Are we minimizing the appropriate errors in data assimilation for weather forecasting?

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Abstract

Data assimilation approaches and algorithms used for weather forecasting generally seek to minimize errors on model fields at analysis time and at the resolution of the model to help reduce forecast errors. While this may be the best assimilation strategy to improve analyses, does it lead to the best forecasts? If not, what error minimization criteria should be used for smaller initial condition errors to result in improved forecast skill? Four error-minimization criteria were considered, together with their combination: lower errors at analysis time, at two times, on smoothed fields, and on time tendencies. Four months of existing forecasts from the Canadian Global Ensemble Prediction System were analyzed in a simulation context. We determined the extent with which pairs of members with smaller differences considering different types of initial condition errors led to smaller differences in forecasts. At short forecast times, minimizing errors on initial values still provides the best forecasts; for medium-range forecasts, also minimizing errors on initial tendencies provide additional value as both types of errors are not 100% correlated. This suggests that, for best forecast results, we may want to adjust assimilation approaches to also minimize errors on tendencies.

Keywords: approaches, tendency errors, errors on tendencies, medium, range, value matrix

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