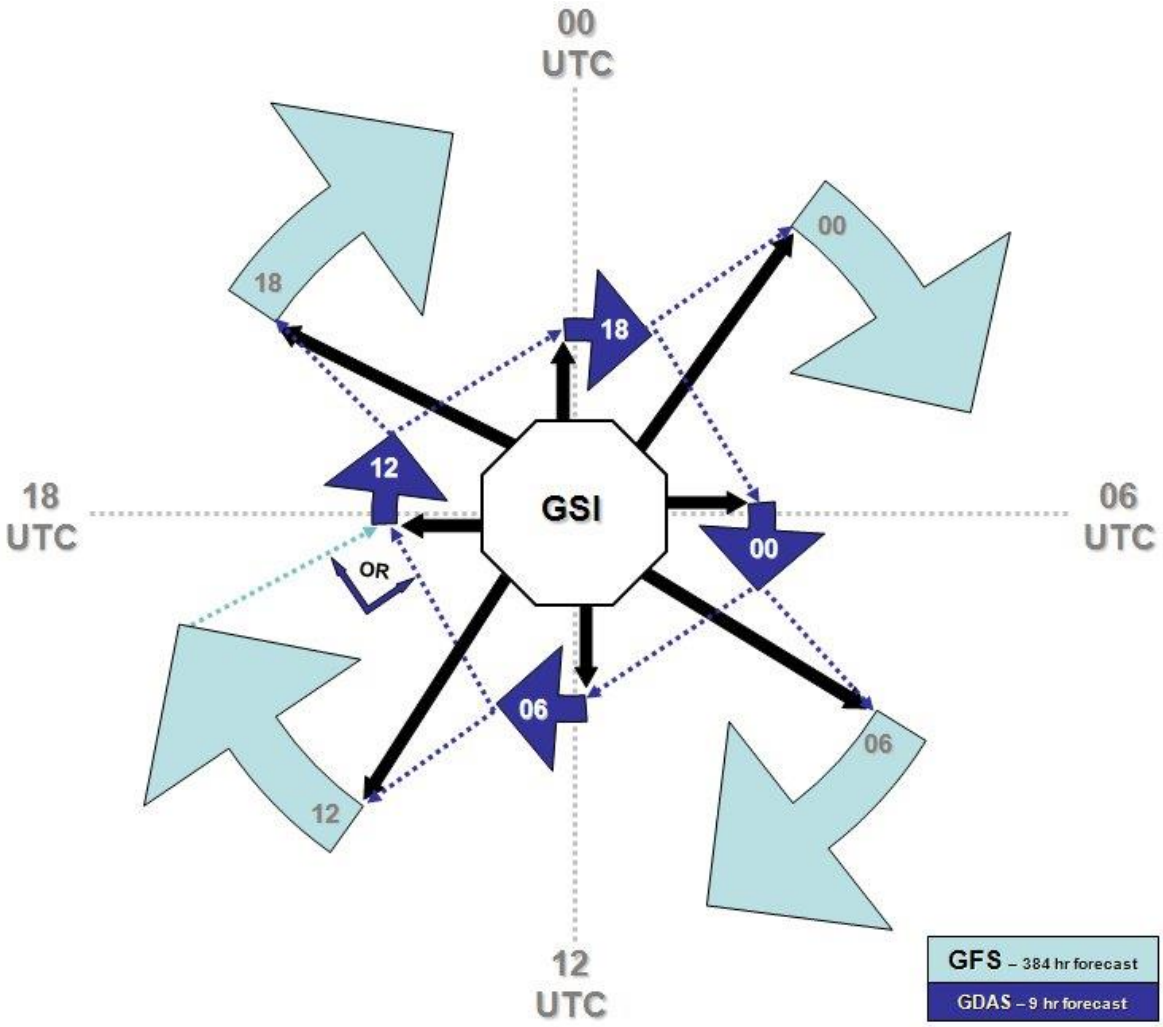
- This page is for users who can access the R&D machines (Zeus) or WCOSS (Gyre/Tide) NCEP machines.
- This page assumes you are new to using the GFS model and running GFS experiments. If you are familiar with the GFS Parallel System, or are even a veteran of it, feel free to jump ahead to specific sections.
- If at any time you are confused and can't find the information that you need please email for help.
    - Also, for Global Model Parallel support subscribe to the glopara support listserv: https://lstsrv.ncep.noaa.gov/mailman/listinfo/ncep.list.emc.glopara-support

2. Operational Overview

The Global Forecast System (GFS) is a three-dimensional hydrostatic global spectral model run operationally at NCEP. The **GFS** consists of two runs per six-hour cycle (00, 06, 12, and 18 UTC), the "early run" **gfs** and the "final run" **gdas**:

- **gfs/GFS** refers to the "early run". In real time, the early run, is initiated approximately 2 hours and 45 minutes after the cycle time. The early gfs run gets the full forecasts delivered in a reasonable amount of time.
- **gdas/GDAS** refers to the "final run", which is initiated approximately six hours after the cycle time.. The delayed gdas allows for the assimilation of later arriving data. The gdas run includes a short forecast (nine hours) to provide the first guess to both the gfs and gdas for the following cycle.

2.1 Timeline of GFS and GDAS



*Times are approximate

2.2 Operational run steps

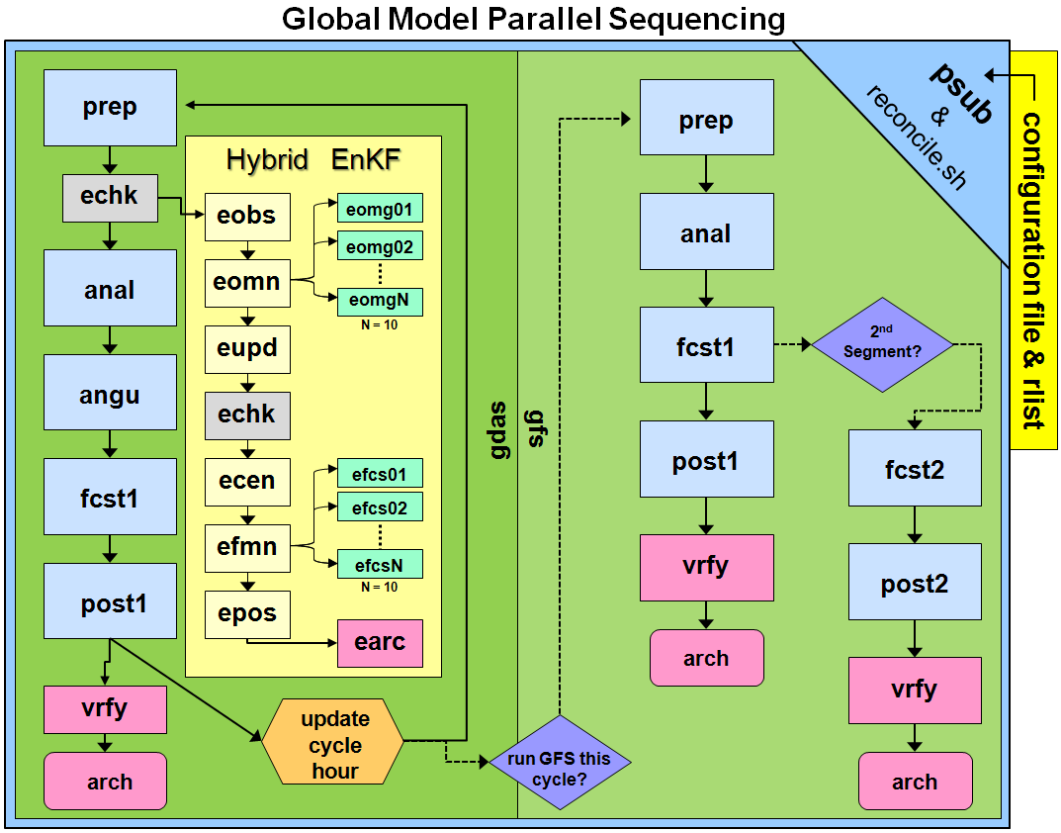
- **dump** - Gathers required (or useful) observed data and boundary condition fields (done during the operational GFS run); used in real-time runs, already completed for archived runs. Unless you are running your experiment in real-time, the dump steps have already been completed by the operational system (gdas and gfs) and the data is already waiting in a directory referred to as the dump archive.
- **storm relocation** - In the presense of tropical cyclones this step adjusts previous gdas forecasts if needed to serve as guess fields. For more info, see the relocation section of Dennis Keyser's Observational Data Dumping at NCEP document. The storm relocation step is included in the prep step (gfsprep/gdasprep) for experimental runs.
- **prep** - Prepares the data for use in the analysis (including quality control, bias corrections, and assignment of data errors) For more info, see Dennis Keyser's PREPBUFR PROCESSING AT NCEP document.
- **analysis** - Runs the data assimilation, currently Gridpoint Statistical Interpolation (GSI)
- **forecast** - From the resulting analysis field, runs the forecast model out to specified number of hours (9 for gdas, 384 for gfs)
- **post** - Converts resulting analysis and forecast fields to WMO grib for use by other models and external users.

Additional steps run in experimental mode are (pink boxes in flow diagram in next section):

- verification (gfsvrfy/gdasvrfy)
- archive (gfsarch/gdasarch) jobs

3. The Parallel Environment

GFS experiments employ the global model parallel sequencing (shown below). The system utilizes a collection of job scripts that perform the tasks for each step. A job script runs each step and initiates the next job in the sequence. Example: When the prep job finishes it submits the analysis job. When the analysis job finishes it submits the forecast job, etc.



Flow diagram of a typical experiment with Hybrid EnKF turned ON

As with the operational system, the **gdas** provides the guess fields for the **gfs**. The **gdas** runs for each cycle (00, 06, 12, and 18 UTC), however, to save time and space in experiments the **gfs** (right side of the diagram) is initially setup to run for only the 00 UTC cycle. (See the "run **GFS** this cycle?" portion of the diagram) The option to run the **GFS** for all four cycles is available (see gfs_cyc variable in configuration file).

As mentioned in section 2.2, an experimental run is different from operations in the following ways:

- Dump step is not run as it has already been completed during real-time production runs
- Addition steps in experimental mode:
  - verification (vrfy)
  - archive (arch)

4. Directories & Scripts

```
WCOSS: /global/save/emc.glopara/svn/gfs/trunk/para
Zeus: /scratch2/portfolios/NCEPDEV/global/save/glopara/svn/gfs/trunk/para
```

bin - These scripts control the flow of an experiment

pbeg Runs when parallel jobs begin.
pcne Counts non-existent files
pcon Searches standard input (typically rlist) for given pattern (left of equal sign) and returns assigned value (right of equal sign).
pcop Copies files from one directory to another.
pend Runs when parallel jobs end.
perr Runs when parallel jobs fail.
plog Logs parallel jobs.
pmkr Makes the rlist, the list of data flow for the experiment.
psub Submits parallel jobs (check here for variables that determine resource usage, wall clock limit, etc).

jobs - These scripts, combined with variable definitions set in configuration, are similar in function to the wrapper scripts in /nwprod/jobs, and call the main driver scripts. E-scripts are part of the Hybrid EnKF.

anal.sh Runs the analysis. Default ex-script does the following:
1) update surface guess file via global_cycle to create surface analysis;
2) runs the atmospheric analysis (global_gsi);
3) updates the angle dependent bias (satang file)

arch.sh Archives select files (online and hpss) and cleans up older data.

copy.sh Copies restart files. Used if restart files aren't in the run directory.

dcop.sh This script sometimes runs after dump.sh and retrieves data assimilation files.

dump.sh Retrieves dump files (not used in a typical parallel run).

earc.sh Archival script for Hybrid EnKF.
1) Write select EnKF output to HPSS,
2) Copy select files to online archive,
3) Clean up EnKF temporary run directories,
4) Remove "old" EnKF files from rotating directory.

ecen.sh Multiple functions:
1) Compute ensemble mean analysis from 80 analyses generated by eupd,
2) Perturb 80 ensemble analyses,
3) Compute ensemble mean for perturbed analyses,
4) Chgres T574L64 high resolution analysis (sanl/siganl) to ensemble resolution (T254L64),
5) Recenter perturbed ensemble analysis about high resolution analysis.

echk.sh Check script for Hybrid EnKF.
1) Checks on availability of ensemble guess files from previous cycle. (The high resolution (T574L64) GFS/GDAS hybrid analysis step needs the low resolution (T254L64) ensemble forecasts from the previous cycle);
2) Checks availability of the GDAS sanl (siganl) file (The low resolution (T254L64) ensemble analyses (output from eupd) are recentered about the high resolution (T574L64). This recentering can not be done until the high resolution GDAS analysis is complete.)

efcs.sh Run 9 hour forecast for each ensemble member. There are 80 ensemble members. Each efcs job sequentially processes 8 ensemble members, so there are 10 efcs jobs in total.

efmn.sh Driver (manager) for ensemble forecast jobs. Submits 10 efcs jobs and then monitors the progress by repeatedly checking status file. When all 10 efcs jobs are done (as indicated by status file) it submits epos.

eobs.sh Run GSI to select observations for all ensemble members to process. Data selection done using ensemble mean.

eomg.sh Compute innovations for ensemble members. Innovations computed by running GSI in observer mode. It is an 80 member ensemble so each eomg job sequentially processes 8 ensemble members.

eomn.sh Driver (manager) for ensemble innovations jobs. Submit 10 eomg jobs and then monitors the progress by repeatedly checking status file. When all 10 eomg jobs are done (as indicated by status file) it submits eupd.

epos.sh Compute ensemble mean surface and atmospheric mean ensemble files.

eupd.sh Perform EnKF update (i.e., generate ensemble member analyses).

fcst.sh Runs the forecast.

prep.sh Runs the data preprocessing prior to the analysis (storm relocation if needed and generation of prepbufr file).

post.sh Runs the post processor.

vrfy.sh Runs the verification step.

exp - This directory typically contains config files for various experiments and some rlists.

