2.5 Overview of the NASA-Unified WRF model

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The NASA Unified Weather Research and Forecasting (NU-WRF) modeling system is an observation-driven regional Earth System modeling and assimilation system at satellite-resolvable scale. The NU-WRF currently combines the capabilities of the WRF ARW with the Land Information System (LIS), the Goddard Chemistry Aerosol Radiation and Transport (GOCART) model, Goddard microphysics and radiation coupling, and their coupling for cloud-aerosol-precipitation-land surface processes and interaction. NU-WRF outputs can be directly compared with wide variety of satellite radiance/backscatter data and products via the Goddard Satellite Data Simulator Unit (G-SDSU). Further, the NU-WRF connects with global-scale modeling efforts, including the GEOS-5 and the MERRA, which can be used as atmospheric boundary and initial conditions.

This presentation highlights variety of NU-WRF studies, including high-resolution weather forecasting for supporting NASA field campaigns, the impact of microphysics on hurricanes, impact of dust aerosols on deep convection, impact of land cover class on near-surface chemistry concentrations, and satellite radiance-based model evaluation. Current NU-WRF development focuses on advanced component couplings and integration of existing land and atmospheric data assimilation. LIS V7 coupling supports assimilation of satellite-derived soil moisture, snow depth, and snow cover to provide the best estimate of land-surface initial states. The Ensemble Data Assimilation (EDA) system based on the Maximum Likelihood Ensemble Filter (MLEF) is a wrapper framework that generates ensemble simulation of NU-WRF to assimilate satellite-observed microwave brightness temperature for constraining precipitation fields and related atmospheric state as a unified system. These advanced NU-WRF data assimilation frameworks are designed to harness current and future satellite missions, including recently launched Global Precipitation Measurement (GPM) and upcoming Soil Moisture Active Passive (SMAP) missions.