3.3 Addressing model uncertainty through stochastic parameter perturbations with the Thompson microphysics scheme as part of a High Resolution Rapid Refresh ensemble.

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In many regional ensemble numerical weather prediction (NWP) systems, model-related uncertainty is addressed by using multiple dynamic cores, multiple physics suites, or some combination of these methods. While these approaches have demonstrated potential, they have practical and theoretical deficiencies and are more difficult and costly to maintain, particularly in an operational environment. In an effort to move toward a more sustainable and unified system, the Developmental Testbed Center (DTC) has undertaken several extensive tests using stochastic parameter perturbations (SPP) within physics parameterizations. Most recently, the DTC has conducted extensive testing to target known parameter uncertainties within the hybrid graupel/hail category of the Thompson microphysics scheme using the Weather Research and Forecasting (WRF) Advanced Research WRF (ARW) forecast model with a physics suite based on the operational High Resolution Rapid Refresh (HRRR) model. In these tests, the relationship used to specify the Y intercept parameter of the assumed inverse exponential size distribution within the Thompson scheme was stochastically perturbed and the resulting ensemble forecast performance was investigated.

Results of the stochastic-based ensemble performance were evaluated in terms of fields such as accumulated precipitation, simulated radar reflectivity, near-surface variables, and upper level variables; a meaningful subset will be presented. The extensive evaluations were conducted using the Model Evaluation Tools (MET) software system. The focus of the presentation will be on metrics used for probabilistic and deterministic evaluation, including traditional metrics widely used in the community and newer methods that provide additional diagnostic information, especially at higher resolution.