Filenames with "config" in the name are configuration files for various experiments. Files ending in "rlist" are used to define mandatory and optional input and output files and files to be archived. For the most up-to-date configuration file that matches production see section 5.2.

scripts - Development versions of the main driver scripts. The production versions of these scripts are in /nwprod/scripts.

ush - Additional scripts pertinent to the model typically called from within the main driver scripts, also includes:

reconcile.sh	This script sets required, but unset variables to default values.

5. Setting up an experiment

Steps:

1. Do you have restricted data access? If not go to: http://www.nco.ncep.noaa.gov/sib/restricted_data/restricted_data_sib/ and submit a registration form to be added to group rstprod.
2. Important terms
3. Set up experiment configuration file
4. Set up rlist
5. Submit first job

Additional information in this section:

1. Plotting model output
2. Experiment troubleshooting
3. Related utilities
4. Data file names (glopara vs production)
5. Global Model Variables
6. Finding GDAS/GFS production files

5.1 Important terms

- **configuration file** - List of variables to be used in experiment and their configuration/value. The user can change these variables for their experiment. Description of variables.
- **job** - A script, combined with variable definitions set in configuration, which is similar in function to the wrapper scripts in /nwprod/jobs, and which calls the main driver scripts. Each box in above diagram is a job.
- **reconcile.sh** - Similar to the configuration file, the reconcile.sh script sets required, but unset variables to default values.
- **rlist** - List of data to be used in experiment. Created in reconcile.sh (when the pmkr script is run) if it does not already exist at beginning of experiment. More information on setting up your own rlist see section 5.4.
- **rotating directory (COMROT or ROTDIR)** - Typically your "noscrub" directory is where the data and files from your experiment will be stored. Example on Zeus: /scratch2/portfolios/NCEPDEV/global/noscrub/$LOGNAME/pr$PSLOT

5.2 Configuration file

The following files have settings that will produce results that match production results. Copy this file, or any other configuration file you wish to start working with, to your own space and modify it as needed for your experiment.

MACHINE	LOCATION	FILE NAME	WHAT
WCOSS	/global/save/emc.glopara/svn/gfs/trunk/para/exp/	para_config_WCOSS	Operations (WCOSS go-live 7/25 and later)
Zeus	/scratch2/portfolios/NCEPDEV/global/save/ glopara/svn/gfs/trunk/para/exp	para_config_Zeus	Mimic WCOSS operations (go-live 7/25 and later)

Make sure to check the following user specific configuration file variables, found near the top of the configuration file:

```
ACCOUNT        LoadLeveler account, i.e., GFS-MTN (see more examples below
               for ACCOUNT, CUE2RUN, and GROUP)
ARCDIR         Online archive directory (i.e. ROTDIR/archive/prPSLOT)
ATARDIR        HPSS tape archive directory (see configuration file for
               example)
COMROT         See ROTDIR description
CUE2RUN        LoadLeveler (or Moab) class for parallel jobs (i.e., dev) (see
               more examples of CUE2RUN below)
EDATE          Analysis/forecast cycle ending date (YYYYMMDDCC, where CC is
               the cycle)
EDUMP          Cycle ending dump (gdas or gfs)
ESTEP          Cycle ending step (prep, anal, fcst1, post1, etc.)
EXPDIR         Experiment directory under save, where your configuration
               file, rlist, runlog, and other experiment scripts sit.
GROUP          LoadLeveler group (i.e., g01) (see more examples of GROUP
               below)
PSLOT          Experiment ID (change this to something unique for your
               experiment)
ROTDIR         Rotating/working directory for model data and i/o. Related to
               COMROT. (i.e. /global/noscrub/$LOGNAME/pr$PSLOT)
```

5.3 Reconcile.sh

Please make sure to take a look at the current reconcile script to assure that any changes you made in the configuration file are not overwritten. The reconcile script runs after reading in the configuration file settings and sets default values for many variables that may or may not be defined in the configuration file. If there are any default choices in reconcile that are not ideal for your experiment make sure to set those in your configuration file, perhaps even at the end of the file after reconcile has been run.

5.4 Rlist

You can start with an existing rlist and modify it by hand as needed or grab the sample that exists in the exp subdirectory:

```
WCOSS/Zeus: prsample1.gsi.rlist
SVN: https://svnemc.ncep.noaa.gov/projects/gfs/trunk/para/exp/prsample1.gsi.rlist
```

The sample rlist files already contain the append.rlist entries.

If the rlist file does not exist when a job is submitted, pmkr will generate one based on your experiment configuration. However, it is currently advised that you **do not** use pmkr to create an rlist, but rather, pick up the sample rlist.

If the variable $ARCHIVE is set to YES (the default is NO), this file is then appended automatically to the rlist by reconcile.sh, but only when the rlist is generated on the fly by pmkr. So, eg, if you submit the first job, which creates an rlist and then you realize that your ARCx entries are missing, creating the append_rlist after the fact won't help unless you remove the now existing rlist. If you delete the errant rlist (and set $ARCHIVE to YES, the next job you submit will see that the rlist does not exist, create it using pmkr, then append the $append_rlist file.

Also, along those lines, you may find that pmkr does not account for some new or development files. You can list those needed entries in the file pointed to by variable $ALIST. The difference between $ALIST and $append_rlist is that the latter only gets appended if variable $ARCHIVE is YES.

Got all that?? (Now you know why it is sometimes easier to start with an existing rlist).

Brief overview of an rlist format:

```
Sample entries:

# rotational input
*/*/anal/ROTI   =       biascr.$GDUMP.$GDATE
*/*/anal/ROTI   =       satang.$GDUMP.$GDATE
*/*/anal/ROTI   =       sfcf06.$GDUMP.$GDATE
*/*/anal/ROTI   =       siggm3.$CDUMP.$CDATE
*/*/anal/ROTI   =       sigges.$CDUMP.$CDATE
*/*/anal/ROTI   =       siggp3.$CDUMP.$CDATE
*/*/anal/ROTI   =       prepqc.$CDUMP.$CDATE
# optional input
*/*/anal/OPTI   =       sfcf03.$GDUMP.$GDATE
*/*/anal/OPTI   =       sfcf04.$GDUMP.$GDATE
*/*/anal/OPTI   =       sfcf05.$GDUMP.$GDATE
*/*/anal/OPTI   =       sfcf07.$GDUMP.$GDATE
*/*/anal/OPTI   =       sfcf08.$GDUMP.$GDATE

The left hand side is set of 4 patterns separated by slashes.

The first pattern represents the cycle (full date)
The second pattern represents the dump.
```

The third pattern represents the job.
The fourth pattern is a string that defines whether a file is optional/required input/output, eg:

DMPI - dump input from current cycle
DMPG - dump input from previous cycle
DMPH - dump input from two cycles prior
ROTI - required input from the rotating directory
OPTI - optional input from the rotating directory
ROTO - required output to the rotating directory (if the file is not available, a flag is set and the next job is not triggered)
OPTO - optional output to the rotating directory (save it if available, no worries if it's not)
ARCR - files to archive in online archive (should be required, but depends on setup of arch.sh)
ARCO - files to archive in online archive
ARCA - files saved to "ARCA" HPSS archive
ARCB - files saved to "ARCB" HPSS archive (check arch.sh job for other HPSS options... current version allows for ARCA thru ARCF)
COPI - required restart and files to initiate experiment with copy.sh job (fcst input)
DMRI - prerequisite dump file for submit (used in psub, but not used in job scripts to copy data!)

The right hand side typically represents a file.

An asterisk on either side is a wild card. Eg:
```
*/*/arch/ARCR        =       pgbf06.$CDUMP.$CDATE
```
The above entry in your rlist means that for any cycle, or any dump, the archive job will copy pgbf06.$CDUMP.$CDATE to the online archive.

If you change that to:
```
 */gfs/arch/ARCR        =       pgbf06.$CDUMP.$CDATE
```
only the the gfs pgbf06 files will be copied to the online archive.

If you changed it to:
```
*00/gfs/arch/ARCR        =       pgbf06.$CDUMP.$CDATE
```
only the 00Z gfs pgbf06 files will be copied to the online archive.

If you changed it to:
```
20080501*/gfs/arch/ARCR        =       pgbf06.$CDUMP.$CDATE
```
only the May 1, 2008 gfs pgbf06 files will be copied to the online archive. (Not a likely choice, but shown as an example)

Changing that first example to:
```
 */*/arch/ARCR        =       pgbf*.$CDUMP.$CDATE
```
tells the archive job to copy the the pgb file for any forecast hour (from the current $CDUMP and $CDATE) to the online archive.

A more complex set of wildcards can be useful for splitting up the HPSS archive to keep tar files manageable. Eg:

```
# all gdas sigma files go to ARCA HPSS archive
*/gdas/arch/ARCA =       sigf*.$CDUMP.$CDATE

# gfs sigf00 thru sigf129 go to ARCB HPSS archive
*/gfs/arch/ARCB =       sigf??.$CDUMP.$CDATE
*/gfs/arch/ARCB =       sigf1[0-2]?.$CDUMP.$CDATE
```

```
# gfs sigf130 thru sigf999 go to ARCC HPSS archive
*/gfs/arch/ARCC =       sigf1[3-9]?.$CDUMP.$CDATE
*/gfs/arch/ARCC =       sigf[2-9]??.$CDUMP.$CDATE
```

5.5 Initial Conditions / Required Forcing Files

The following files are needed to run the GFS/GDAS:

	PARALLEL	PRODUCTION
NON-CYCLING / FREE FORECAST	sfcanl.$CDUMP.$CDATE	gdas1.tCCz.sfcanl
	siganl.$CDUMP.$CDATE	gdas1.tCCz.sanl
CYCLING w/o HYBRID ENKF	biascr.$CDUMP.$CDATE	gdas1.tCCz.abias
	satang.$CDUMP.$CDATE	gdas1.tCCz.satang
	sfcanl.$CDUMP.$CDATE	gdas1.tCCz.sfcanl
	siganl.$CDUMP.$CDATE	gdas1.tCCz.sanl
CYCLING w/ HYBRID ENKF	biascr.$CDUMP.$CDATE	gdas1.tCCz.abias
	satang.$CDUMP.$CDATE	gdas1.tCCz.satang
	sfcanl.$CDUMP.$CDATE	gdas1.tCCz.sfcanl
	siganl.$CDUMP.$CDATE	gdas1.tCCz.sanl
	siganl_$CDATE_mem$MEM	siganl_$CDATE_mem$MEM
	sfcanl_$CDATE_mem$MEM	sfcanl_$CDATE_mem$MEM

Where CC is the cycle (00, 06, 12, or 18 Z) & $MEM is the member number (001-080)

So where do I find initial conditions (ICs)? See the next sections...

