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Stochastic parameterizations: Impact on short-term perturbation growth and ensemble prediction.

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In this paper, the characteristics of perturbation growth due to stochastic physical parameterizations are examined in detail. It is shown that the initial perturbation growth due to stochastic parameterizations is rapid and, despite the lack of spatial correlations in the stochastic forcing, results in rapid upscale energy growth. The influence of stochastic parameterizations on initial ensemble perturbation characteristics and subsequent ensemble performance is also examined. Because of the cycling nature of the ensemble transform (ET) initial ensemble perturbation scheme, this short-term perturbation growth due to the stochastic parameterizations has a profound impact on the characteristics of the ET initial perturbations. Results from the implementation of this stochastic convection scheme in the Navy Operational Global Atmospheric Prediction System (NOGAPS) ET ensemble show significant improvements in ensemble behavior with the inclusion of stochastic parameterizations. These include improved initial perturbation amplitudes in the tropics, as well as a decrease in ensemble mean errors and a decrease in excessive outliers (cases where the verification lies outside the ensemble range). Results will focus on the impact of stochastic moist convection, but will include preliminary results from other stochastic parameterizations as well.