

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

[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_GRID_STAT_INPUT_DIR = path to the location of the forecast files
FCST_NATIVE_DATA_TYPE = data type of file, ex. GRIB

OBS_GRID_STAT_INPUT_DIR = path to the location of the forecast files
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_tpy, 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_tpy, 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.
GRID_STAT_OUT_DIR = path to the location where to save the output from grid_stat

[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
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
```

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

[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
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

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]

PLOTTING_SCRIPTS_DIR = path to the directory containing python plotting scripts, should be METPLUS_BASE/ush/plotting_scripts
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
STAT_FILES_INPUT_DIR = location of .stat files from running StatAnalysis, should be {STAT_ANALYSIS_OUT_DIR}
PLOTTING_OUT_DIR = path to where to save output from MakePlots

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>
```