

## Grid-to-Grid Use Case

This performs grid-to-grid verification using the MET tools. The grid-to-grid use case is comprised of 2 parts, the first in which the partial sums are computed and the second where plots of statistics are created. Each part is comprised of 3 types of grid-to-grid verification:

- pres: for various variables on pressure level surfaces
- anom: for various variables on pressure level surfaces making use climatological data as well as using Fourier decomposition of geopotential heights
- sfc: for various variables on a single level

For each part and each type, there are METplus configuration files (.conf files) that serve as examples of what is needed to successfully run METplus. These files are located in `<your/path/to/METplus/code>/METplus/parm/use_cases/grid_to_grid`. The user can run the type of grid-to-grid verification that fulfills their needs by running METplus with the corresponding .conf file(s). If the user wishes to run more than one of the types of grid-to-grid verification types listed above, then METplus just needs to be run with the .conf file(s) for each.

### Part 1: Partial Sum Computation

#### Overview

Part 1 performs the computation of partial sums computed between two gridded datasets. For example, this can be a comparison of the model forecast file and the model's analysis file at the valid time (i.e. model analysis file used as "truth"). The user has the option of running two METplus processes for part 1. These are described below.

**GridStat:** use of MET's `grid_stat` to compute the scalar and vector partial sums (`pres` and `sfc`), and scalar and vector anomalous partial sums (`anom`) for the user-specified variables and their corresponding levels, dates (initialization or valid), forecast hours, and regions. This will produce individual files for each variable, level, forecast hour at its valid date.

**StatAnalysis:** use of MET's `stat_analysis` to gather partial sum data by dates for all the user specified variables, levels, forecast hours and regions from the stat files produced from running GridStat. This process mimics the way the partial sum data are saved in NCEP EMC's VSDB global model verification package.

The METplus processes described above can be run together with the same .conf file or can be run separately (i.e. running METplus twice, first GridStat then StatAnalysis) with a .conf specific to the processes. If the user wishes to

run part 2, BOTH GridStat and StatAnalysis must be run successfully beforehand.

## Configuration Files

Below is a list of the example .conf files for part 1 for the 3 types of grid-to-grid verification (pres, anom, and sfc). These are found in *<your/path/to/METplus/code>/METplus/parm/use\_cases/grid\_to\_grid*.

pres: grid2grid\_pres\_part1.conf  
anom: grid2grid\_anom\_part1a.conf, grid2grid\_anom\_part1b.conf (runs Fourier decomposition for geopotential heights, optional), grid2grid\_anom\_part1c.conf (requires METplus being run 3 time in this order of .conf files)  
sfc: grid2grid\_sfc\_part1.conf

Pres and sfc .conf files run GridStat and StatAnalysis together, and the anom .conf files make use of running GridStat and StatAnalysis separately.

The METplus .conf files allow for the user to have the ability to customize the verification for their, but for METplus to be run successfully the .conf file needs to be set up correctly. The settings in the .conf files and their meaning are described below. In discussing items in the .conf file, **this font will be used**. In the .conf files, be sure that the key-value settings reside under the correct section heading; the section headings are denoted by [ ].

The 3 grid-to-grid verification types and the GridStat and StatAnalysis processes share numerous settings that must be included in their .conf files.

[dir]

METPLUS\_BASE = path the base directory where METplus is installed  
PARM\_BASE = path to the base directory where all parameters files are located (both MET and METplus), to use those from METplus set to {METPLUS\_BASE}/parm  
MET\_INSTALL\_DIR = path to the location of the MET installation  
MET\_BASE = path to the base directory of the MET installation, should be {MET\_INSTALL\_DIR}/share/met  
OUTPUT\_BASE = path to the base directory to save METplus output  
LOG\_DIR = path to the base directory to save METplus log files to, ex. {OUTPUT\_BASE}/logs  
TMP\_DIR = path of where to save temporary files  
FCST\_GRID\_STAT\_INPUT\_DIR = path to the location of the forecast files  
OBS\_GRID\_STAT\_INPUT\_DIR = path to the location of the forecast files  
GRID\_STAT\_OUT\_DIR = path to the location where to save the output from grid\_stat

STAT\_ANALYSIS\_CONFIG = location of MET stat\_analysis configuration file, {PARM\_BASE}/met\_config/STATAnalysisConfig\_VSDBformat should be used  
 STAT\_ANALYSIS\_LOOKIN\_DIR = where MET's stat\_analysis should look for .stat files, probably same path of {GRID\_STAT\_OUT\_DIR}  
 STAT\_ANALYSIS\_OUT\_DIR = path to the location where to save the output from stat\_analysis

