Examining Dense Data Usage near the Regions with Severe Storms in All-Sky Microwave Radiance Data Assimilation and Impacts on GEOS Hurricane Analyses

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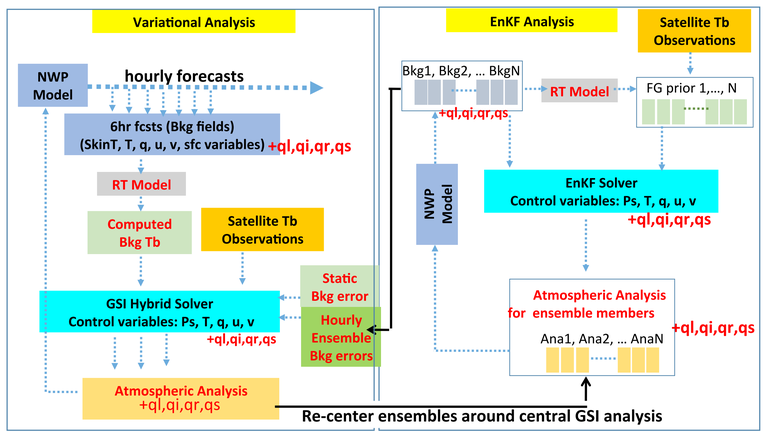
All-sky Microwave Radiance Data Assimilation in GEOS

- The Goddard Earth Observing System (GEOS) Hybrid 4D-EnVar Atmospheric Data Assimilation System (ADAS**)** has been extended to assimilate all-sky microwave radiance data from various microwave sensors such as GPM Microwave Imager (GMI), Microwave Humidity Sounder (MHS), and Advanced Technology Microwave Sounder (ATMS).
- This system provides GEOS analyses with additional constraints on meteorological parameters in cloudy/precipitating regions that are dynamically sensitive to forecast accuracy for precipitation and storms.
- In addition, this all-sky ADAS system is used to generate GEOS Global Precipitation and Cloud Analysis products to support NASA Precipitation Measurement Mission (PMM).

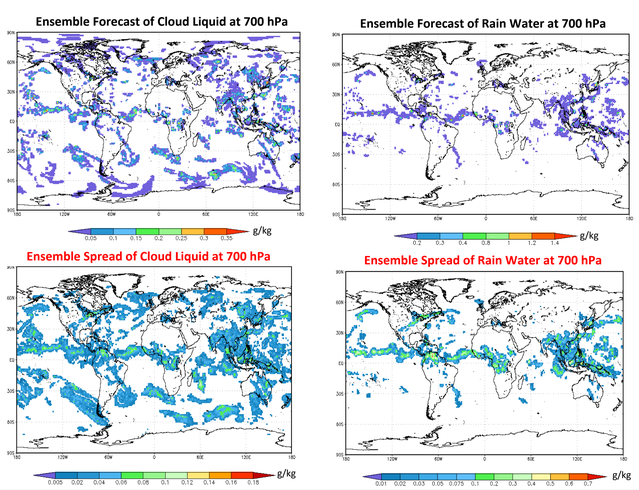
Dynamic Thinning for All-sky Data

- All NWP centers apply large data thinning distances (e.g. 145 km in GEOS ADAS) in assimilating clear-sky radiance data to avoid correlated observation errors. However, satellite data in cloudy and precipitating regions have relatively small spatial correlations in observation errors due to inhomogeneous spatial distributions of clouds and precipitation**.**
- To maximize the impact of all-sky radiance data, a dynamic thinning distance method has been developed in GEOS all-sky framework to apply short thinning distances to the data in cloudy and precipitating regions while keeping 145 km thinning distance for the satellite data in clear sky regions.
- Using this method, benefits of all-sky microwave radiance data on GEOS hurricane analyses and forecasts are examined in this study.

