Facilitating the transition of GSI based hybrid EnVar data assimilation research and development on global, hurricane and convective scale prediction to NWS operational NWP suites

A report to the DTC visitor program

Proposal period
08/30/2018 – 12/22/2018

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1. Objectives of the proposal

The Multiscale data Assimilation and Predictability (MAP) lab led by the PI at the University of Oklahoma had performed active research and development of the hybrid EnVar data assimilation on the NWS operational global, hurricane and convective scale numerical weather prediction in collaboration with NOAA. The proposal requested funding from the DTC visitor program to support the PI's sabbatical visit during Fall 2018 (August 30-December 22 2018) at NCEP/EMC. The objectives of the visit were to facilitate the transition of PI's recent R&D for global, hurricane and convective scale data assimilation (DA) to NCEP operation.

2. Outcomes of the sabbatical visit

Through active in-person communication with the global DA, HWRF and regional DA teams at EMC during the visit of the PI, the following specific outcomes were achieved:

a) Accelerated the research, development and potential operational transition of the valid time shifting (VTS) method (Huang and Wang 2018) and the scale dependent localization (SDL) method (e.g. Wang et al. 2018) for the FV3GFS 4DEnVar.
b) Accelerated the operational implementation of the direct radar data assimilation capability in both EnKF and EnVar (Johnson et al. 2015, Wang and Wang 2017, Duda et al. 2019) for the operational HRRR system. The codes developed by the PI's MAP lab on the direct radar assimilation for both EnKF and EnVar are now in the GSI master to facilitate the operational implementation to HRRR and to allow usage and access by the general community. Parts of the direct radar data assimilation codes are used in HRRRv4 which is scheduled for operational implementation at NWS in 2020.
c) Accelerated the research and development of the ground based radar data assimilation for the hybrid DA system for operational HWRF (e.g. Lu et al. 2017, 2018). This capability is planned to be included in the next HWRF upgrade in spring 2020.
d) Further developed new proposals and ideas

3. References (*denote students and postdocs advised by the PI)

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Johnson, A.*, X. Wang, J. Carely, L. Wicker and C. Karstens, 2015: A Comparison of Multi-scale GSI-based EnKF and 3DVar Data Assimilation using Radar and Conventional Observations for Mid-latitude Convective-scale Precipitation Forecasts. *Mon. Wea. Rev.* , 143, 3087-3108.

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Wang, X. and T. Lei*, 2014: GSI-based four dimensional ensemble variational data assimilation (4DEnsVar): formulation and single resolution experiments with real data for NCEP GFS. *Mon. Wea. Rev.*, 142, 3303-3325.

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