[exe]  
 WGRIB2 = <path/to>/wgrib  
 RM\_EXE = <path/to>/rm  
 CUT\_EXE = <path/to>/cut  
 TR\_EXE = <path/to>/tr  
 NCAP2\_EXE = <path/to>/ncap2  
 CONVERT\_EXE = <path/to>/convert  
 NCDUMP\_EXE = <path/to>/exe  
 EGREP\_EXE = <path/to>/grep

[config]  
 LOOP\_BY\_INIT = options are true or false  
 if a user wants to loop by model initialization times this should be set to true with the following options set  
 INIT.TIME.FMT = format of initialization time, ex. %Y%m%d%H  
 INIT.TIME.BEG = beginning initialization time  
 INIT.TIME.END = ending initialization time  
 INIT.INC = increment in seconds to increase initialization time by  
 if a user wants to loop by model valid times this should be set to false with the following options set  
 VALID.TIME.FMT = format of valid time, ex. %Y%m%d%H  
 VALID.TIME.BEG = beginning valid time  
 VALID.TIME.END = ending valid time  
 VALID.INC = increment in seconds to increase valid time by

LOOP.METHOD = this must be set to times  
 PROCESS\_LIST = the METplus processes to run, options GridStat , StatAnalysis ,or GridStat, StatAnalysis

MODEL.TYPE = naming convention to refer to forecasts  
 OB.TYPE = naming convention to refer to the observations

If the user is running the GridStat process (i.e. GridStat listed in PROCESS\_LIST), then the following setting must also be included in the .conf file.

[config]  
 FCST.NATIVE.DATA.TYPE = data type of file, ex. GRIB

OBS\_NATIVE\_DATA\_TYPE = data type of file, ex. GRIB

LEAD\_SEQ = list of comma separated forecast hours to process

FCST\_MAX\_FORECAST = maximum forecast hour to process, ex.

last forecast hour in LEAD\_SEQ

FCST\_INIT\_INTERVAL = interval in hours forecast initialization  
to process

FCST\_IS\_PROB = options are true (variables to verify are  
probabilistic) or false (variables to verify are not probabilistic)

Next, is setting up the information on the to be verified. Here # is a placeholder for a numerical value starting with 1, counting up through however many variables are to be verified. The numerical value for the forecast variable information is matched with the same numerical value for the observation variable information. The forecast variable information must be specified. If the observation variable information for # differs from that of the forecast variable information for #, then the observation variable information needs be specified, if not METplus will use the forecast variable information for # for the observation variable information for #. The variable information for # has 2 mandatory settings, and 1 optional setting.

FCST\_VAR#\_NAME = mandatory, forecast variable name for forecast  
variable number #

FCST\_VAR#\_LEVELS = mandatory, list of comma separated levels  
for forecast variable #

FCST\_VAR#\_OPTIONS = optional, extra information for MET in  
regards to the forecast variable #, such GRIB\_lvl.typ, see  
MET User's Guide for more options

OBS\_VAR#\_NAME = mandatory, observation variable name for forecast  
variable number #

OBS\_VAR#\_LEVELS = mandatory, list of comma separated levels  
for observation variable #

OBS\_VAR#\_OPTIONS = optional, extra information for MET in  
regards to the observation variable #, such GRIB\_lvl.typ,  
see MET User's Guide for more options

GRID\_STAT\_CONFIG = location of MET grid\_stat configuration  
file, can be one user defined or used from {PARM\_BASE}/met\_config.  
\*\*\*NOTE\*\*\* the user can set parameters in this configuration  
file for grid\_stat to run with. These include the grid to  
do the verification on, interpolation method, climatology  
files, and verification masking regions. See the MET User's  
Guide for more information on the parameters and settings

for this file.

```
[filename_templates]
FCST_GRID_STAT_INPUT_TEMPLATE = template/naming style of the
forecast files, ex.  pgbf{lead?fmt=%HH}.gfs.{init?fmt=%Y%m%d%H}
OBS_GRID_STAT_INPUT_TEMPLATE = template/naming style of the
observations files, ex.  pgbanl.gfs.{init?fmt=%Y%m%d%H}
```

If the user is running the StatAnalysis process (i.e. StatAnalysis listed in PROCESS\_LIST), then the following setting must be included in the .conf file.

```
[config]
VERIF_CASE = set to grid2grid for this use case
VERIF_TYPE = options for VERIF_CASE = grid2grid are pres ,
anom , and sfc
```

## Running

To run the full “pres” grid-to-grid use case for part 1, run

```
master_metplus.py -c <your/path/to/METplus/code>
/METplus/parm/use_cases/grid_to_grid/grid2grid_pres_part1.conf
```

