Testing and Evaluation of the GSI-Hybrid Data Assimilation at DTC and its Applications for Hurricane Forecasts

Chunhua Zhou¹, Hui Shao¹ and Ligia Bernardet²

¹National Center for Atmospheric Science (NCAR), ²NOAA/Global Systems Division

Abstract

In collaboration with various research and operational centers, the Developmental Testbed Center (DTC) conducts testing and evaluation of the GSI (Gridpoint Statistical Interpolation) based hybrid variational-ensemble Data Assimilation (DA) system for hurricane forecast applications. Multiple cases of tropical storms are run to investigate the various aspects of the GSI-Hybrid DA system, including the cross covariance feature, cycling scheme, background error tuning and data impact, in the framework of the NCEP/EMC (Environmental Modeling Center) GSI-Hybrid DA system for basin scale HWRF (Hurricane Weather Research and Forecast) model. Diagnostics are performed to study the configurations of this developing system and its impact on hurricane forecasts, as part of the effort of operational implementation of the GSI-Hybrid DA system in HWRF.

What is GSI-Hybrid 3DVAR?

- GSI-Hybrid (3DVAR)
- Obs: q=1g/kg at 700mb at 28.9N, 270.5E
- Increment of specific humidity

Model Configuration

- HWRF: basin scale branch from EMC, 61 vertical levels, model top at 2mb, horizontal grid spacing=27km
- GSI: basin scale branch from EMC
- Background: GFS

Cross-covariance investigation

- 3DVAR: β₁=1.0, β₂=0.0
  - 80 global ensembles
  - Horizontal localization scale 600km
- HYB: β₁=0.25, β₂=0.75
  - Single observation is at or around storm center of Isaac (28.9N, 270.5E)
- ENS: β₁=0.0, β₂=1.0
  - Background: 2012082900

Configuration Test

- "Minimal" GSI-hybrid Versus GFS
- CTRL: GFS analysis as background
- CYCL: 1-day cycling prior to analysis time

Future work:

- Better error representation; Radiance DA (new bias correction scheme, cloudy radiance); vortex scale DA.

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