Geophysical Research Abstracts
Vol. 20, EGU2018-10341, 2018
EGU General Assembly 2018

Making forecasts better - community infrastructure for facilitating improvement and testing of physical parameterizations

Dom Heinzeller (1,3,4), Ligia Bernardet (1,3,4), Grant Firl (2,3), Laurie Carson (2,3), Christopher Harrop (1,3,4), Pedro Jimenez (2), Gerard Ketefian (1,3,4), Julie Schramm (1,5), Don Stark (2,3), Lulin Xue (2,3), Man Zhang (1,3,4), Dave Gill (2,3)

(1) National Oceanic and Atmospheric Administration, Earth System Research Laboratory, Global Systems Division, Boulder, CO, USA, (2) National Center for Atmospheric Research, Boulder, CO, USA, (3) Developmental Testbed Center, Boulder, CO, USA, (4) University of Colorado Cooperative Institute for Research in Environmental Sciences, Boulder, CO, USA, (5) Colorado State University Cooperative Institute for Research in the Atmosphere, Fort Collins, CO, USA

"Making Forecasts Better" is the vision of the Global Systems Division (GSD) of NOAA's Earth System Research Laboratory. It is also a central goal of operational modeling centers and climate prediction centers, who are always on the lookout for opportunities to improve their numerical weather prediction products, seasonal predictions and climate change projections. Forecast advancements can come from a variety of sources, including the use of additional observations for data assimilation, leveraging the increase of computational power by running models at higher resolution, advanced initialization methods, ensembles, and statistical post-processing. Another fruitful avenue for numerical forecast improvements is the use of improved physical parameterizations, which can provide a more accurate description of sub-gridscale and diabatic processes in the model. This presentation describes an initiative aimed at facilitating the addition of physics innovations to earth system model components in a model-agnostic approach to enable rapid transitions from research to operations and vice versa, and to empower collaborations between modeling communities across the globe.

The Global Model Test Bed (GMTB), which has staff at GSD and at the National Center for Atmospheric Research, has been tasked to develop a Common Community Physics Package (CCPP), a collection of physical parameterizations with a well-described interface that lowers the bar for community scientists to conduct research and contribute innovations to be considered for operational implementation and for sharing with model developers and users. The physical parameterizations within the CCPP are called through an Interoperable Physics Driver, which allows them to be used with a variety of models or dynamical cores, including the GMTB single-column model and the Finite-Volume Cubed-Sphere dynamical core (FV3) planned for use in upcoming operational implementations of the U.S. Global Forecast System (GFS). While the initial development is centered around these models, GMTB's long-term vision is to embrace other weather- and climate modeling groups to leverage the brain power of scientists worldwide and translate it into model improvements accessible to all.

The CCPP, which will initially contain the GFS physics suite and later be augmented with other parameterizations, will be a well-documented, freely-available community-supported code that students and scientists can obtain for experimentation and development. Innovations that have potential for improving components of earth system models can be contributed back, generating a pool of resources for operational centers and research institutions.

In this presentation, we will review progress of the development of CCPP. We will discuss the technical design and the requirements for physical parameterizations to be considered as CCPP-compliant. An application of CCPP will be demonstrated with the atmospheric core FV3, scheduled for becoming operational in the GFS in 2019. We will also describe GMTB's approach for testing and assessing modeling innovations through hierarchical testing, a concept involving assessment at varying levels of complexity. This ranges from controlled experiments using the GMTB single-column model to sophisticated end-to-end hindcast runs, including an extensive set of diagnostics and forecast verification metrics, mostly based on the Model Evaluations Tools (MET) package supported by the Developmental Testbed Center (DTC).