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Assimilation of hurricane position with an ensemble Kalman filter

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Satellite imagery often is sufficient estimate the position of isolated atmospheric vortices, such as hurricanes. Such position information is used only indirectly in initialing numerical forecast of hurricanes, usually through various vortex-bogussing algorithms. We explore the direct assimilation of observations of vortex position and other vortex characteristics with an ensemble Kalman filter (EnKF). Tests with a simple barotropic model suggest the method should work well as along as the background errors in vortex position are smaller than the vortex scale; when background errors are too large, forecast probability distributions for state variables become strongly non-Gaussian and the EnKF analysis, can be far from optimal, since it is based on first and second moments only. Frequent position observations, as are available from geostationary imagery, are thus essential to the method. For two observed hurricane cases, the method improves forecasts in a regional model significantly over those initialized directly from operational analyses. Experiments for the observed cases employ the Data Assimilation Research Testbed (DART) and the Weather Research and Forecasting (WRF) model.