5.6 Finding GDAS and GFS production run files

Select files needed to run parallels are copied to the global dump archive:

```
Zeus: /scratch2/portfolios/NCEPDEV/global/noscrub/dump/YYYYMMDDCC
WCOSS: /global/noscrub/Kate.Howard/dump/YYYYMMDDCC
```

where:

```
YYYY  = 4-digit year of run date
MM  = 2-digit month of run date
DD  = 2-digit day of run date
CC = run cycle (00, 06, 12 18).
```

These files have a different naming convention from that of NCO. A mapping of those file names is available in the input & output files section.

If other files are needed, eg, for verification:

NCO maintains files for the last 10 days in WCOSS directories:

```
/com/gfs/prod/gdas.YYYYMMDD
/com/gfs/prod/gfs.YYYYMMDD
/com/gfs/prod/enkf.YYYYMMDD/CC
```

Locations of production files on HPSS (tape archive)

```
/NCEPPROD/hpssprod/runhistory/rhYYYY/YYYYMM/YYYYMMDD/
/NCEPPROD/2year/hpssprod/runhistory/rhYYYY/YYYYMM/YYYYMMDD/
/NCEPPROD/1year/hpssprod/runhistory/rhYYYY/YYYYMM/YYYYMMDD/
```

Examples:

```
/NCEPPROD/hpssprod/runhistory/rh2007/200707/20070715/
/NCEPPROD/2year/hpssprod/runhistory/rh2007/200707/20070715/
/NCEPPROD/1year/hpssprod/runhistory/rh2007/200707/20070715/
```

To see, eg, which files are stored in the 2-year archive of gfs model data:

```
d2n6 93 % /nwprod/util/ush/hpsstar dir /NCEPPROD/2year/hpssprod/runhistory/rh2007/200707/20070715 | grep
gfs_prod_gfs
[connecting to hpsscore.ncep.noaa.gov/1217]
-rw-r--r--   1 nwprod    prod      6263988224 Jul 16 22:31 com_gfs_prod_gfs.2007071500.sfluxgrb.tar
-rw-r--r--   1 nwprod    prod          160544 Jul 16 22:31 com_gfs_prod_gfs.2007071500.sfluxgrb.tar.idx
-rw-r--r--   1 nwprod    prod     14814876672 Jul 16 22:23 com_gfs_prod_gfs.2007071500.sigma.tar
-rw-r--r--   1 nwprod    prod           80672 Jul 16 22:23 com_gfs_prod_gfs.2007071500.sigma.tar.idx
-rw-r--r--   1 nwprod    prod      7124057600 Jul 16 22:27 com_gfs_prod_gfs.2007071500.surface.tar
-rw-r--r--   1 nwprod    prod           33568 Jul 16 22:27 com_gfs_prod_gfs.2007071500.surface.tar.idx
-rw-r--r--   1 nwprod    prod      6262680576 Jul 17 01:49 com_gfs_prod_gfs.2007071506.sfluxgrb.tar
-rw-r--r--   1 nwprod    prod          160544 Jul 17 01:49 com_gfs_prod_gfs.2007071506.sfluxgrb.tar.idx
-rw-r--r--   1 nwprod    prod     14814876672 Jul 17 01:37 com_gfs_prod_gfs.2007071506.sigma.tar
-rw-r--r--   1 nwprod    prod           80672 Jul 17 01:37 com_gfs_prod_gfs.2007071506.sigma.tar.idx
-rw-r--r--   1 nwprod    prod      5868585472 Jul 17 01:42 com_gfs_prod_gfs.2007071506.surface.tar
-rw-r--r--   1 nwprod    prod           26912 Jul 17 01:42 com_gfs_prod_gfs.2007071506.surface.tar.idx
-rw-r--r--   1 nwprod    prod      6257581056 Jul 17 04:58 com_gfs_prod_gfs.2007071512.sfluxgrb.tar
-rw-r--r--   1 nwprod    prod          160544 Jul 17 04:58 com_gfs_prod_gfs.2007071512.sfluxgrb.tar.idx
-rw-r--r--   1 nwprod    prod     14814876672 Jul 17 04:47 com_gfs_prod_gfs.2007071512.sigma.tar
-rw-r--r--   1 nwprod    prod           80672 Jul 17 04:47 com_gfs_prod_gfs.2007071512.sigma.tar.idx
-rw-r--r--   1 nwprod    prod      6744496128 Jul 17 04:52 com_gfs_prod_gfs.2007071512.surface.tar
-rw-r--r--   1 nwprod    prod           31520 Jul 17 04:52 com_gfs_prod_gfs.2007071512.surface.tar.idx
-rw-r--r--   1 nwprod    prod      6249061376 Jul 17 08:18 com_gfs_prod_gfs.2007071518.sfluxgrb.tar
-rw-r--r--   1 nwprod    prod          160544 Jul 17 08:18 com_gfs_prod_gfs.2007071518.sfluxgrb.tar.idx
-rw-r--r--   1 nwprod    prod     14814876672 Jul 17 08:08 com_gfs_prod_gfs.2007071518.sigma.tar
-rw-r--r--   1 nwprod    prod           80672 Jul 17 08:08 com_gfs_prod_gfs.2007071518.sigma.tar.idx
-rw-r--r--   1 nwprod    prod      5284646912 Jul 17 08:12 com_gfs_prod_gfs.2007071518.surface.tar
-rw-r--r--   1 nwprod    prod           24352 Jul 17 08:12 com_gfs_prod_gfs.2007071518.surface.tar.idx
```

5.7 Global Model Variables

To view the full list of global model variables see Appendix A.

5.8 Input/output files

Many of the parallel files are in GRIB or BUFR formats, the WMO standard for gridded and ungridded meteorological data, respectively. Other parallel files such as restart files are in flat binary format, and are not generally intended to be accessed by the general user.

Unfortunately but predictably, the global parallel follows a different file naming convention than the operational file naming convention. (The global parallel file naming convention started in 1990 and predates the operational file naming convention.)

The global parallel file naming convention is a file type followed by a period, the run (gdas or gfs), and the 10-digit current date $CDATE in YYYYMMDDHH form. (Eg, pgbf06.gfs.2008060400). Some names may have a suffix, for instance if the file is compressed.

For the sake of users that are accustomed to working with production files or those who want to do comparisons, the equivalent production file name info is included here. Production file naming convention is the run followed by a period, the cycle name, followed by a period, and the file type. (Eg, gfs.t00z.pgrbf06). In the table below, only the file type is listed for production names.

The files are divided into the categories restart files, observation files, and diagnostic files. Some files may appear in more than one category. Some verification files in the diagnostics table do not include a run qualifier.

Guide to variables in sections 5.8.1, 5.8.2, and 5.8.3:

Variable	Description	Values
$CDUMP	Dump type	gdas, gfs
$CDATE	Cycle date	YYYYMMDDCC
$FF	Forecast hour	00-384
$FE	Forecast hour (GDAS EnKF)	03, 06, 09
$MEM	Hybrid EnKF member number	001-080
$GRP	Hybrid EnKF member group number	01-10

5.8.1 Restart / Initial Condition (IC) Files

glopara filename	production base name (eg, gdas1.t00z.prepbufr)	file description	format
prepqc.$CDUMP.$CDATE	prepbufr	Conventional Observations with quality control	BUFR
biascr.$CDUMP.$CDATE	abias	Time dependent sat bias correction file	text
satang.$CDUMP.$CDATE	satang	Angle dependent sat bias correction	text
bfg_$CDATE_fhr$FE_ensmean	bfg_$CDATE_fhr$FE_ensmean	Mean of ensemble surface forecasts at fhr$FE	binary
bfg_$CDATE_fhr$FE_mem$MEM	bfg_$CDATE_fhr$FE_mem$MEM	Surface foreacast at fhr$FE for member $MEM starting from $CDATE ICs	binary
sfcanl.$CDUMP.$CDATE	sfcanl	surface analysis	binary
sfcanl_$CDATE_ensmean	sfcanl_$CDATE_ensmean	ean of ensemble surface ICs valid at $CDATE	binary
sfcanl_$CDATE_mem$MEM	sfcanl_$CDATE_mem$MEM	Surface ICs for member $MEM valid at $CDATE; input to ensemble forecasts	binary
siganl.$CDUMP.$CDATE	sanl	atmospheric analysis (aka sigma file)	binary
sanl_$CDATE_ensmean	sanl_$CDATE_ensmean	Mean of ensemble atmospheric analyses generated by EnKF update code valid at $CDATE	binary
sanl_$CDATE_mem$MEM	sanl_$CDATE_mem$MEM	Atmospheric analyses generated by EnKF update code for member $MEM valid at $CDATE	binary
sfcf$FF.$CDUMP.$CDATE	bf$FF	surface boundary condition at forecast hour $FF	binary
sfg_$CDATE_fhr$FE_ensmean	sfg_$CDATE_fhr$FE_ensmean	Mean of ensemble atmospheric forecasts at fhr$FE	binary
sfg_$CDATE_fhr$FE_mem$MEM	sfg_$CDATE_fhr$FE_mem$MEM	Atmospheric forecast at fhr$FE for	binary

		member $MEM starting from $CDATE ICs	
sfg_$CDATE_fhr$FEs_mem$MEM	sfg_$CDATE_fhr$FEs_mem$MEM	Spectrally smoothed atmospheric foreacast at fhr$FE for member $MEM starting from $CDATE ICs	binary
sig$FF.$CDUMP.$CDATE	sf$FF	atmospheric model data at forecast hour $FF	binary
siganl_$CDATE_mem$MEM	siganl_$CDATE_mem$MEM	Atmospheric ICs for member $MEM valid at $CDATE at END of ecen; input to ensemble forecasts	binary
pgbanl.$CDUMP.$CDATE	pgrbanl	pressure level data from analysis	GRIB
pgbf$FF.$CDUMP.$CDATE	pgrbf$FF	pressure level data from forecast hour	GRIB

5.8.2 Observation files

glopara filename	production base name (eg,gdas1.t00z.engicegrb)	file description	format
1bamua.$CDUMP.$CDATE	1bamua.tm00.bufr_d	AMSU-A NCEP-proc. br. temps	BUFR
1bamub.$CDUMP.$CDATE	1bamub.tm00.bufr_d	AMSU-B NCEP-processed brightness temp	BUFR
1bhrs2.$CDUMP.$CDATE	1bhrs2.tm00.bufr_d	HIRS-2 NCEP-processed brightness temps	BUFR
1bhrs3.$CDUMP.$CDATE	1bhrs3.tm00.bufr_d	HIRS-3 NCEP-processed brightness temps	BUFR
1bhrs4.$CDUMP.$CDATE	1bhrs4.tm00.bufr_d	HIRS-4 1b radiances	BUFR
1bmhs.$CDUMP.$CDATE	1bmhs.tm00.bufr_d	MHS NCEP-processed br. temp	BUFR
1bmsu.$CDUMP.$CDATE	1bmsu.tm00.bufr_d	MSU NCEP-processed brightness temps	BUFR
adpsfc.$CDUMP.$CDATE	adpsfc.tm00.bufr_d	Surface land	BUFR
adpupa.$CDUMP.$CDATE	adpupa.tm00.bufr_d	Upper-air	BUFR
aircar.$CDUMP.$CDATE	aircar.tm00.bufr_d	MDCRS ACARS Aircraft	BUFR
aircft.$CDUMP.$CDATE	aircft.tm00.bufr_d	Aircraft	BUFR
airs.$CDUMP.$CDATE	airs.tm00.bufr_d	AQUA AIRS/AMSU-A/HSB proc. btemps-center FOV	BUFR
airsev.$CDUMP.$CDATE	airsev.tm00.bufr_d	AQUA-AIRS AIRS/AMSU-A/HSB proc. btemps-every FOV	BUFR
airswm.$CDUMP.$CDATE	airswm.tm00.bufr_d	AQUA-AIRS AIRS/AMSU-A/HSB proc btemps-warmest FOV	BUFR
ascatw.$CDUMP.$CDATE	ascatw.tm00.bufr_d	METOP 50 KM ASCAT scatterometer data (reprocessed by wave_dcodquikscat	BUFR
avcsam.$CDUMP.$CDATE	avcsam.tm00.bufr_d	A.M.(N17,M2) AVHRR GAC NCEP-proc clr & sea btmps	BUFR
avcspm.$CDUMP.$CDATE	avcspm.tm00.bufr_d	P.M.(N18-19) AVHRR GAC NCEP-proc clr & sea btmps	BUFR
bathy.$CDUMP.$CDATE	bathy.tm00.bufr_d	Bathythermal	BUFR
erscat.$CDUMP.$CDATE	erscat.tm00.bufr_d	ERS	BUFR
esmhs.$CDUMP.$CDATE	esmhs.tm00.bufr_d	NOAA 18-19 MHS processed bright. temps from RARS	BUFR
geoimr.$CDUMP.$CDATE	geoimr.tm00.bufr_d	GOES 11x17 fov imager clear radiances	BUFR
goesfv.$CDUMP.$CDATE	goesfv.tm00.bufr_d	GOES 1x1 fov sounder radiances	BUFR
goesnd.$CDUMP.$CDATE	goesnd.tm00.bufr_d	GOES Satellite data	BUFR
gpsipw.$CDUMP.$CDATE	gpsipw.tm00.bufr_d	GPS - Integrated Precipitable Water	BUFR
gpsro.$CDUMP.$CDATE	gpsro.tm00.bufr_d	GPS radio occultation data	BUFR
icegrb.$CDUMP.$CDATE	engicegrb	Sea Ice Analysis	GRIB
mls.$CDUMP.$CDATE	mls.tm00.bufr_d	Aura Microwave Limb Sounder (MLS) ozone data	BUFR
mtiasi.$CDUMP.$CDATE	mtiasi.tm00.bufr_d	METOP-2 IASI 1C radiance data (variable channels)	BUFR
obsinput_$CDATE_ensmean	obsinput_$CDATE_ensmean	Tarball containing $CDATE data (observations) selected using ensemble means; generated by eobs	tarball
osbuv8.$CDUMP.$CDATE	osbuv8.tm00.bufr_d	SBUV layer ozone product (Version 8)	BUFR
osbuvb.$CDUMP.$CDATE	osbuv.tm00.bufr_d	SBUV layer ozone product (Version 6)	BUFR
proflr.$CDUMP.$CDATE	proflr.tm00.bufr_d	Wind Profiler	BUFR

