



EARTH SYSTEM MODELING TESTING & EVALUATION

Accurate, Reliable, Independent

We make forecast-system evaluation operationally relevant by executing rigorous end-to-end tests on forecasts for multiple seasons. Evaluations encapsulate a broad range of weather regimes ranging from quiescent to strong flows and across spatiotemporal scales. At the NSF NCAR Research Applications Laboratory (RAL), we utilize standard, as well as, new and emerging verification techniques.

By conducting carefully controlled testing, we are able to provide the operational community with guidance for selecting new NWP technologies with potential value for operational implementation. RAL testing also provides the research community with baselines against which the impacts of new techniques can be evaluated. The statistical results may also aid researchers in selecting model configurations to use for their projects.

COLLABORATION

RAL connects a network of national and international sponsors and collaborators with a primary goal of testing and evaluation (T&E) Earth system models (ESMs), including Numerical Weather Prediction (NWP), and corresponding community support for T&E tools and procedures. RAL works in three areas: ESM Testing & Evaluation that is independent and operationally relevant,

Benefits & Impacts

- Assessing science techniques for operations & research
- Conducting value added evaluation approaches
- Connecting a broad network of collaborators
- Developing & supporting community code



ral.ucar.edu



[@NCAR_RAL](https://twitter.com/NCAR_RAL)



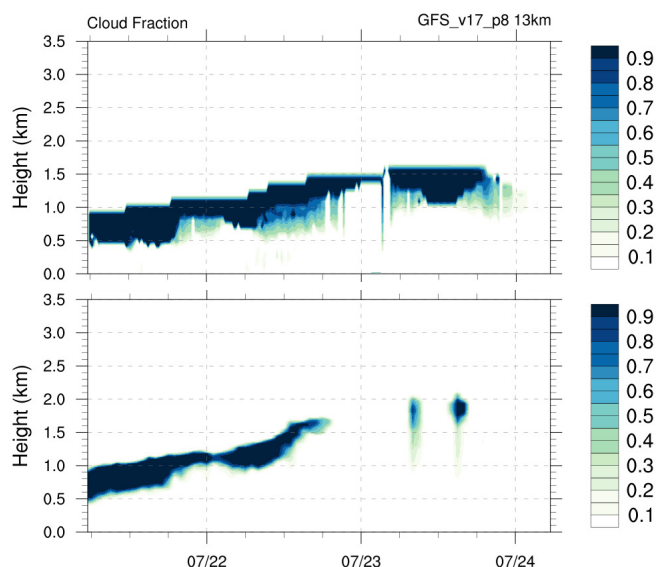
info@ral.ucar.edu

Verification methods using both standard NWP metrics and novel approaches, and Community Support for T&E software. Important collaborators include, among others, NOAA labs and NCEP centers (e.g. Environmental Modeling Center), NOAA's Earth Prediction Innovation Center (EPIC), the US Air Force (USAF), US Navy, and the UK MetOffice. A large focus includes staff support for Developmental Testbed Center (DTC) projects, where DTC is a distributed testbed between NSF NCAR and NOAA's Global Systems Laboratory, and supported by NSF, NOAA and USAF for projects defined by those organizations.

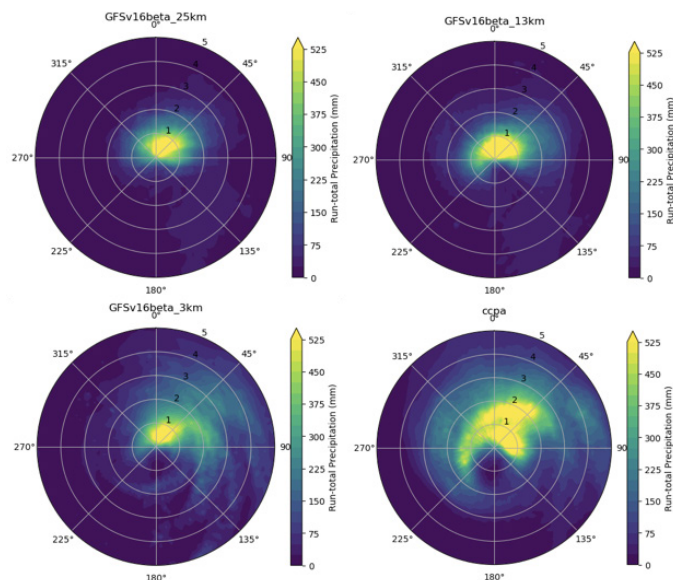
ATMOSPHERIC PHYSICS

The Common Community Physics Package (CCPP) is a library of physical parameterizations and an infrastructure used to connect the physics with host ESMs and is designed to lower the bar for community involvement in physics testing & development through increased interoperability, improved documentation, and continuous support to developers and users. CCPP is being integrated in NOAA UFS, NSF NCAR, and Navy models. CCPP is an enabler of Hierarchical System Development (HSD) where the CCPP SCM capability allows for more simplified physics testing.

HSD is a simple-to-complex model-improvement approach where ESM elements are tested first in isolation, then progressively connected with increased coupling between elements, e.g. SCM, small domain, regional, global and fully-coupled (ocean, atmosphere, etc.) models.



**Modeled (top) vs observed (bottom)
cloud fraction (tool: CCPP SCM)**



**Storm relative precipitation (mm) from
Hurricane Laura vs. Climatology-Calibrated
Precipitation Analysis (tool: METplus)**

MODEL VERIFICATION

The enhanced Model Evaluation Tools (METplus) is a state-of-the-science verification framework that spans a wide range of temporal (warn-on-forecast to climate) and spatial (storm-to-global) scales, and was developed by RAL and the DTC. METplus is continually updated and supported by an international community of users and developers and is extensible through additional capability developed in collaboration with the community. The core framework components include bulk statistics and diagnostics methods, analysis and visualization tools, and a suite of Python wrappers to provide low-level automation and use-case examples. METplus is a component of NOAA's UFS cross-cutting infrastructure as well as NSF NCAR's modeling systems.

COMMUNITY SUPPORT

RAL projects provide support from DTC for users and developers for CCPP and METplus software, i.e. code repositories, public releases, documentation, helpdesk forums, workshops, tutorials, and training.

LEARN MORE!
ral.ucar.edu/jnt

