The use of "stochastic physics" in data assimilation: Application to the operational hybrid GDAS and plans for NGGPS/FV3

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The operational global data assimilation system (GDAS) at NCEP has utilized a hybrid ensemble-variational (EnVar) scheme since May 2012. Since the original implementation, the scheme has had an 80-member ensemble at reduced resolution that is cycled along with the full resolution control and updated each cycle with a serial, square root filter (EnSRF, Whitaker and Hamill 2002). The representation of various components of system errors is critically important in order for the ensemble to properly represent the background error covariances. The original implementation utilized a combination of relaxation to prior spread (RTPS, multiplicative) and lagged-forecast pair perturbations added to the ensemble posterior (Whitaker and Hamill 2012). The system has since evolved to supplement and eventually replace the additive perturbations with various so-called stochastic physics parameterizations. The three schemes that are currently used operationally are stochastically perturbed physics tendencies (SPPT), stochastic energy backscatter (SKEB), and stochastically perturbed boundary layer humidity (SHUM).

Here, we will present a description of the three schemes as well as demonstrate their impact on data assimilation within the context of replacing the additive inflation. We will also describe status and plans for the use of stochastic physics in the data assimilation for the next generation global prediction system (NGGPS) using the FV3 dynamics core.