qkswnd.$CDUMP.$CDATE	qkswnd.tm00.bufr_d	QuikScat	BUFR
rassda.$CDUMP.$CDATE	rassda.tm00.bufr_d	Radio Acoustic Sounding System Temp Profiles	BUFR
satwnd.$CDUMP.$CDATE	satwnd.tm00.bufr_d	Satellite-derived wind reports	BUFR
sfcbog.$CDUMP.$CDATE	sfcbog.tm00.bufr_d	Mean Sea-level Pressure bogus reports	BUFR
sfcshp.$CDUMP.$CDATE	sfcshp.tm00.bufr_d	Surface marine	BUFR
snogrb.$CDUMP.$CDATE	snogrb	Snow Analysis	GRIB
snogrb_t###.$CDUMP.$CDATE	snogrb_t###	Snow Analysis on spectral t### grid	GRIB
spssmi.$CDUMP.$CDATE	spssmi.tm00.bufr_d	SSM/I Retrievals	BUFR
sptrmm.$CDUMP.$CDATE	sptrmm.tm00.bufr_d	TRMM	BUFR
ssmit.$CDUMP.$CDATE	ssmit.tm00.bufr_d	SSM/I brightness temperatures	BUFR
sstgrb.$CDUMP.$CDATE	sstgrb	Sea Surface Temperature Analysis	GRIB
statup.$CDUMP.$CDATE	updated.status.tm00.bufr_	Summary	text
stat01.$CDUMP.$CDATE	status.tm00.bufr_d	Bufr status	text
stat02.$CDUMP.$CDATE	status.tm00.ieee_d	Satellite status	text
tcvitl.$CDUMP.$CDATE	syndata.tcvitals.tm00	Tropical Storm Vitals	text
tesac.$CDUMP.$CDATE	tesac.tm00.bufr_d	TESAC	BUFR
trkob.$CDUMP.$CDATE	trkob.tm00.bufr_d	TRACKOB	BUFR
vadwnd.$CDUMP.$CDATE	vadwnd.tm00.bufr_d	VAD (NEXRAD) wind	BUFR
wdsatr.$CDUMP.$CDATE	wdsatr.tm00.bufr_d	WindSat scatterometer data from NESDIS (reprocessed	BUFR
wndsat.$CDUMP.$CDATE	wndsat.tm00.bufr_d	WindSat scatterometer data from FNMOC	BUFR

For more information on dump data types (as seen in production) visit this site: http://www.nco.ncep.noaa.gov/pmb/nwprod/realtime/index.bufrdump.shtml

5.8.3 Diagnostic files

glopara filename	production base name (eg,gdas1.t00z.gsistat)	file description	format
gsistat.$CDUMP.$CDATE	gsistat	GSI (obs-ges), qc, and iteration statistics	text
gsistat_$CDATE_ensmean	gsistat_$CDATE_ensmean	gsistat file for $CDATE; based on data selection run (eobs) using ensemble mean background fields	text
gsistat_$CDATE_mem$MEM	gsistat_$CDATE_mem$MEM	gsistat file for member $MEM for $CDATE	text
radstat.$CDUMP.$CDAT	radstat	Radiance assimilation statistics	binary
radstat_$CDATE_ensmean	radstat_$CDATE_ensmean	Radiance diagnostic file with $CDATE observations; generated by eobs (data selection using ensemble mean)3	binary
radstat_$CDATE_mem$MEM	radstat_$CDATE_mem$MEM	Radiance diagnost file for member $MEM with $CDATE observations	binary
cnvstat.$CDUMP.$CDATE	cnvstat	Conventional observation assimilation statistics	binary
cnvstat_$CDATE_ensmean	cnvstat_$CDATE_ensmean	Conventional diagnostic file with $CDATE observations; generated by eobs (data selection using ensemble mean)	binary
cnvstat_$CDATE_mem$MEM	cnvstat_$CDATE_mem$MEM	Conventional diagnostic file for member $MEM with $CDATE observations	binary
enkfstat_$CDATE	enkfstat_$CDATE	EnKF update code stdout for $CDATE	text
ensstat_$CDATE_all	ensstat_$CDATE_all	Log file denoting completion of averaging of ensemble forecasts (epos step) for $CDATE	text
fcsstat_$CDATE_all	fcsstat_$CDATE_all	Log file for denoting completion of all $CDATE ensemble forecasts	text
fcsstat_$CDATE_grp$GRP	fcsstat_$CDATE_grp$GRP	Log file for completion of group $GRP ensemble forecasts for $CDATE	text
omgstat_$CDATE_all	omgstat_$CDATE_all	Log file denoting completion of all	text

		$CDATE ensemble innovation jobs	
omgstat_$CDATE_grp$GRP	omgstat_$CDATE_grp$GRP	Log file for completion of group $GRP ensemble innovation job for $CDAT	text
oznstat.$CDUMP.$CDATE	oznstat	Ozone observation assimilation statistics	binary
oznstat_$CDATE_ensmean	oznstat_$CDATE_ensmean	Ozone diagnostic file with $CDATE observations; generated by eobs (data selection using ensemble mean)	binary
oznstat_$CDATE_mem$MEM	oznstat_$CDATE_mem$MEM	Ozone diagnost file for member $MEM with $CDATE observations3	binary
pertdates_$CDATE	pertdates_$CDATE	Dates from from pertubation database used in $CDATE additive inflation step (ecen	text
pcpstat.$CDUMP.$CDATE	pscpstat	Precipitation assimilation statistics	binary
flxf$FF.$CDUMP.$CDATE	fluxgrbf$FF	Model fluxes at forecast hour $FF	GRIB
logf$FF.$CDUMP.$CDATE	logf$FF	Model logfile at forecast hour $F	text
tcinform_relocate.$CDUMP.$CDATE		Storm relocation information	text
tcvitals_relocate.$CDUMP.$CDATE		tropical cyclone vitals	text
prepqc.$CDUMP.$CDATE	prepbufr	Conventional Observations with QC	BUFR
prepqa.gdas.$CDATE		Observations with QC plus analysis	BUFR
prepqf.gdas.$CDATE		Observations with QC plus forecast	BUFR
adpsfc.anl.$CDATE		Surface observation and analysis fit file	GrADS
adpsfc.fcs.$CDATE		Surface observation and forecast fit file3	GrADS
adpupa.mand.anl.$CDAT		Rawinsonde observation and analysis fit file	GrADS
adpupa.mand.fcs.$CDATE		Rawinsonde observation and forecast fit file3	GrADS
sfcshp.anl.$CDATE		Ship observation and analysis fit file3	GrADS
sfcshp.fcs.$CDATE		Ship observation and forecast fit file	GrADS

5.9 Submitting & running your experiment

1. Create directory $EXPDIR (defined in configuration file)
2. Place a configuration file and rlist into $EXPDIR
3. Create directory $COMROT (defined in configuration file) (may be called ROTDIR)
4. Copy required initial condition / forcing files to $COMROT
5. Make the necessary edits to your configuration file to match the kind of experiment you wish to run. To learn more about what to change in the configuration file see section 5.2
6. Then, it's time to submit! On command line type:

$PSUB $CONFIG $CDATE $CDUMP $CSTEP

Where:

$PSUB = psub script with full location path, see configuration file for current psub script to use. (Either psub_zeus or psub_wcoss)
$CONFIG = name of configuration file (with full location path if not submitting from within your $EXPDIR)
$CDATE = YYYYMMDDCC, initial/starting year (YYYY), month (MM), day (DD), and cycle (CC) for model run
$CDUMP = dump (gdas or gfs) to start run
$CSTEP = initial model run step (see flow diagram above for options)

Example on Zeus:

/global/save/glopara/trunk/para/bin/psub_zeus para_config_zeus 2007080100 gdas fcst1

Notes:

- If you wish to cycle AND run the Hybrid EnKF then you need to submit both the fcst1 and efmn steps at the beginning.
- If you do not wish to cycle OR you do not wish to run the Hybrid EnKF then start with just the fcst1 step.
- If you have a submit script that you are comfortable with then please feel free to use that to submit your experiment instead of the psub command.

Additional information about running an experiment:

- Remember that since each job script starts the next job, you need to define ESTEP as the job that follows the step which you wish to end on. For example: You want to finish when the forecast has completed and the files are processed...your ESTEP could be "prep", which is the first step of the next cycle.
- The script "psub" kicks off the experiment and each parallel sequenced job.

A handy way to follow the status of your experiment is to do a tail of your runlog in your $EXPDIR directory:

`tail -f pr$PSLOT.runlog` (where $PSLOT is your experiment tag)

5.9.1 Plotting output

Everyone has a favorite plotting program but one great option is GrADS. To use GrADS you'll first need to create a control file from your GRIB output:

1. Create GrADS readable ctl file using grib2ctl script:

   Find copy here: /u/Wesley.Ebisuzaki/bin/grib2ctl.pl (WCOSS)

   To run:

   GRIB2CTL [options] INPUT > OUTPUT.ctl

   GRIB2CTL = full path of grib2ctl.pl or simply grib2ctl.pl if it's already in your environment
   INPUT = the full name and path of the GRIB file
   OUTPUT = the name of the ctl file you wish to create
   [options] = full list of options can be found if you type "grib2ctl.pl" and hit enter. If you are making a ctl file from a forecast file then it is suggested to use the -verf option.

2. Create index file using gribmap:

   gribmap -i OUTPUT.ctl

   You should now have .ctl and .idx files.

3. Open GrADS (**grads** or **gradsc**) and then open your ctl file (**open OUTPUT.ctl**)

   For information on using GrADS go here: http://www.iges.org/grads/gadoc/

5.9.2 Experiment troubleshooting

Machine issues? Contact appropriate helpdesk:

```
WCOSS - wcoss-helpdesk@noaa.gov
Zeus - rdhpcs.zeus.help@noaa.gov
```

As model implementations occur, ensure that you are using up-to-date versions of scripts/code and configuration file for your experiment. For instance, don't use the newest production executables with older job scripts. Changes may have been made to the production versions that will impact your experiment but may not be obvious.

For problems with your experiment please contact Kate Howard: kate.howard@noaa.gov

…or the Glopara Support Listserv:

ncep.list.emc.glopara-support@lstsrv.ncep.noaa.gov

Please make sure to provide the following information in the email:

- Machine you are working on (WCOSS or Zeus)
- COMROT or ROTDIR, working directory location
- Configuration file name and location
- Any other specific information pertaining to your problem, i.e., dayfile name and/or location.

To join the global model mailing lists:

Glopara support listserv -
https://lstsrv.ncep.noaa.gov/mailman/listinfo/ncep.list.emc.glopara-support

Global parallel announcements -
https://lstsrv.ncep.noaa.gov/mailman/listinfo/ncep.list.emc.glopara-announce

6. Parallels

View the Global Parallel Spreadsheet here:
https://docs.google.com/a/noaa.gov/spreadsheet/ccc?key=0AoyO6L08rs23dE9HdFhqa25YdUVyNUVZWTVrY01EeWc#gid=0%7C.

