Choice of Control Variables in Variational Data Assimilation and Its Analysis and Forecast Impact

Yuanfu Xie (1), Jenny Sun (2), and Wei-ting Fang (3)

(1) US NOAA Earth System Research Lab/Global Systems Division, Boulder, CO, USA, (2) NCAR, Boulder, CO, USA, (3) Central Weather Bureau, Taiwan

Choice of control variables directly impacts the analysis qualify of a variational data assimilation and its forecasts. A theory on selecting control variables for wind and moisture field is introduced for 3DVAR or 4DVAR. For a good control variable selection, Parseval's theory is applied to 3-4DVAR and the behavior of different control variables is illustrated in physical and Fourier space in terms of minimization condition, meteorological dynamic scales and practical implementation. The computational and meteorological benefits will be discussed. Numerical experiments have been performed using WRF-DA for wind control variables and CRTM for moisture control variables. It is evident of the WRF forecast improvement and faster convergence of CRTM satellite data assimilation.