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Physics-Based Stochastic Ensemble Generation in the NCEP GFS Model

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It has been widely recognized that perturbing physics parameterizations in numerical weather prediction (NWP) models may lead to better spread of the model state for ensemble prediction. Over the past few years, research has been conducted at NOAA/ Earth Systems Research Laboratory (ESRL) to assess and represent uncertainties in the physics of the Global Forecast System (GFS) for the purpose of improving ensemble spread of the operational ensemble prediction system at the National Centers for Environment Prediction (NCEP). The starting point of the research is to perturb the convective parameterization scheme in the GFS model. The perturbation is generated through a stochastic permutation of different closure assumptions and trigger functions, resulting in an ensemble of possible model realizations of global convective activities. Experimental runs using the NOAA/ESRL experimental ensemble Kalman Filter (EnKF) data assimilation system with the perturbed convective parameterization scheme have been carried out for a month-long 5-day forecast experiment. The preliminary results indicate that the stochastic perturbation rendition of the convective parameterization scheme is shown to be capable of improving the spread of ensemble forecasts in the tropics, which leads to an improvement in the tropical analysis from the EnKF data assimilation system.