7. Subversion & Trac

GFS Trac page - https://svnemc.ncep.noaa.gov/trac/gfs

GFS svn project page - https://svnemc.ncep.noaa.gov/projects/gfs/
GSM Trac page - https://svnemc.ncep.noaa.gov/trac/gsm
GSM svn project page - https://svnemc.ncep.noaa.gov/projects/gsm/

8. Related utilities

Information on some useful related utilities:

```
copygb  copies all or part of one GRIB file to another GRIB file,
        interpolating if necessary

sfchdr  global_sfchdr prints information from the header of a surface file

sighdr  global_sighdr prints information from the header of a sigma file

ss2gg   ss2gg converts a sigma file to a grads binary file and creates a
        corresponding descriptor (ctl) file
```

8.1 copygb

The command copygb copies all or part of one GRIB file to another GRIB file, interpolating if necessary.

copygb can be found at: /nwprod/util/exec/copygb

Documentation is in: /nwprod/util/sorc/copygb.fd/copygb.doc

The NCEP grids for the -g option are listed in:
http://www.nco.ncep.noaa.gov/pmb/docs/on388/tableb.html

Documentation for the interpolation options are covered in: /nwprod/lib/sorc/ip/iplib.doc (though some parts may be outdated).

There's also web doc for each routine at:
http://www.nco.ncep.noaa.gov/pmb/docs/libs/iplib/ncep_iplib.shtml
...but the info needed for copygb is more readily available in the simple text file:
/nwprod/lib/sorc/ip/iplib.doc.

If you want to dig into any "w3" subroutines referenced, they generally have good docblocks in their source code. The directory is /nwprod/lib/sorc/w3 and a there's a web doc at http://www.nco.ncep.noaa.gov/pmb/docs/libs/w3lib/ncep_w3lib.shtml

8.2 sfchdr

global_sfchdr prints information from the header of a surface file

```
global_sfchdr can be found at:

    /nwprod/exec/global_sfchdr
```

```
Usage: global_sfchdr sfcfile <variable.list >value.list
    or  global_sfchdr sfcfile variable >value
    or  global_sfchdr sfcfile

Running sfchdr with no additional arguments (other than the input file) as in
the last example allows for keyboard input of multiple variables,
one at a time, until the program is interrupted (eg, via CTRL-c).

Enter "?" (without the quotes) as standard input and the possible input
values will be printed.

Description of those possible values follows:
     filetype  - description ("GFS/SFC")
     fhour             - forecast hour
     ifhr              - integral forecast hour as string
     idate             - initial date (YYYYMMDDHH)
     iyr               - initial year
     imo               - initial month
     idy               - initial day
     ihr               - initial hour
     vdate             - valid date (YYYYMMDDHH)
     vyr               - valid year
     vmo               - valid month
     vdy               - valid day
     vhr               - valid hour
     latb              - number of latitudes
     lonb              - number of longitudes
     ivs               - version number
     lsoil             - number of soil levels
     irealf    - floating point flag (=1 for 4-byte ieee, =2 for 8-byte ieee)
     lpl               - number of longitudes for each latitude
     zsoil     - soil depths (in meters)
```

8.3 sighdr

global_sighdr prints information from the header of a sigma file

```
global_sighdr can be found at:

       /nwprod/exec/global_sighdr

Usage: global_sighdr sigfile <variable.list >value.list
       or  global_sighdr sigfile variable >value

The following is from the docblock of /nwprod/sorc/global_sighdr.fd/sighdr.f

program sighdr
!$$$  main program documentation block
!
! Main program: sighdr              Print information from sigma header
!   Prgmmr: Iredell          Org: np23        Date: 1999-08-23
!
! Abstract: This program prints information from the sigma header.
!   The following parameters may be printed out:
!     filetype
```

```
!     fhour
!     ifhr
!     idate
!     iyr
!     imo
!     idy
!     ihr
!     vdate
!     vyr
!     vmo
!     vdy
!     vhr
!     si
!     sl
!     ak
!     bk
!     siglev
!     jcap
!     levs
!     itrun
!     iorder
!     irealf
!     igen
!     latf
!     lonf
!     latb
!     lonb
!     latr
!     lonr
!     ntrac
!     icen2
!     ienst
!     iensi
!     idpp
!     idsl
!     idvc
!     idvm
!     idvt
!     idrun
!     idusr
!     pdryini
!     ncldt
!     ixgr
!     nxgr
!     nxss
!     ivs
!     nvcoord
!     vcoord
!     cfvars
```

8.4 ss2gg

ss2gg converts a sigma file to a grads binary file and creates a corresponding descriptor (ctl) file

```
Original Author: Mark Iredell

Usage: ss2gg sigfile(s) gggfile ctlfile idrt imax jmax

where:

sigfile(s) = sigma file(s) to be converted to grads readable ieee files
```

```
gggfile = output file name

ctlfile = name of grads descriptor file (output)

idrt = output grid type
         0 = linear S->N
         4 = gaussian
       256 = linear N->S

imax = integer number of longitude points for output grid

jmax = integer number of latitude points for output grid

!                (IDRT=4 FOR GAUSSIAN GRID,
!                 IDRT=0 FOR EQUALLY-SPACED GRID INCLUDING POLES.
!     imax     - Integer even number of longitudes for output grid
!     jmax     - Integer number of latitudes for output grid
```

Appendix A – Global Model Variables

VARIABLE	GROUP	DESCRIPTION
ACCOUNT	GENERAL	LoadLeveler account, i.e. GFS-MTN
adiab	FCST	Debugging, true=run adiabatically
AERODIR	FCST	Directory, usually set to $FIX_RAD, see $FIX_RAD
AIRSBF	ANAL	Naming convention for AIRSBF data file
ALIST	GENERAL	Extra set of files to be added to rlist if ARCHIVE=YES; used only if rlist is being generated on the fly in this step; done in reconcile.sh
AM_EXEC	FCST	Atmospheric model executable
AM_FCS	FCST	See $FCSTEXECTMP
AMSREBF	ANAL	AMSR/E bufr radiance dataset
ANALSH	ANAL	Analysis job script, usually "anal.sh"
ANALYSISSH	ANAL	Analysis driver script
ANAVINFO	ANAL	Text files containing information about the state, control, and meteorological variables used in the GSI analysis
ANGUPDATESH	ANGU	Angle update script
ANGUPDATEXEC	ANGU	Angle update executable
ANISO_A_EN	ENKF	TRUE = use anisotropic localization of hybrid ensemble control variable a_en
anltype	ANAL	Analysis type (gfs or gdas) for verification (default=gfs)
Apercent	FCST	For idvc=3, 100: sigma-p, 0: pure-theta
append_rlist	GENERAL	Location of append_rlist (comment out if not using)
AQCX	PREP	Prep step executable
ARCA00GDAS	ARCH	Points to HPSS file name for ARCA files for 00Z cycle GDAS
ARCA00GFS	ARCH	Points to HPSS file name for ARCA files for 00Z cycle GFS
ARCA06GDAS	ARCH	Points to HPSS file name for ARCA files for 06Z cycle GDAS
ARCA06GFS	ARCH	Points to HPSS file name for ARCA files for 06Z cycle GFS
ARCA12GDAS	ARCH	Points to HPSS file name for ARCA files for 12Z cycle GDAS
ARCA12GFS	ARCH	Points to HPSS file name for ARCA files for 12Z cycle GFS
ARCA18GDAS	ARCH	Points to HPSS file name for ARCA files for 18Z cycle GDAS
ARCA18GFS	ARCH	Points to HPSS file name for ARCA files for 18Z cycle GFS
ARCB00GFS	ARCH	Points to HPSS file name for ARCB files for 00Z cycle GFS
ARCB06GFS	ARCH	Points to HPSS file name for ARCB files for 06Z cycle GFS
ARCB12GFS	ARCH	Points to HPSS file name for ARCB files for 12Z cycle GFS
ARCB18GFS	ARCH	Points to HPSS file name for ARCB files for 18Z cycle GFS
ARCC00GFS	ARCH	Points to HPSS file name for ARCC files for 00Z cycle GFS
ARCC06GFS	ARCH	Points to HPSS file name for ARCC files for 06Z cycle GFS
ARCC12GFS	ARCH	Points to HPSS file name for ARCC files for 12Z cycle GFS
ARCC18GFS	ARCH	Points to HPSS file name for ARCC files for 18Z cycle GFS
ARCDIR	ARCH	Location of online archive
ARCDIR1	ARCH	Online archive directory
ARCH_TO_HPSS	ARCH	Make hpss archive
ARCHCFSRRSH	ARCH	Script location
ARCHCOPY	ARCH	If yes then copy select files (ARCR and ARCO in rlist) to online archive
ARCHDAY	ARCH	Days to delay online archive step
ARCHIVE	ARCH	Make online archive
ARCHSCP	ARCH	If yes & user glopara, scp all files for this cycle to alternate machine
ARCHSCPTO	ARCH	Remote system to receive scp'd data (mist->dew, dew->mist)
ARCHSH	ARCH	Archive script
ASYM_GODAS	ANAL	For asymmetric godas (default=NO)
ATARDIR	ARCH	HPSS tape archive directory
ATARFILE	ARCH	HPSS tape archive tarball file name, $ATARDIR/\$ADAY.tar
AVG_FCST	FCST	Time average forecast output files
AVRG_ALL	AVRG	To submit averaging and archiving scripts; this should be set to 'YES' - valid for reanalysis
AVRGALLSH	AVRG	Script location
B1AMUA	ANAL	Location and naming convention of B1AMUA data file
B1HRS4	ANAL	Location and naming convention of B1HRS4 data file
B1MHS	ANAL	Location and naming convention of B1MHS data file
BERROR	ANAL	Location and naming convention of BERROR files
beta1_inv	ENKF	1/beta1 = the weight given to static background error covariance
BUFRLIST	PREP	BUFR data types to use
C_EXEC	FCST	Coupler executable
CAT_FLX_TO_PGB	POST	Cat flx file to pgb files (only works for ncep post and IDRT=0)