To run the full “anom” grid-to-grid use case for part 1, run

```
master_metplus.py -c <your/path/to/METplus/code>
/METplus/parm/use_cases/grid_to_grid/grid2grid_anom_part1a.conf
```

followed by

```
master_metplus.py -c <your/path/to/METplus/code>
/METplus/parm/use_cases/grid_to_grid/grid2grid_anom_part1b.conf
```

followed by

```
master_metplus.py -c <your/path/to/METplus/code>
/METplus/parm/use_cases/grid_to_grid/grid2grid_anom_part1c.conf
```

To run the full “sfc” grid-to-grid use case for part 1, run

```
master_metplus.py -c <your/path/to/METplus/code>
/METplus/parm/use_cases/grid_to_grid/grid2grid_sfc_part1.conf
```

If a user is using their own .conf,

```
master_metplus.py -c <your/path/to/your/conf/file>
```

Additionally, multiple .conf files can be passed to master\_metplus.py. The last .conf file listed will override any of the settings listed in the .conf files(s) before it. Here is an example of passing in multiple .conf files,

```
master_metplus.py -c <your/path/to/METplus/code>
/METplus/parm/use_cases/grid_to_grid/grid2grid_pres_part1.conf -c
<your/path/to/your/conf/file>
```

## Part 2: Plotting of Statistics

### Overview

Part 2 performs the plotting of statistics computed from the partial sum data produced from part 1. Such plots are time series, forecast hour means, date-pressure plots, forecast hour-pressure mean plots, and forecast hour-date mean plots. BOTH GridStat and StatAnalysis from part 1 must be run successfully before running part 2. The user has the option of running two METplus processes for part 2. These are described below.

**StatAnalysis:** use of MET's stat\_analysis to filter the stat files from part 1 by variable, level, forecast hour, and region over a range of valid or initialization dates.

**MakePlots:** compute and create plots for user-specified statistics, variables, levels, dates (by initialization time or valid time), forecast hours, and regions.

The METplus processes described above can be run together with the same .conf file or can be run separately (i.e. running METplus twice, first StatAnalysis then MakePlots) with a .conf specific to the processes.

### Configuration Files

Below is a list of the example .conf files for part 2 for the 3 types of grid-to-grid verification (pres, anom, and sfc). These are found in <your/path/to/METplus/code>/METplus/parm/use\_cases/grid\_to\_grid.

```
pres: grid2grid_pres_part2.conf
anom: grid2grid_anom_part2.conf
sfc: grid2grid_sfc_part2.conf
```

The METplus .conf files allow for the user to have the ability to customize the verification for their, but for METplus to be run successfully the .conf file needs to be set up correctly. The settings in the .conf files and their meaning are described below. In discussing items in the .conf file, **this font will be used**. In the .conf files, be sure that the key-value settings reside under the correct

section heading; the section headings are denoted by [ ].

The 3 grid-to-grid verification types and the StatAnalysis and MakePlots processes share numerous settings that must be included in their .conf files.

#### [dir]

METPLUS\_BASE = path the base directory where METplus is installed  
PARM\_BASE = path to the base directory where all parameters files are located (both MET and METplus), to use those from METplus set to {METPLUS\_BASE}/parm  
MET\_INSTALL\_DIR = path to the location of the MET installation  
MET\_BASE = path to the base directory of the MET installation, should be {MET\_INSTALL\_DIR}/share/met  
OUTPUT\_BASE = path to the base directory to save METplus output  
LOG\_DIR = path to the base directory to save METplus log files to, ex. {OUTPUT\_BASE}/logs  
TMP\_DIR = path of where to save temporary files  
STAT\_ANALYSIS\_LOOKIN\_DIR = where MET's stat\_analysis should look for .stat files, location of files are running part  
1 StatAnalysis  
STAT\_ANALYSIS\_OUT\_DIR = path to the location where to save the output from stat\_analysis  
PLOTING\_SCRIPTS\_DIR = path to the directory containing python plotting scripts, should be METPLUS\_BASE/ush/plotting\_scripts  
STAT\_FILES\_INPUT\_DIR = location of .stat files from running StatAnalysis, should be {STAT\_ANALYSIS\_OUT\_DIR}  
PLOTING\_OUT\_DIR = path to where to save output from MakePlots  
[exe]  
WGRIB2 = <path/to>/wgrib  
RM\_EXE = <path/to>/rm  
CUT\_EXE = <path/to>/cut  
TR\_EXE = <path/to>/tr  
NCAP2\_EXE = <path/to>/ncap2  
CONVERT\_EXE = <path/to>/convert  
NCDUMP\_EXE = <path/to>/exe  
EGREP\_EXE = <path/to>/grep

#### [config]

LOOP\_BY\_INIT = options are true or false

if a user wants to loop by model initialization times this should be set to true with the following options set

