Increased momentum toward unified verification and diagnostic evaluation of NCAR and NOAA community models

Tara L. Jensen1,4, J. Halley Gotway1,4, M. Ek1,4, C. Davis2, J. Dudhia3, A. Gettelman3,
1NCAR/RAL, Boulder, CO  2NCAR/MMM, Boulder, CO  3NCAR/CGD, Boulder, CO  4Developmental Testbed Center, Boulder, CO
dtc.org/community-code/model-evaluation-tools-met  jensen@ucar.edu  met_help@ucar.edu

dtc.org/NCAR/MET  github.org/NCAR/MET  metplus.gITHUB.org/NCAR/METviewer

The Model Evaluation Tools (MET) is a comprehensive numerical weather prediction (NWP) verification package supported to the community by the Developmental Testbed Center (DTC). It provides traditional verification statistics (e.g., RMSE, bias, skill scores), advanced spatial verification methods, and methods for ensemble and probabilistic forecasts. MET also includes pre-processing and aggregation tools, interpolation methods, and confidence intervals. METplus is an umbrella package that includes a suite of Python wrappers to streamline the set-up process and make it easier to facilitate reproducible evaluation and diagnostics across the community. METplus has been selected as the foundation of the NOAA unified verification capability and is being assessed for a similar purpose for NCARs community modeling suites.

What is METplus

Suites of tools extending MET bundled together with Python wrappers:
* MET (core)
* METviewer database and display (core)
* Analysis and Plotting
* User Interface
* METviewer Batch Engine
* Python plotting scripts
* Communication between MET & python algorithms
* Running in parallel with current ECM operational verification package

Why Unify?

Unified evaluation has three goals: (1) to create and apply approaches to evaluation that are compatible and interoperable to the extent possible; (2) to help unify modeling approaches across time and space scales; and (3) to integrate different communities so that their collective knowledge can be shared through collaborative interpretation of diagnostic results.

Unified evaluation is part of unified modeling, and further, can guide advances in model components, physics and chemistry that function well across the widest possible space and time domains. Using METplus as a foundation for unified evaluation may be a good starting point.

Call Python Scripts from MET

User writes a script to read gridded data into a 2-dimensional array of data.
The 2D NumPy array must be named met_data.
The script should define a dictionary named attr which defines:
- valid and initialization (init) times as strings in YYYYMMDD_HHMMSS format.
- lead and accumulation (accum) times as strings in YYYYMMDD format.
- name, long_name, level, and units as strings.
- grid dictionary defining the projection and grid information in the same way as the gridded NCFD file produced by MET.

Command Line

python scripts/python/read_asci_numpy.py data/python/fcst.txt FCST

Regridding

Automated regridding within statistical tools

Regridding options:
- To Forecast Grid
- To Observation Grid
- To Pre-defined Grid (e.g. NCEP G212, MRMS grid, or user generated)
- To a Grid specification (similar concept to UPP copygb)

Interpolation options:
- Unweighted Mean
- Distance-weighted mean
- Min, Max, Median
- Least Squares
- Bilinear
- Budget

Neighborhoods

Gridded Neighborhood Methods

Allows for some spatial / temporal uncertainty in either model or observation by giving credit for being "close".

Gridded - Fraction of events computed for both fields. Fraction skill score is then computed

Point Obs - HIRA

Fraction of "events" in neighborhood converted to fraction and treated as a probability

Ob is either "0" or "1" based on event threshold

Brier Score typically used to quantify skill

Met Evaluation Tools (MET) is a comprehensive numerical weather prediction (NWP) verification package supported by the Developmental Testbed Center (DTC), the National Oceanic and Atmospheric Organization (NOAA), the National Aeronautics and Space Administration (NASA). DTC sponsors include NOAA, NCAR, U.S. Air Force (USAF), and National Science Foundation (NSF). NCAR is sponsored by NSF.