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Development of the High-Resolution Rapid Refresh (HRRR) Version 4 and Transition to an FV3-Based Rapid Refresh Forecast System (RRFS)

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The High Resolution Rapid Refresh (HRRR) is an hourly-updated 3-km Weather Research and Forecasting (WRF-ARW) Convective Allowing Model (CAM) developed at the Earth Systems Research Laboratory (ESRL) Global Systems Division (GSD) and run operationally at the National Center for Environmental Prediction (NCEP) in the United States. The current experimental HRRR provides deterministic guidance for 0 to 36 hours over the contiguous United Sates as well as over Alaska. The forecasts aid in the production of severe weather outlooks and watches, prediction of aviation hazards, and provide guidance for renewable energy applications.

HRRR version 4 is the last WRF-ARW based version being transitioned to operations and it is expected to be implemented by Spring 2020. This presentation will provide an update on the latest development work for HRRRv4, including a focus on the use of CAM ensemble covariance information for improved initialization. Preliminary results have shown that use of the CAM ensemble covariance information in the hybrid analysis for the HRRR improves the deterministic forecast. We are currently working on optimizing this configuration to allow for partial cycling of the deterministic HRRR (as opposed to initializing it with a pre-forecast hour spin-up off of the RAP each hour). There is a tradeoff between HRRR cycling to maximize the benefits of the small-scale covariance information and reducing potential model drift. Additionally, we are working to determine the optimal configuration of the ensemble assimilation system, again with a desire to optimize the tradeoff between small-scale cycled assimilation and potential drift from the larger-scale systems.

The future of CAM systems like the HRRR will be to provide real-time ensemble analyses and forecasts, in order to produce improved skill and uncertainty information. To this end, development of an FV3-based CAM ensemble assimilation and prediction system known as the Rapid Refresh Forecast System (RRFS) has begun. A stand-alone regional (SAR) version of the FV3 is now running. This is being following by work to build the HRRR physics modules and data assimilation features into the FV3-based SAR configuration. The physics modules include Thompson microphysics, MYNN PBL scheme, and RUC LSM scheme, while the data assimilation features include the HRRR radar reflectivity procedure and the special modification for surface observations. This SAR FV3 work is geared to a planned operation transition to the RRFS in the 2022 time frame. At the conference, we will report on the latest developments in this work.