

Assimilation of High-Frequency GOES-R Geostationary Lightning Mapper (GLM) Flash Extent Density Data in GSI-Based EnKF and Hybrid for Improving Convective Scale Weather Predictions

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Abstract

The Geostationary Lightning Mapper (GLM) (Goodman et al. 2013) on board of the Geostationary Operational Environmental Satellite R-Series (GOES-R) will provide almost continuous coverage of total lightning (intra-cloud and cloud to ground) data over the continental United States (CONUS). Lightning flash extent density (FED) data products at up to 8 km pixel resolution and sub-minute time intervals will be available. The GLM FED data will be able to provide realtime high-frequency monitoring of severe convection over CONUS and coastal regions, and can be exploited for improving numerical prediction of convective storms.

Through this proposed project, scientists from the Center for Analysis and Prediction of Storms (CAPS) at the University of Oklahoma, and from the National Severe Storms Laboratory (NSSL), in collaboration with the NCEP Environmental Modeling Center (EMC), will work together to develop, implement and test direct assimilation capabilities for GOES-R GLM data within the operational GSI framework, by using advanced ensemble Kalman filter (EnKF) and hybrid ensemble-variational (EnVar) methods. The data assimilation system will also be coupled with advanced multi-moment microphysics schemes to evaluate the impact of microphysics sophistication on the effectiveness of GOES-R GLM data assimilation. The capabilities developed will be first tested using selected, representative convective cases, then evaluated extensively in real time during the Hazardous Weather Testbed (HWT) Spring Experiment. The impacts of assimilating additional GOES-R GLM data with and without operational radar data will be assessed by comparing against parallel data assimilation and forecast members of the Storm-Scale Ensemble Forecasts to be run by CAPS during HWT Spring Experiment.

The work proposed here would help accelerate the use of GOES-R GLM data in operational numerical weather prediction (NWP) models at NCEP, and thereby help meet the Weather Ready Nation objectives and realize the Warn-on-Forecast goals. Given that the data assimilation capabilities are implemented within the operational GSI system and tested for model configurations similar to operational HRRR and high-resolution NAM, they can be readily implemented operationally at NCEP. This proposed research directly addresses program priorities A1, A2 and A3 in the GOES-R Risk Reduction program.