Evaluation of Physical Parameterizations for NGGPS - a Community Testbed

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The model physics community and operational centers share common goals of improving the representation of physical processes in numerical weather prediction (NWP) models and therefore improving forecasts; however, the transition from research to operations (R2O) is often a challenging process. To help address this, the Global Model Test Bed (GMTB) was established within the Developmental Testbed Center (DTC) at the request of the Next Generation Global Prediction System Program Office. The GMTB has several focus areas to assist the research and operational communities by making the R2O pipeline more efficient, with an overarching goal of lowering the barrier to entry for testing and implementing physics innovations into operational models. The GMTB has been charged with developing and supporting a Common Community Physics Package (CCPP), a collection of physical parameterizations with a well-described interface that allows the community to conduct research and contribute innovations to be considered for operational implementation. In addition, the GMTB is actively developing a common testing infrastructure that is available to both the research and operational communities, enabling in-depth investigation of advanced physics suites to facilitate an evidence-based decision making process. Adopting a simple-to-complex framework, the hierarchical test harness includes capabilities such as a Single Column Model (SCM), and the developmental FV3-powered Global Forecast System (GFS). The SCM, developed by the GMTB, allows for testing physical responses to prescribed forcing in a controlled testing environment. In contrast, the global model permits testing physics in a realistic scenario. GMTB adopted the NCEP Global Forecast System (GFS) workflow, which includes pre-processing, cycled data assimilation, forecast model, post-processing, and archiving. The workflow has been enhanced to also include forecast verification using the DTC's Model Evaluation Tools (MET) verification package, forecast graphics generation, and process-oriented diagnostic tools. The hierarchical test harness naturally allows for systematic testing, helping to accelerate the implementation of new model physics innovations into operations.

To demonstrate the utility of hierarchical test harness established by the GMTB, this presentation will highlight the testing of an advanced convective parameterization option within the GFS, the Grell-Freitas (GF) scale-aware scheme. The configuration using the GF scheme was compared against the operational one, which employs the scale-aware Simplified Arakawa-Schubert scheme. In the initial tier of testing, the SCM was run for both configurations for two cases, a maritime deep convective case and a continental deep convective case. Testing with the SCM progressed to more complex three-dimensional testing, involving both cold-started and cycled, global retrospective experiments run for both configurations at a resolution of T574 (~34 km). The sample of retrospective runs allowed for both an in-depth case study analysis as well as an objective statistical assessment.