INIT\_TIME\_FMT = format of initialization time, ex. %Y%m%d%H

INIT\_TIME\_BEG = beginning initialization time

INIT\_TIME\_END = ending initialization time

INIT\_HOUR\_BEG = beginning initialization hour

INIT\_HOUR\_END = end initialization hour

INIT\_INC = increment to increase initialization hour by

if a user wants to loop by model valid times this should be set to false with the following options set

VALID\_TIME\_FMT = format of valid time, ex. %Y%m%d

VALID\_TIME\_BEG = beginning valid time

VALID\_TIME\_END = ending valid time

VALID\_HOUR\_BEG = beginning valid hour

VALID\_HOUR\_END = end valid hour

VALID\_INC = increment to increase valid hour by

LOOP\_METHOD = this must be set to processes

PROCESS\_LIST = the METplus processes to run, options StatAnalysis , MakePlots ,or StatAnalysis, MakePlots

VERIF\_CASE = set to grid2grid for this use case

VERIF\_TYPE = options for VERIF\_CASE = grid2grid are pres , anom , and sfc

MODEL\_LIST = list of comma separated models to process

REGION\_LIST = list of comma separated verification regions to process

LEAD\_LIST = list of comma separated forecast horus to process

Next, is setting up the information on the to be verified. Here # is a placeholder for a numerical value starting with 1, counting up through however many variables are to be verified. The numerical value for the forecast variable information is matched with the same numerical value for the observation variable information. The forecast variable information must be specified. If the observation variable information for # differs from that of the forecast variable information for #, then the observation variable information needs be specified, if not METplus will use the forecast variable information for # for the observation variable information for #. The variable information for # has 2



mandatory settings, and 1 optional setting.

FCST\_VAR#\_NAME = mandatory, forecast variable name for forecast variable number #  
FCST\_VAR#\_LEVELS = mandatory, list of comma separated levels for forecast variable #  
FCST\_VAR#\_OPTIONS = optional, extra information for MET in regards to the forecast variable #, such GRIB\_lvl\_typ, see MET User's Guide for more options

OBS\_VAR#\_NAME = mandatory, observation variable name for forecast variable number #  
OBS\_VAR#\_LEVELS = mandatory, list of comma separated levels for observation variable #  
OBS\_VAR#\_OPTIONS = optional, extra information for MET in regards to the observation variable #, such GRIB\_lvl\_typ, see MET User's Guide for more options

If running the "anom" part 2 grid-to-grid verification, include these settings as well/

[config]

FOURIER\_HEIGHT\_DECOMP = options are true (include Fourier geopotential height decomposition) or (do not include Fourier geopotential height decomposition) false  
WAVE\_NUM\_BEG\_LIST = list of comma separated numerical values corresponding to those listed in WAVE\_NUM\_END\_LIST, max is 4 listed values  
WAVE\_NUM\_END\_LIST = list of comma separated numerical values corresponding to those listed in WAVE\_BEG\_END\_LIST, max is 4 listed values

If the user is running the StatAnalysis process (i.e. StatAnalysis listed in PROCESS\_LIST), then the following setting must be included in the .conf file.

[config]

STAT\_ANALYSIS\_CONFIG = location of MET stat\_analysis configuration file, {PARM\_BASE}/met\_config/STATAnalysisConfig-plotformat should be used

If the user is running the MakePlots process (i.e. MakePlots listed in `PROCESS_LIST`), then the following setting must be included in the `.conf` file.

[config]

`PLOT_STATS_LIST` = list of comma separated statistics to create plots for, if running `VERIF_TYPE=pres` options are `bias,rmse,mssess,rsd,rmse_md,rmse_pv,pcor` if running for `VERIF_TYPE=anom` options are `acc` if running for `VERIF_TYPE=sfc` options are `fbar`

## Running

To run the full “pres” grid-to-grid use case for part 2, run

```
master_metplus.py -c <your/path/to/METplus/code>  
/METplus/parm/use_cases/grid_to_grid/grid2grid_pres_part2.conf
```

To run the full “anom” grid-to-grid use case for part 2, run

```
master_metplus.py -c <your/path/to/METplus/code>  
/METplus/parm/use_cases/grid_to_grid/grid2grid_anom_part2.conf
```

To run the full “sfc” grid-to-grid use case for part 1, run

```
master_metplus.py -c <your/path/to/METplus/code>  
/METplus/parm/use_cases/grid_to_grid/grid2grid_sfc_part2.conf
```

If a user is using their own `.conf`,

```
master_metplus.py -c <your/path/to/your/conf/file>
```

Additionally, multiple `.conf` files can be passed to `master_metplus.py`. The last `.conf` file listed will override any of the settings listed in the `.conf` files(s) before it. Here is an example of passing in multiple `.conf` files,

```
master_metplus.py -c <your/path/to/METplus/code>  
/METplus/parm/use_cases/grid_to_grid/grid2grid_pres_part2.conf  
-c <your/path/to/your/conf/file>
```