ccnorm	FCST	Assumes all cloud water is inside cloud (true), operation (false)
CCPOST	POST	To run concurrent post
ccwf	FCST	Cloud water function, ras, 1: high res, 2: T62
CDATE	GENERAL	Date of run cycle (YYYMMDDCC), where CC is the forecast cycle, e.g. 00, 06, 12, 18
CDATE_SKIP	ANAL	LDAS modified sfc files not used before this date; must be >24 hours from the start
CDFNL	VRFY	SCORES verification against selected dump, pgbanl.gdas or pgbanl.gfs
CDUMP	GENERAL	Dump name (gfs or gdas)
CDUMPFCST	PREP	Fits-to-obs against gdas or gfs prep
CDUMPPREP	PREP	Prep dump to be used in prepqfit
CFSRDMP	DUMP	Location of CFS/climate dump archive
CFSRR_ARCH	ARCH	Script location
CFSRRPLOTSH	AVRG	Script location
CFSV2	FCST	CFS switch, YES=run CFS version 2
ch1	FCST	Hours in gdas fcst1 & post1 job wall-clock-limit [hours:minutes:seconds] (see reconcile script)
ch1	POST	See ch1 (FCST)
ch2	FCST	Same as ch1 but for segment 2
ch2	POST	See ch2 (FCST)
cha	ANAL	Analysis wall time; hours in job wall-clock-limit [hours:minutes:seconds] (see reconcile script)
CHG_LDAS	ANAL	To bring in new vegtyp table to LDAS
CHGRESEXEC	GENERAL	Chgres executable location
CHGRESSH	GENERAL	Chgres script location
CHGRESTHREAD	GENERAL	Number of threads for chgres (change resolution)
CHGRESVARS	GENERAL	Chgres variables
CLDASSH	ANAL	CLDAS script
climate	FCST	CFS variable, grib issue
CLIMO_FIELDS_OPT	FCST	Interpolate veg type, soil type, and slope type from inputgrid, all others from sfcsub.f, 3: to coldstart higher resolution run
cm1	FCST	Minutes in gdas fcst1 & post1 job wall-clock-limit [hours:minutes:seconds] (see reconcile script)
cm1	POST	See cm1 (FCST)
cm2	FCST	Same as cm1 but for segment 2
cm2	POST	See cm2 (FCST)
cma	ANAL	Analysis wall time; minutes in job wall-clock-limit [hours:minutes:seconds] (see reconcile script)
cmapdl	GENERAL	Cmap dump location in $COMDMP
cmbDysPrf4	ANAL	GODAS executable
cmbDysPrfs4	ANAL	GODAS executable
CO2_seasonal_cycle	FCST	CO2 seasonal cycle; global_co2monthlycyc1976_YYYY.txt
CO2DIR	FCST	Directory with CO2 files
COMCOP	GENERAL	Location where copy.sh looks for production (or alternate) files
COMDAY	GENERAL	Directory to store experiment "dayfile" output (dayfile contains stdout & stderr), see $COMROT
COMDIR	GENERAL	See $TOPDIR
COMDMP	GENERAL	Location of key production (or alternate) files (observation data files, surface boundary files)
COMDMPTMP	GENERAL	Temporary version of $COMDMP
COMROT	GENERAL	Experiment rotating/working directory, for large data and output files
COMROTTMP	GENERAL	If set, replaces config value of $COMROT (protects COMROT, or to define COMROT with variables evaluated at runtime)
CONFIG	GENERAL	Configuration file name
cont_eq_opt1	FCST	TRUE = when the advected and nonlinear fields of the mass-continuity equation are separated into two parts so that a different interpolation can be used for each part - following the EC approach. Only use with herm_x = herm_y = herm_z = lin_xy = false and lin_xyz = true. Additionally, opt1_3d_cubic = true, if quasi-tricubic interpolation is used for nonlinear terms
CONVINFO	ANAL	Location of convinfo.txt file, conventional data
COPYGB	GENERAL	Location of copygb utility
COUP_FCST	FCST	NO: AM model only, YES: coupled A-O forecast (default=NO)
COUP_GDAS	FCST	YES: run coupled GDAS
COUP_GFS	FCST	YES: run coupled GFS forecast
CQCX	PREP	Prep executable
crtrh	FCST	For Zhao microphysics, if zhao_mic is .false., then for Ferrier-Moorthi microphysics
cs1	FCST	Seconds in gdas fcst1 & post1 job wall-clock-limit [hours:minutes:seconds] (see reconcile script)
cs1	POST	See cs1 (FCST)
cs2	FCST	Same as cs1 but for segment 2
cs2	POST	See cs2 (FCST)
csa	ANAL	Analysis wall time; seconds in job wall-clock-limit [hours:minutes:seconds] (see reconcile script)
CSTEP	GENERAL	Step name (e.g. prep, anal, fcst2, post1, etc.)
ctei_rm	FCST	Cloud top entrainment instability criterion, mstrat=true

CTL_ANL	POST	Parameter file for grib output
CTL_FCS	POST	Parameter file for grib output
CTL_FCS_D3D	POST	Parameter file for grib output
CUE2RUN	COMP	User queue variable; LoadLeveler class for parallel jobs (i.e. dev)
CUE2RUN1	COMP	Similar to $CUE2RUN but alternate queue
CUE2RUN3	COMP	Similar to $CUE2RUN but alternate queue
cWGsh	ANAL	GODAS script
CYCLESH	GENERAL	Script location
CYCLEXEC	GENERAL	Executable location
CYINC	GENERAL	Variable used to decrement GDATE {06}
DATATMP	GENERAL	Working directory for current job
DAYDIR	GENERAL	See $COMROT
DELTIM	FCST	Time step (seconds) for segment 1
DELTIM2	FCST	Time step (seconds) for segment 2
DELTIM3	FCST	Time step (seconds) for segment 3
DELTIM_EFCS	ENKF	Time step for ensemble forecast
diagtable	PREP	Ocean and ice diagnostic file
diagtable_1dy	PREP	Oceanand ice diagnostic file
diagtable_1hr	PREP	Ocean and ice diagnostic file
diagtable_3hr	PREP	Ocean and ice diagnostic file
diagtable_6hr	PREP	Ocean and ice diagnostic file
diagtable_hrs	PREP	Ocean and ice diagnostic file
diagtable_long	PREP	Ocean and ice diagnostic file
dlqf	FCST	Fraction of cloud water removed as parcel ascends
DMPDIR	DUMP	Dump directory location
DMPEXP	DUMP	Dump directory location, gdasy/gfsy
DMPOPR	DUMP	Dump directory location
DO_RELOCATE	PREP	Switch; to perform relocation or not
DO2ANL	ANAL	Do second analysis run, depends on value of CDFNL
DODUMP	DUMP	For running in real-time, whether or not to run the dump step
DOENKF	ENKF	YES = turns on EnKF script processing
DOHYBVAR	ENKF	YES = tells analysis step to use ensemble background error products from previous cycle
DSDUMP	DUMP	CFS dump directory
dt_aocpl	FCST	Coupler timestep
dt_cpld	FCST	Coupled timestep
dt_ocean	FCST	Ocean timestep
dt_rstrt	FCST	OM restart writing interval/timestep (small)
dt_rstrt_long	FCST	OM restart writing interval/timestep (long)
Dumpsh	DUMP	Dump script location and name
EDATE	GENERAL	Analysis/forecast cycle end date - must be >CDATE; analysis/forecast cycle ending date (YYYYMMDDCC, where CC is the cycle)
EDUMP	GENERAL	Cycle ending dump (gdas or gfs)
EMISDIR	FCST	Directory, usually set to $FIX_RAD, see $FIX_RAD
ENS_NUM_ANAL	ENKF	Number of ensemble members
ENS_NUM_ENKF	ENKF	Number of ensemble members
ENTHALPY	FCST	Control the chgres and nceppost (default=NO)
ESTEP	GENERAL	Cycle ending step; stop experiment when this step is reached for $EDATE; this step is not run
EXEC_AMD	FCST	Atmospheric model directory
EXEC_CD	FCST	Coupler directory
EXEC_OMD	FCST	Ocean model directory
EXECcfs	FCST	CFS executable directory location
EXECDIR	GENERAL	Executable directory (typically underneath HOMEDIR)
execdir_godasprep	PREP	GODAS prep executable directory, see $EXECDIR
EXECICE	FCST	Sea ice executable directory, see $EXECDIR
EXPDIR	GENERAL	Experiment directory under /save, where your configuration file, rlist, runlog, and other experiment scripts reside
FAISS	FCST	Scale in days to relax to sea ice to climatology
fbak2	FCST	Back up time for 2nd segment
fbak3	FCST	Back up time for 3rd segment
FCSTEXECDIR	FCST	Location of forecast executable directory (usually set to $EXECDIR)
FCSTEXECTMP	FCST	Location and name of forecast executable
FCSTSH	FCST	Forecast script name and location
FCSTVARS	FCST	Group of select forecast variables and their values
fcyc	FCST	Surface cycle calling interval

fdfi_1	FCST	Digital filter time for AM 1st segment (default=3)
fdfi_2	FCST	Run digital filter for 2nd segment (default=0)
fdump	VRFY	Verifying forecasts from gfs: GFS analysis or gdas: GDAS analysis
FH_END_POST	POST	Implying use FHMAX (defaul=99999)
FH_STRT_POST	POST	Implying to use FHINI or from file $COMROT/FHREST.$CDUMP.$CDATE.$nknd (default=99999)
FHCYC	FCST	Cycling frequency in hours
FHDFI	FCST	Initialization window in hours (if =0, no digital filter; if =3, window is +/- 3hrs)
FHGOC3D	FCST	Hour up to which data is needed to force offline GOCART to write out data
FHINI	FCST	Initial forecast hour
FHLWR	FCST	LW radiation calling interval (hrs); longwave frequency in hours
FHMAX	FCST	Maximum forecast hour
FHMAX_HF	FCST	High-frequency output maximum hours; for hurricane track, gfs fcst only for 126-hr is needed
FHOUT	FCST	Output frequency in hours
FHOUT_HF	FCST	High frequency output interval in hours; for hurricane track, gfs fcst only for 126-hr is needed
FHRES	FCST	Restart frequency in hours
FHROT	FCST	Forecast hour to Read One Time level
FHSTRT	FCST	To restart a forecast from a selected hour, default=9999999
FHSWR	FCST	SW radiation calling interval (hrs); frequency of solar radiation and convective cloud (hours)
FHZER	FCST	Zeroing frequency in hours
FIT_DIR	VRFY	Directory for SAVEFITS output
FIX_LIS	PREP	Location of land model fix files
FIX_OCN	PREP	Location of ocean model fix files
FIX_OM	PREP	See $FIX_OCN
FIX_RAD	PREP	Fix directory, usually set to $FIXGLOBAL
FIXDIR	PREP	Fix file directory
FIXGLOBAL	PREP	Atmospheric model fix file directory
flgmin	FCST	Minimum large ice fraction
fmax1	FCST	Maximum forecast hour in 1st segment (default=192 hrs)
fmax2	FCST	Maximum forecast hour in 2nd segment (default=384 hrs)
fmax3	FCST	Maximum forecast hour in 3rd segment (default=540 hrs)
FNAISC	FCST	CFS monthly ice data file
FNMASK	FCST	Global slmask data file, also see $SLMASK
FNOROG	FCST	Global orography data file
FNTSFC	FCST	CFS oi2sst data file
FNVEGC	FCST	CFS vegfrac data file
FNVETC	FCST	Global vegetable type grib file
FORECASTSH	FCST	Forecast script name and location
fout_a	FCST	GDAS forecast output frequency (default=3); used when gdas_fh is not defined (i.e. no long gdas fcst)
fout1	FCST	GFS sig, sfc, flx output frequency for 1st segment (default=3 hr)
fout2	FCST	GFS sig, sfc, flx output frequency for 2nd segment (default=3 hr)
fout3	FCST	GFS sig, sfc, flx output frequency for 3rd segment (default=3 hr)
foutpgb1	POST	NCEPPOST pgb frequency for 1st segment (default=fout1)
foutpgb2	POST	NCEPPOST pgb frequency for 2nd segment (default=fout1)
foutpgb3	POST	NCEPPOST pgb frequency for 3rd segment (default=fout1)
fres1	FCST	Interval for restart write, 1st segment (default=24 hr)
fres2	FCST	Interval for restart write, 2nd segment (default=24 hr)
fres3	FCST	Interval to write restart for 3rd segment (default=fres2)
fseg	FCST	Number of AM forecast segments; maximum=3 (default=1)
FSNOL	FCST	Scale in days to relax to snow to climatology
FTSFS	FCST	Scale in days to relax to SST anomaly to zero
fzer1	FCST	GFS output zeroing interval for 1st segment (default=6 hr)
fzer2	FCST	GFS output zeroing interval for 2nd segment (default=6 hr)
fzer3	FCST	GFS output zeroing interval for 3rd segment (default=6 hr)
G3DPSH	ANAL	G3DP script name and location
gdas_cyc	FCST	Number of GDAS cycles
gdas_fh	FCST	Default=999, i.e. no long fcst in GDAS step when <999, that would be the interval at which seasonal or longer from gdas initial conditions are made; for example, if gdas_fh=6 runs are made
GDAS_GP	POST	YES: use old post (global_postgp.sh), NO: nceppost
GDUMP	GENERAL	Dump to use for guess files (defaults to $CDFNL, which defaults to "gdas")
generate_ens	ENKF	TRUE = generate internal ensemble based on existing background error
GENPSICHI	POST	Generate psi (streamfunction) and chi (velocity potential)
GENPSICHIEXE	POST	Executable for GENPSICHI