GEOS All-sky Data Analysis System
(Hybrid 4D-EnVar GSI based)

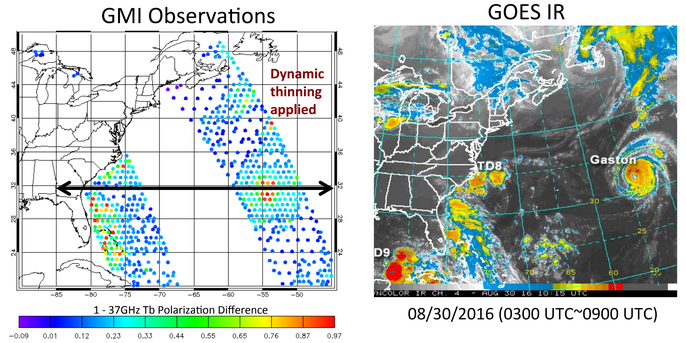


Background Errors for Moisture Variables from 32 GEOS Ensemble Forecasts

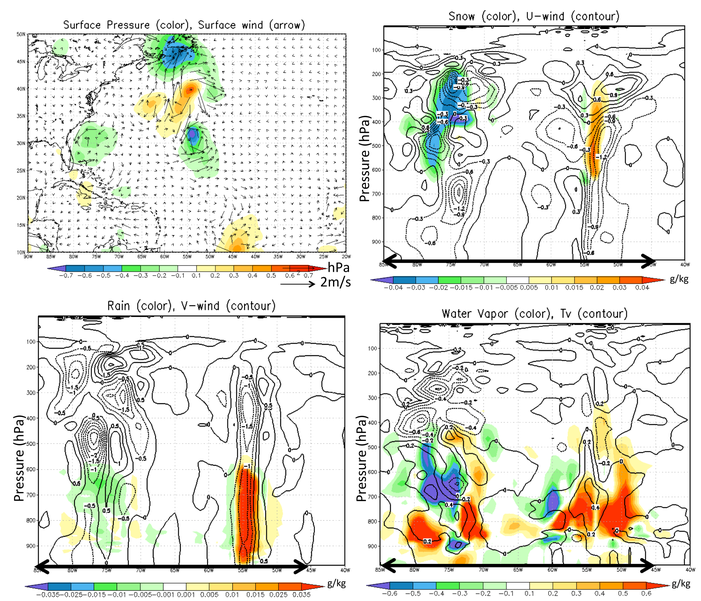


Impacts on Hurricane Analyses
Hurricane Gaston (2016)

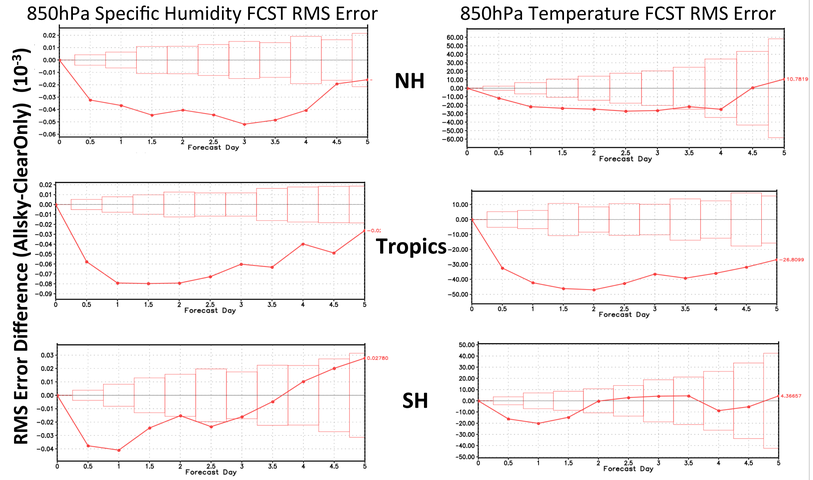
Observations



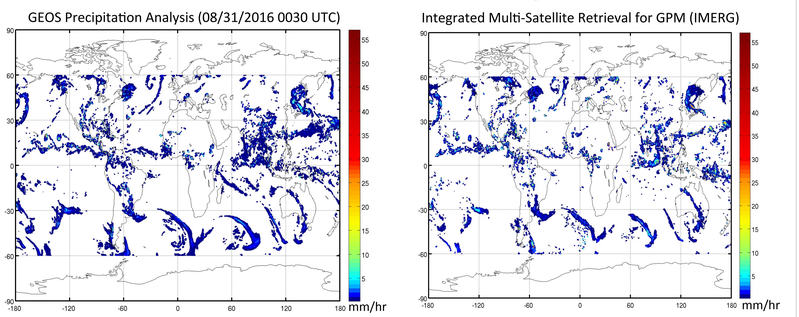
Changes made in GEOS analyses by assimilating all-sky data



Impacts on GEOS Forecasts



GEOS Global Precipitation Analysis Products



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