Evaluation of an advanced convective scheme using the Global Model Test Bed’s physics test harness

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Motivation

Working through the Developmental Testbed Center, the initial focus of the Global Model Test Bed (GMBT) is to develop a framework to evaluate advancements in physics parameterizations for future use in operational NWP. Such a framework consists of an Interoperable Physics Driver (IPD), a Common Community Physics Package (CCPP), and a physics test harness. All three components are under active development. This poster provides a look at the initial use of the physics test harness to evaluate the untuned Grell-Freitas convective parameterization (Grell and Freitas, 2014).

Methods and Tools

The goal of this study is to preliminarily evaluate an untuned version of the Grell-Freitas convection scheme as a potential replacement of the convection scheme (scale-aware simplified Arakawa-Schubert or SASAS) in the 2017 operational GFS physics suite.

- Two deep convective cases: Maritime (TPW-ICE) and Continental (ARM SGP Summer 1997)
- All use T574 grid
- 15 runs initialized at 00Z from June 1, 2016 to June 15, 2016

Physics Test Harness

- Common infrastructure for testing physics development
- Simple-to-complex progression, conceptually and computationally
- Researchers can “enter” test harness at whichever level is appropriate

Provided by the DTC...
- Documentation and access to IPD and CCPP code
- Support for developers to connect schemes
- SCMs code, supported case catalog, ability to compare with observations and operational GFS physics suite
- Support for running operational global model (GFS, FV3-GFS soon) in cold start and cycled DA mode on Theta

Research-to-Operations Pipeline

Steps
1. Develop connects scheme to IPD with tech. support from DTC
2. Developer uses test harness tools to provide evidence of improvement
3. Develop/DTC/NOAA EMC collaborate on formal test plan
4. Developer/DTC/NOAA EMC carry out test plan
5. Results of test plan are provided to governing body for CCPP inclusion decision

Evaluation of multimodal physics and precipitation tendencies

- Maritime (TPW-ICE) and Continental (ARM SGP Summer 1997)
- All use T574 grid
- 15 runs initialized at 00Z from June 1, 2016 to June 15, 2016

SCM Results

- For the maritime case, G-F produces weaker convective tendencies, leaving the grid-scale microphysics scheme to do more "work" to balance the forcing. Interestingly, for the continental case, convective tendencies approach microphysics tendencies with both stronger. It appears the SASAS scheme had less PBL moisture to work with, resulting in less-active convection.

Water Vapor and Clouds

- For both cases and for all analyses periods, the GFS suite with G-F produced profiles with a higher moisture content and higher cloud fractions in the mid-troposphere and below compared to the GFS suite with SASAS.

Acknowledgements

This work is a collaboration of the Developmental Testbed Center; the GMBT project is funded by NOAA’s Next-Generation Global Prediction System (NCGP).

References