gfs_cyc	FCST	GFS cycles (00, 06, 12, and 18Z) (default=1 - (00Z) cycle)
GFSDUMP	DUMP	GFS dump subdirectory name and location, usually "$DMPDIR/dump"
gg_tracers	FCST	Semilag option
GLDASCYCHR	FCST	GLDAS cycling frequency
GODAS_DATA_DELAY	ANAL	Delay for ocean data in days
GODAS_WNDO	ANAL	Data window for asymmetric godas
GODASEXEC	ANAL	GODAS executable
GODASSH	ANAL	GODAS script
GRID_IDD	FCST	3D output options
GRID11FCST00gdas	FCST	Grib identifier for 00z GDAS forecast output
GRID11FCST06gdas	FCST	Grib identifier for 06z GDAS forecast output
GRID11FCST12gdas	FCST	Grib identifier for 12z GDAS forecast output
GRID11FCST18gdas	FCST	Grib identifier for 18z GDAS forecast output
grid25_1	POST	Define this to interpolate pgb file to 2.5 x 2.5
grid25_2	POST	Same as grid25_1 but for segment 2 of post
grid62_1	POST	Define this to interpolate fix file to T62 grid
GROUP	GENERAL	LoadLeveler group (i.e. g01)
group_name	GENERAL	Similar to $GROUP
GSIDIR	ANAL	GSI HOMEDIR, usually equals $HOMEDIR
GSIEXEC	ANAL	GSI executable name and location
GSIFIXDIR	ANAL	Location of GSI fix files
HOMEcfs	FCST	CFS HOMEDIR, usually equals $HOMEDIR
HOMEDIR	GENERAL	Home directory for parallel scripts
HORZ_DIR	VRFY	Directory for SAVEFITS output
HPSSTAR	ARCH	Location of hpsstar utility (creates, retrieves, and manages tarfiles on HPSS)
HRKDAY	GENERAL	Hours to keep dayfiles in COMROT
HRKOCN_ANL	GENERAL	Hours to keep ocean analysis file
HRKOCN_GRB	GENERAL	Hours to keep ocean grib output file
HRKRES	GENERAL	Hours to keep restart files
HRKROT	GENERAL	Hours to keep rotating archive
HRKSIG	GENERAL	Hours to keep sigma and sfc fcst files in directory $COMROT
HRKSIGG	GENERAL	Hours to keep sigma files from analysis in directory COMROT
HRKTMP	GENERAL	Hours to keep tmpdir
HRKVFY	GENERAL	Hours to keep verification files in directory COMROT
HYBRID	FCST	Switch to run hybrid
HYBRID_ENSEMBLE	ENKF	GSI namelist for hybrid ensemble variables
IAER	FCST	111: with stratospheric aerosol, tropospheric aerosol LW, tropospheric aerosol SW
ialb	FCST	For original albedo, 0: climatology SW albedo based on surface vegetation types, 1: MODIS based land surface albedo
ICO2	FCST	0: fixed CO2 constant, 1: time varying global mean CO2, 2: changing CO2
ictm	FCST	CO2 option for radiation, YYYY#
IDRT_NP	POST	Master pgb from global_nceppost.sh, 4: gaussian, 0: linear
IDSL	FCST	Integer new type of sigma structure, 1: Phillips approach, 2: Henry, plain average
idvc_a	FCST	AM vertical coordinate for analysis, 2: sigma-p (Sela), 3: generalized (Juang)
idvc_f	FCST	For hybrid model forecast (2: Joe Sela, 3: Henry Juang)
IDVM	FCST	Integer new vertical mass variable ID
idvt	FCST	Integer new tracer variable ID; first number: # of cloud species, second number: location of ozone in tracer
IEMS	FCST	0: blackbody ground emission, 1: climatology on one-deg map
IGEN	FCST	Integer output generating code (See ON388 Table A), grib output identifier, GFS=82, CFS=197
IGEN_ANL	FCST	Same as IGEN but for analysis
IGEN_FCST	FCST	Same as IGEN but for forecast
IGEN_OCNP	FCST	Same as IGEN but for ocean analysis
inch_1	FCST	Interval of coupled run (default=360)
inch_2	FCST	Coupled model interval of increment hour look (segment 2)
io_1	FCST	Forecast pgb output lon resolution, 1st segment
io_2	FCST	Forecast pgb output lon resolution, 2nd segment
io_3	FCST	Forecast pgb output lon resolution, 3rd segment
io_a	ANAL	Analysis pgb output lon and lat resolution
io_save	ARCH	Longitude dimension for online archive pgb files (defaults to 144... only applies if lower res than posted pgb files)
IOVR_LW	FCST	0: random cloud overlap for LW, 1: maximum/random cloud overlap for LW
IOVR_SW	FCST	0: random cloud overlap for SW, 1: maximum/random cloud overlap for SW
ISOL	FCST	0: fixed solar constant, 1: changing solar constant

ISUBC_LW	FCST	0: standard LW clouds (no MCICA), 1: prescribed MCICA seeds, 2: random MCICA seeds
ISUBC_SW	FCST	0: standard SW clouds (no MCICA), 1: prescribed MCICA seeds, 2: random MCICA seeds
iter_one_no_interp	FCST	TRUE = omits the trilinear interpolation for the first iteration of the departure-point calculations
IVS	FCST	Sigma file format (options 198410, 200509 defined in /nwprod/sorc/global_fcst.fd/sigio_module.f)
ivssfc	FCST	Surface file version
ivssig	FCST	Sigma file version
JCAP	FCST	Wave number (0-192 hr), atmospheric model resolution (spectral truncation), eg. JCAP=382
JCAP_A	FCST	See $JCAP
JCAP_TMP	FCST	See $JCAP
JCAP_ENKF	ENKF	Spectral resolution for Hybrid EnKF; similar to JCAP
JCAP_ENS	ENKF	$JCAP_ENKF; Project T254 ensemble into linear grid (512x256)
JCAP2	FCST	Wave number (192-384 hr) for 2nd segment, see $JCAP
JCAP3	FCST	Wave number (384-540 hr) for 3rd segment, see $JCAP
jo_1	FCST	Forecast pgb output lat resolution, 1st segment
jo_2	FCST	Forecast pgb output lat resolution, 2nd segment
jo_3	FCST	Forecast pgb output lat resolution, 3rd segment
jo_a	FCST	Analysis pgb output lon and lat resolution
jo_save	FCST	Lat dimension for online archive pgb files (defaults to 72... only applies if lower res than posted pgb files
JOBSDIR	GENERAL	Job script directory (typically underneath HOMEDIR)
JUST_AVG	AVRG	Default=NO
JUST_POST	POST	Terminate jobs after finishing post
JUST_TSER	POST	Extract just time-series by running post
km_mom4	POST	Number of MOM4 levels
ko_1	FCST	Forecast pgb output lev resolution, 1st segment
ko_2	FCST	Forecast pgb output lev resolution, 2nd segment
ko_3	FCST	Forecast pgb output lev resolution, 3rd segment
ko_a	ANAL	Analysis pgb output lev resolution
kto_1	FCST	Forecast IPV (isentropic potential vorticity) output resolution, if kto is set to 0, then no IPV output
kto_2	FCST	Vertical levels for segment 2, post step
kto_3	FCST	Same as kto_2 but for segment 3
l_hyb_ens	ENKF	TRUE = turn on hybrid ensemble option
LANLSH	ANAL	Land analysis script name and location
LATA	ANAL	Grid used by hurricane relocation, analysis grid lat dimension (typically linear gaussian grid)
LATA_ENKF	ENKF	ensemble analysis grid lat dimension (typically linear gaussian grid)
LATB	FCST	Model grid lat dimension (aka quadratic grid)
LATB_D3D	FCST	3D diagnostic output grid parameter
LATB_ENKF	ENKF	ensemble forecast grid lat dimension (aka quadratic grid)
LATB2	FCST	Same as $LATB but for segment 2
LATB3	FCST	Same as $LATB but for segment 3
LATCH	FCST	Integer number of latitudes to process at one time in global_chgres; defaults to 8 in the code; defaults to 48 in branch parallel scripts; set to 8 in configuration file if you must match production when moving from the 1st to 2nd fcst segment; otherwise, go with the branch parallel script default of 48 to save resources (check current version of global_chgres.fd/chgres.f to confirm the code default; check fcst.sh and reconcile for script default)
ld3d_1	FCST	Write out 3D diagnostics, .false.: no 3D diagnostics
ld3d_2	FCST	3D diagnostic for segment 2
ld3d_3	FCST	3D diagnostic for segment 3
ldas_cyc	ANAL	0: no ldas cycles (default=0)
LDIAG3D	FCST	Switch for 3D diagnostics (default=false)
LEVS	FCST	Number of atmospheric model vertical levels
LEVS_ENKF	ENKF	Number of levels in Hybrid EnKF forecasts; similar to LEVS
lg3d_1	FCST	GOCART option segment 1 (default=false)
lg3d_2	FCST	GOCART option segment 2 (default=false)
lin_xy	FCST	TRUE = when the advected and nonlinear fields of the mass-continuity equation are separated into two parts so that a different interpolation can be used for each part. Only use with herm_x = herm_y = herm_z = cont_eq_opt1= false, and lin_xyz = true.
lingg_a	FCST	Semilag option
lingg_b	FCST	Semilag option
LINKFILESH	GENERAL	Link file script
liope	FCST	Atmospheric variable for io pes (default=.true.)
LISEXEC	ANAL	GLDAS (aka LIS) executable
LISSH	ANAL	GLDAS (aka LIS) script
LONA	FCST	Grid used by hurricane relocation, analysis grid lon dimension (typically linear gaussian grid)
LONA_ENKF	ENKF	ensemble analysis grid lon dimension (typically linear gaussian grid)

LONB	FCST	Model grid lon dimension (aka quadratic grid)
LONB_D3D	FCST	3D diagnostic output grid parameter
LONB_ENKF	ENKF	ensemble forecast grid lon dimension (aka quadratic grid)
LONB2	FCST	Same as $LONB but for segment 2
LONB3	FCST	Same as $LONB but for segment 3
LONSPERLAT	FCST	Forecast step, global_lonsperlat text file
lsm	FCST	Land surface model, 1: NOAH land model, 0: OSU land model
LSOIL	FCST	Number of soil layers
MAKEPREPBUFRSH	PREP	Makeprepbufr script, created prepbufr
mdlist	VRFY	Exps (up to 10) to compare in maps
MEANDIR	AVRG	Directory for monthly means
MFCST00GFS	GENERAL	Starting number for dayfile iterations
mkEvNc4r	ANAL	GODAS executable
MODIS_ALB	FCST	To use MODIS based albedo product
MON_AVG	AVRG	CFS option, monthly averages for long integrations, starts 00z first day of month
MP_PULSE	COMP	IBM computing resource variable
mppnccombine	FCST	Location and name of cfs_mppnccombine executable
mstrat	FCST	Switch to turn on/off Moorthi stratus scheme
MTNDIR	FCST	See $FIXGLOBAL
MTNVAR	FCST	The global_mtnvar fortran code
NARRSNO	ANAL	How snow assimilation is performed, North American Reanalysis
NCEPPOST	POST	Switch to use NCEP post (default=YES)
NCP	GENERAL	Location of ncp utility
ncw	FCST	For Ferrier microphysics
n_ens	ENKF	number of ensemble members
NEW_DAYFILE	GENERAL	To create new dayfile for every rerun
newoz_nrl	FCST	YES: use NRL ozone production and loss coefficients (default=YES)
NGPTC	FCST	For operational GFS, not reproducible with different NGPTC; number of horizontal points computed in the same call inside radiation and physics (defaults to JCAP/10)
nknd_fcst	FCST	For hindcasts from segment 2 only
NLAT_A	ANAL	Analysis grid parameter, JCAP > 574
NLAT_ENS	ENKF	`expr $LATA_ENKF + 2`; Project T254 ensemble into linear grid (512x256)
NLON_A	ANAL	Analysis grid parameter, JCAP > 574
NLON_ENS	ENKF	$LONA_ENKF; Project T254 ensemble into linear grid (512x256)
NMEM_ENS	ENKF	$ENS_NUM_ENKF; Project T254 ensemble into linear grid (512x256)
NOANAL	ANAL	NO: run analysis and forecast, YES: no analysis (default=NO)
NOFCST	FCST	NO: run analysis and forecast, YES: no forecast (default=NO)
npe_node_a	ANAL	Number of PEs/node for atmospheric analysis with GSI
npe_node_ang	ANGU	Number of PEs/node for global_angupdate
npe_node_av	AVRG	Number of PEs/node for avrg
npe_node_f	FCST	Number of PEs/node for AM forecast
npe_node_o	ANAL	Number of PEs/node for ocean analysis
npe_node_po	POST	Number of PEs/node for post step (default=16)
npe_node_pr	PREP	Number of PEs/node for prep step (default=32 for dew/mist/haze)
nproco_1	FCST	Number of processors for ocean model 1st segment
nproco_2	FCST	Number of processors for ocean model 2nd segment
nproco_3	FCST	Number of processors for ocean model 3rd segment
NRLACQC	PREP	NRL aircraft QC, if="YES" will quality control all aircraft data
nsout	FCST	Outputs every AM time step when =1 (default=0)
NSST_ACTIVE	FCST	NST_FCST, 0: AM only, no NST model, 1: uncoupled, non-interacting, 2: coupled, interacting
nth_f1	FCST	Threads for AM 1st segment
nth_f2	FCST	Threads for AM 2nd segment
nth_f3	FCST	Threads for AM 3rd segment
NTHREADS_GSI	ANAL	Number of threads for anal
NTHSTACK	FCST	Stacks for fcst step (default=128000000)
NTHSTACK_GSI	ANAL	Stack size for anal (default=128000000)
NUMPROCANAL	ANAL	Number of tasks for GDAS anal
NUMPROCANALGDAS	ANAL	Number of tasks for GDAS anal
NUMPROCANALGFS	ANAL	Number of tasks for GFS anal
NUMPROCAVRGGDAS	ANAL	Number of PEs for GDAS average
NUMPROCAVRGGFS	ANAL	Number of PEs for GFS average
NWPROD	GENERAL	Option to point executable to nwprod versions
O3CLIM	FCST	Location and name of global_o3clim text file
O3FORC	FCST	Location and name of global_o3prdlos fortran code

