

Comparison of Two Pairs of Momentum
Control Variables in WRFDA for Convective-scale Data Assimilation

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The variational data assimilation system for the WRF-ARW model is among a number of large-scale data assimilation systems that use stream function and velocity potential as momentum control variables. As recent development of the WRF data assimilation is moving toward the convective-scale applications, we ask the question whether the control variables of stream function and velocity potential are appropriate for domains with limited size and fine grid spacing. In this paper, we compare the background error characteristics of this pair of control variables with that of eastward and northward velocity components and their relative impacts on high-resolution analysis and convective forecasting. The background error characteristics that are examined include the correlation between the control variables and the closeness to Gaussian error distribution. Single observation experiments are conducted to examine the responses of variance and length scale. Finally, a real data experiment is conducted to investigate their impacts on the variational analysis and convective forecasting.