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Representing Microphysical Uncertainty in Convective-Scale Data Assimilation Using Additive Noise

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For convective clouds and precipitation, model uncertainty in cloud microphysics is considered one of the most significant sources of model error. In our recent paper (Feng et al. 2021), samples for model microphysical uncertainty are obtained by calculating the differences between simulations equipped with two- and one-moment schemes during a one-month training period. The samples are then added to convective-scale ensemble data assimilation as additive noise and combined with large-scale additive noise based on samples from climatological atmospheric background error covariance. Two experiments, including the combination and large-scale error only, are conducted for a one-week convective period. The results reveal that the simulation with a two-moment scheme triggers more convection and has larger ice-phase precipitation particles, which produce a stronger signal in the melting layer. During data assimilation cycling, although more water is introduced to the model, it is shown that the combination performs better for both background and analysis and significantly improves short-term ensemble forecasts of radar reflectivity and hourly precipitation.

Feng, Y., Janjić, T., Zeng, Y., Seifert, A., & Min, J. (2021). Representing microphysical uncertainty in convective-scale data assimilation using additive noise. Journal of Advances in Modeling Earth Systems, 13, e2021MS002606.