

Section 10

Forecast verification: methods and studies.

NCEP EMC Transition to Using METplus for GFS Verification

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Under Next Generation Global Predictions System (NGGPS) program, the decision was made to use the Model Evaluation Tools (MET)¹ to unify verification across the federal, research, and academic numerical weather prediction (NWP) communities to provide a clear and consistent way for the evaluations of the modeling systems being developed under NGGPS². This decision was expanded to include METviewer³ and METExpress⁴, two database and display systems, and a repository of python scripts that provides a low level workflow with use case examples using MET; verification capabilities in pre-existing community packages will also be leveraged². The authoritative umbrella repository bringing all these pieces together is known as METplus⁵ (Figure 1).

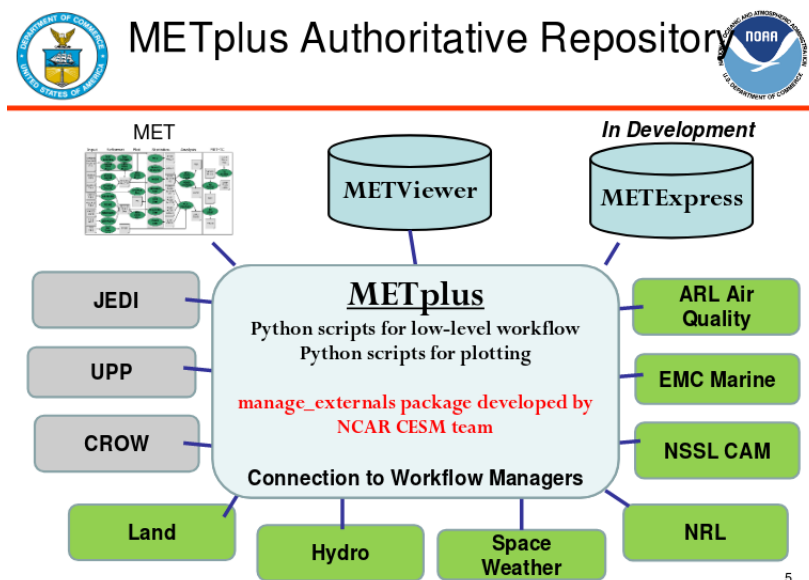


Figure 1. Visual representation of the METplus Authoritative Repository from Tara Jensen⁶.

Verification for the Global Forecast System (GFS) is done using the National Centers For Environmental Prediction (NCEP) Environmental Modeling Center (EMC) Global NWP Model Verification Package which uses the Verification Statistics DataBase (VSDB). This package has numerous capabilities: grid-to-grid verification (comparing model forecasts to model analysis), grid-to-observations verification (comparing model forecasts to surface and rawinsonde observations), precipitation verification, scorecards (shows the statistical significance difference between two model for various statistics, regions, forecast leads, variables), fits-to-observations (comparing the model forecast and data assimilation files to conventional ground and air observations), spatial map graphics, tropical cyclone verification, and data assimilation analysis increment graphics. These codes were developed at EMC (https://www.emc.ncep.noaa.gov/gmb/wx24fy/doc/vsdb_readme.txt). Verification for the GFS and other operational global models is run daily at EMC using this package (https://www.emc.ncep.noaa.gov/gmb/STATS_vsdb/). It is also run as a part of the GFS workflow

computing statistics "on the fly" as experiments are run by model developers to compare their experiments to the operational GFS.

MET was originally designed to mimic the capabilities of VSDB, but in order for METplus to replace the current verification used at EMC various use cases needed to be developed that replicate what is already being done. In February and March 2018, a code sprint, or a time period dedicated to code development, was held between members of EMC and DTC. During this code sprint, use cases were developed and enhanced for the grid-to-grid, grid-to-observations, precipitation, and tropical cyclone verifications. In addition, plotting scripts that can be run within METplus were developed in this code sprint. The code for METplus can be found at <https://github.com/NCAR/METplus/>.

While METplus will be used for daily GFS verification, it is important to have the ability to run METplus within the global workflow that model developers use. Work is currently under way in connecting METplus into the GFS workflow. METplus configuration files are able to read environment variables, and this has been an important feature in connecting METplus into the workflow. The workflow that will be used for the GFS version 16, targeted for 2021, retrospectives will have METplus connected into the workflow.

Development for METplus for EMC's global verification needs has made great strides in the last year. However, work still needs to be done comparing the output from METplus to the current verification package, as well as building on the use cases and plotting capabilities of METplus and its components. Development for METexpress is underway, and METviewer and MET are being continuously developed accommodate user needs. Instances of METviewer and METexpress for use at EMC are being explored using Amazon Web Services. The process of EMC transitioning to METplus has cultivated a unique relationship between DTC and EMC. There has been much collaboration between both centers on the development and applications of METplus. EMC has become a tester of MET beta versions to help test and find bugs in the code before official releases as well as helping in the development of the METplus python scripting. This productive relationship has helped ease the process of transitioning to METplus at EMC.

References

¹ Model Evaluation Tools (MET) was developed at the National Center for Atmospheric Research (NCAR) through grants from the National Science Foundation (NSF), the National Oceanic and Atmospheric Administration (NOAA), and the United States Air Force (USAF). NCAR is sponsored by the United States National Science Foundation.

² https://www.weather.gov/media/sti/nggpps/UFS%20SIP%20FY19-21_20181129.pdf

³ METviewer was developed at the National Center for Atmospheric Research (NCAR) through grants from the National Science Foundation (NSF), the National Oceanic and Atmospheric Administration (NOAA), the United States Air Force (USAF), and the United States Department of Energy (DOE). NCAR is sponsored by the United States National Science Foundation.

⁴ METexpress is being developed by National Oceanic and Atmospheric Administration (NOAA) Earth System Research Laboratory (ESRL) Global Systems Division (GSD).

⁵ METplus was developed at the National Center for Atmospheric Research (NCAR) through grants from the National Science Foundation (NSF), the National Oceanic and Atmospheric Administration (NOAA), and the United States Air Force (USAF). NCAR is sponsored by the United States National Science Foundation.

⁶ Jensen, Tara. "What's Available in MET+?" DTC Community UFS Test Plan and Metrics Workshop, July 30-Aug 1 2018, National Center for Weather and Climate Prediction, College Park, MD.