OANLSH	ANAL	Ocean analysis script
OBSQC	ENKF	GSI namelist for observation quality control variables
OCN2GRIBEXEC	POST	Ocean to grib executable
OCNMEANDIR	AVRG	Directory for ocn monthly means
ocnp_delay_1	POST	OM post delay time
ocnp_delay_2	POST	OM post delay time
OCNPSH	POST	Ocean post script
OIQCT	PREP	Prep step prepobs_oiqc.oberrs file
oisst_clim	ANAL	Ocean analysis fix field
OM_EXEC	FCST	Ocean model executable
omres_1	FCST	Ocean 1st segment model resolution (0.5 x 0.25) and number of processors
omres_2	FCST	Ocean 2nd segment model resolution (0.5 x 0.25) and number of processors
omres_3	FCST	Ocean 3rd segment model resolution (0.5 x 0.25) and number of processors
OPANAL_06	ANAL	For old ICs without LANDICE, only applicable for starting from existing analysis
OPREPSH	PREP	Ocean analysis prep script
opt1_3d_qcubic	FCST	See cont_eq_opt1 variable for more information
OROGRAPHY	FCST	Global orography grib file
OUT_VIRTTEMP	FCST	Output into virtual temperature (true)
OUTTYP_GP	POST	1: gfsio, 2: sigio, 0: both
OUTTYP_NP	POST	1: gfsio, 2: sigio, 0: both
OVERPARMEXEC	POST	CFS overparm grib executable
oz_univ_static	ENKF	TRUE = decouple ozone from other variables and defaults to static B (ozone only)
OZINFO	ANAL	Ozone info file
PARATRKR	TRAK	Script location
PARM_GODAS	PREP	GODAS parm file
PARM_OM	PREP	Ocean model parm files
PARM_PREP	PREP	Prep step parm files
PCONFIGS	GENERAL	For running in real-time, configuration file
PCPINFO	ANAL	PCP info files
PEND	GENERAL	Location of pend script
pfac	FCST	Forecasting computing variable
pgb_typ4prep	PREP	Type of pgb file for prep step (default=pgbf)
pgbf_gdas	POST	GDAS pgbf file resolution, 4: 0.5 x 0.5 degree, 3: 1 x 1 degree
PMKR	GENERAL	Needed for parallel scripts
polist_37	POST	Output pgb (pressure grib) file levels
polist_47	POST	Output pgb (pressure grib) file levels
post_delay_1	POST	AM post delay time
post_delay_2	POST	AM post delay time
POST_SHARED	POST	Share nodes (default=YES)
POSTGPEXEC_GP	POST	Post executable, for enthalpy version
POSTGPEXEC_NP	POST	Post executable, ncep post
POSTGPSH_GP	POST	$POSTGPEXEC_GP script
POSTGPSH_NP	POST	$POSTGPEXEC_NP script
POSTGPVARSNP	POST	Similar to FCSTVARS but for post variables
POSTSH	POST	Post script
POSTSPL	POST	Special CFSRR analysis file created for CPC diagnostics
PRECIP_DATA_DELAY	ANAL	Delay for precip data in hours (for global lanl)
PREPDIR	PREP	Location of prep files/codes/scripts, usually $HOMEDIR
PREPFIXDIR	PREP	Location of prep fix files
PREPQFITSH	PREP	Name and location of a prep script
PREPSH	PREP	Name and location of main prep script
PREX	PREP	Prevents executable
PROCESS_TROPCY	PREP	Switch, if YES: run QCTROPCYSH script (default ush/syndat_qctropcy.sh)
PRPC	PREP	Prep parm file
PRPT	PREP	Prep bufr table
PRPX	PREP	Prepdata executable
PRVT	PREP	Global error table for prep
PSLOT	GENERAL	Experiment ID
PSTX	PREP	Prep step, global_postevents executable
PSUB	GENERAL	Location of psub script
q2run_1	FCST	Additional queue for fcst segment 1
q2run_2	FCST	Additional queue for fcst segment 2
QCAX	PREP	Prep step, prepobs_acarsqc executable
r2ts_clim	ANAL	Ocean analysis fix field

ras	FCST	Convection parameter, relaxed
readfi_exec	FCST	CFS sea ice executable
readin_localization	ENKF	TRUE = read external localization information file
readsst_exec	FCST	CFS sea ice executable
RECONCILE	GENERAL	Location of reconcile script
REDO_POST	POST	Default=NO
regrid_exec	FCST	CFS sea ice executable
RELOCATESH	PREP	Name and location of relocation script
RELOX	PREP	Name and location of relocation executable
RESDIR	GENERAL	Restart directory
RESUBMIT	GENERAL	To resubmit a failed job (default=NO)
RLIST	GENERAL	List that controls input and output of files for each step
RM_G3DOUT	FCST	For GOCART related special output
RM_ORIG_G3D	FCST	For GOCART related special output
ROTDIR	GENERAL	See $COMROT
RTMAERO	ANAL	Location of CRTM aerosol coefficient bin file
RTMCLDS	ANAL	Location of CRTM cloud coefficient bin file
RTMEMIS	ANAL	Location of CRTM emissivity coefficient bin file
RTMFIX	ANAL	Location of CRTM fix file(s)
RUN_ENTHALPY	FCST	Control the forecast model (default=NO)
RUN_OPREP	PREP	YES: run ocean prep to get tmp.prf and sal.prf
RUN_PLOT_SCRIPT	AVRG	Script location
RUN_RTDUMP	ANAL	YES: archived tmp.prf and sal.prf used
rundir	GENERAL	Verification run directory
RUNLOG	GENERAL	The experiment runlog
SALTSFCRESTORE	ANAL	GODAS script
SATANGL	ANAL	Name and location of satangbias file
SATINFO	ANAL	Name and location of satinfo file
SAVEFITS	VRFY	Fit to obs scores
SBUVBF	ANAL	Location and naming convention of osbuv8 data file
SCRDIR	GENERAL	Scripts directory (typically underneath $HOMEDIR)
scrubtyp	GENERAL	Scrub or noscrub
semilag	FCST	Semilag option
SEND2WEB	VRFY	Whether or not to send maps to webhost
s_env_h	ENKF	homogeneous isotropic horizontal ensemble localization scale (km)
s_env_v	ENKF	vertical localization scale (grid units for now)
SET_FIX_FLDS	COPY	Only useful wit copy.sh; create orographic and MODIS albedo related fix fields if they don't exist
settls_dep3dg	FCST	Set settls_dep3ds and settls_dep3dg to true for the SETTLS departure-point calculation
settls_dep3ds	FCST	Set settls_dep3ds and settls_dep3dg to true for the SETTLS departure-point calculation
SETUP	ANAL	GSI setup namelist
SHDIR	GENERAL	Similar to SCRDIR, just a directory setting
sice_rstrt_exec	FCST	Sea ice executable
SICEUPDATESH	FCST	Sea ice update script
SIGGESENV	ENKF	template for ensemble member sigma guess files
SLMASK	FCST	Global slmask data file, also see $FNMASK
snoid	ANAL	Snow id (default=snod)
SNOWNC	ANAL	NetCDF snow file
SSMITBF	ANAL	SSM/I bufr radiace dataset
sst_ice_clim	ANAL	Fix fields for ocean analysis
SSTICECLIM	ANAL	Ocean analysis fix field
SUB	GENERAL	Location of sub script
SYNDATA	PREP	Switch (default=YES)
SYNDX	PREP	Syndat file, prep step
tasks	FCST	Number of tasks for 1st segment of forecast
tasks2	FCST	Number of tasks for 2nd segment of forecast
tasks3	FCST	Number of tasks for 3rd segment of forecast
tasksp_1	POST	Number of PEs for 1st segment of post
tasksp_2	POST	Number of PEs for 2nd segment of post
tasksp_3	POST	Number of PEs for 3rd segment of post

thlist_16	POST	Output theta levels
time_extrap_etadot	FCST	TRUE = with settls_dep3ds and settls_dep3dg =false, when a second-order accuracy of the vertical displacements are desired
TIMEAVGEXEC	AVRG	Executable location
TIMEDIR	GENERAL	Directory for time series of selected variables
TIMELIMANAL	ANAL	Wall clock time for AM analysis
TIMELIMAVRG	AVRG	CPU limit (hhmmss) for averaging
TIMELIMPOST00GDAS	POST	CPU limit for 00z GDAS post
TIMELIMPOST00GFS	POST	CPU limit for 00z GFS post
TIMELIMPOST06GFS	POST	CPU limit for 06z GFS post
TIMELIMPOST12GFS	POST	CPU limit for 12z GFS post
TIMELIMPOST18GFS	POST	CPU limit for 18z GFS post
TIMEMEANEXEC	AVRG	Executable location
TOPDIR	GENERAL	Top directory, defaults to '/global' on CCS or '/mtb' on Vapor if not defined
TOPDRA	GENERAL	Top directory, defaults to '/global' on CCS or '/mtb' on Vapor if not defined
TOPDRC	GENERAL	Top directory, defaults to '/global' on CCS or '/mtb' on Vapor if not defined
TOPDRG	GENERAL	Top directory, defaults to '/global' on CCS or '/mtb' on Vapor if not defined
TRACKERSH	TRAK	Tracker script location
TSER_FCST	FCST	Extract time-series of selected output variables
USE_RESTART	GENERAL	Use restart file under COMROT/RESTART if run is interrupted
USHAQC	PREP	See $USHDIR
USHCQC	PREP	See $USHDIR
USHDIR	GENERAL	Ush directory (typically underneath HOMEDIR)
USHGETGES	PREP	Directory location of getges.sh script
USHICE	PREP	See $USHDIR
USHNQC	PREP	See $USHDIR
USHOIQC	PREP	See $USHDIR
USHPQC	PREP	See $USHDIR
USHPREV	PREP	See $USHDIR
USHQCA	PREP	See $USHDIR
USHSYND	PREP	Directory, usually "$PREPDIR/ush"
USHVQC	PREP	See $USHDIR
usrdir	GENERAL	See $LOGNAME
uv_hyb_ens	ENKF	TRUE = ensemble perturbation wind variables are u,v; FALSE = ensemble perturbation wind variables are stream function and velocity potential
VBACKUP_PRCP	VRFY	Hours to delay precip verification
VDUMP	VRFY	Verifying dump
vlength	VRFY	Verification length in hours (default=384)
VRFY_ALL_SEG	VRFY	NO: submit vrfy only once at the end of all segments, YES: submit for all segments (default=YES)
vrfy_delay_1	VRFY	AM verification delay time (in hhmm) for segment 1
vrfy_delay_2	VRFY	AM verification delay time for segment 2
VRFYPRCP	VRFY	Precip threat scores
VRFYSCOR	VRFY	Anomaly correlations, etc.
VRFYTRAK	VRFY & TRAK	Hurricane tracks
VSDB_START_DATE	VRFY	Starting date for vsdb maps
VSDB_STEP1	VRFY	Compute stats in vsdb format (default=NO)
VSDB_STEP2	VRFY	Make vsdb-based maps (default=NO)
vsdbhome	VRFY	Script home (default=$HOMEDIR/vsdb)
vsdbsave	VRFY	Place to save vsdb database
VSDBSH	VRFY	Default=$vsdbhome/vsdbjob.sh
WEBDIR	VRFY	Directory on web server (rzdm) for verification output
webhost	VRFY	Webhost (rzdm) computer
webhostid	VRFY	Webhost (rzdm) user name
yzdir	VRFY	Additional verification directory, based on personal directory of Yuejian Zhu
zflxtvd	FCST	Vertical advection scheme
zhao_mic	FCST	TRUE: Zhao microphysics option, FALSE: Ferrier microphysics