A domain (180x180x70L, 60km) centered over Arctic region (Figure 1) is chosen for testing the impact of regional versus global background error statistics.

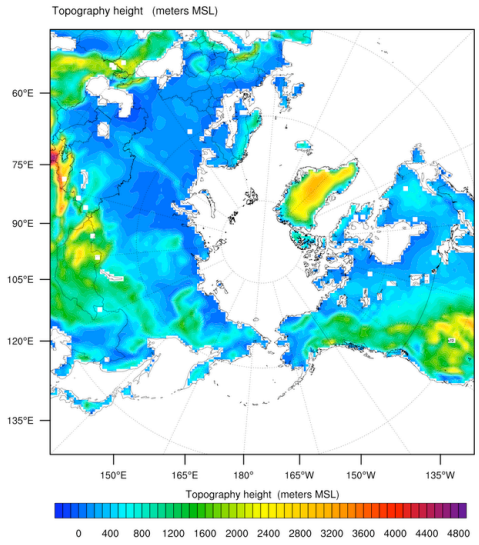

Figure 1

One-month (December 2007) of 24h and 12h forecasts initialized from ECMWF ERA-Interim analysis are used to calculate the domain-specific background error statistics using the newly-developed GEN_BE_gsi utility. Figure 2 shows the domain-averaged variance profiles of stream function, unbalanced velocity potential, unbalanced temperature and moisture. Figure 3 is the latitude-dependent variances of unbalanced surface pressure. Blue is from regional domain-specific BE and red is from the default global BE file (nam_glb_berror.f77.gcv) with the tuning factors, as = 0.6 (psi), 0.6 (chi), 0.75 (t), 0.75 (q), 0.75 (ps). In general, global BE has larger variances than regional BE except for the lower level temperature.

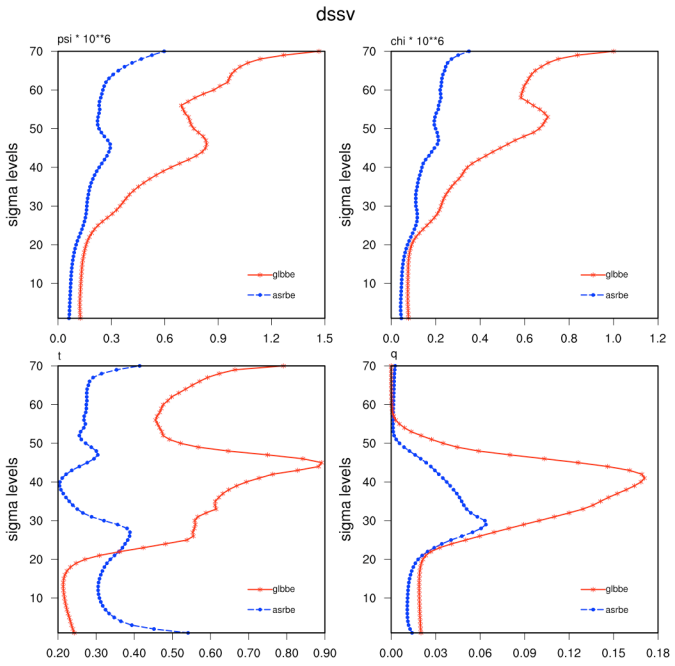

Figure 2

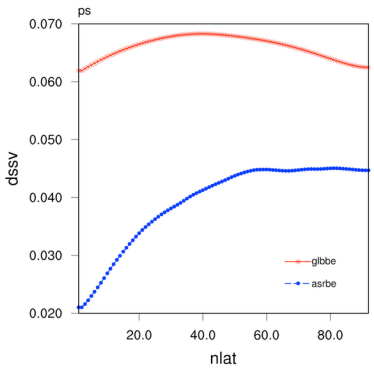

Figure 3

Two experiments with different background error statistics are conducted for the period of 2007120106-2007121018 to compare the performance of data assimilations as well as model forecasts. For each analysis time, the first guess is WRF 6h forecast initialized from ERA-Interim analysis. Conventional data are assimilated and then the WRF model is run to produce forecasts up to 24 hours.

Figure 4 shows the analysis fit to soundings. The assimilations using global BE fit closer to soundings except for the low-level winds and temperatures.

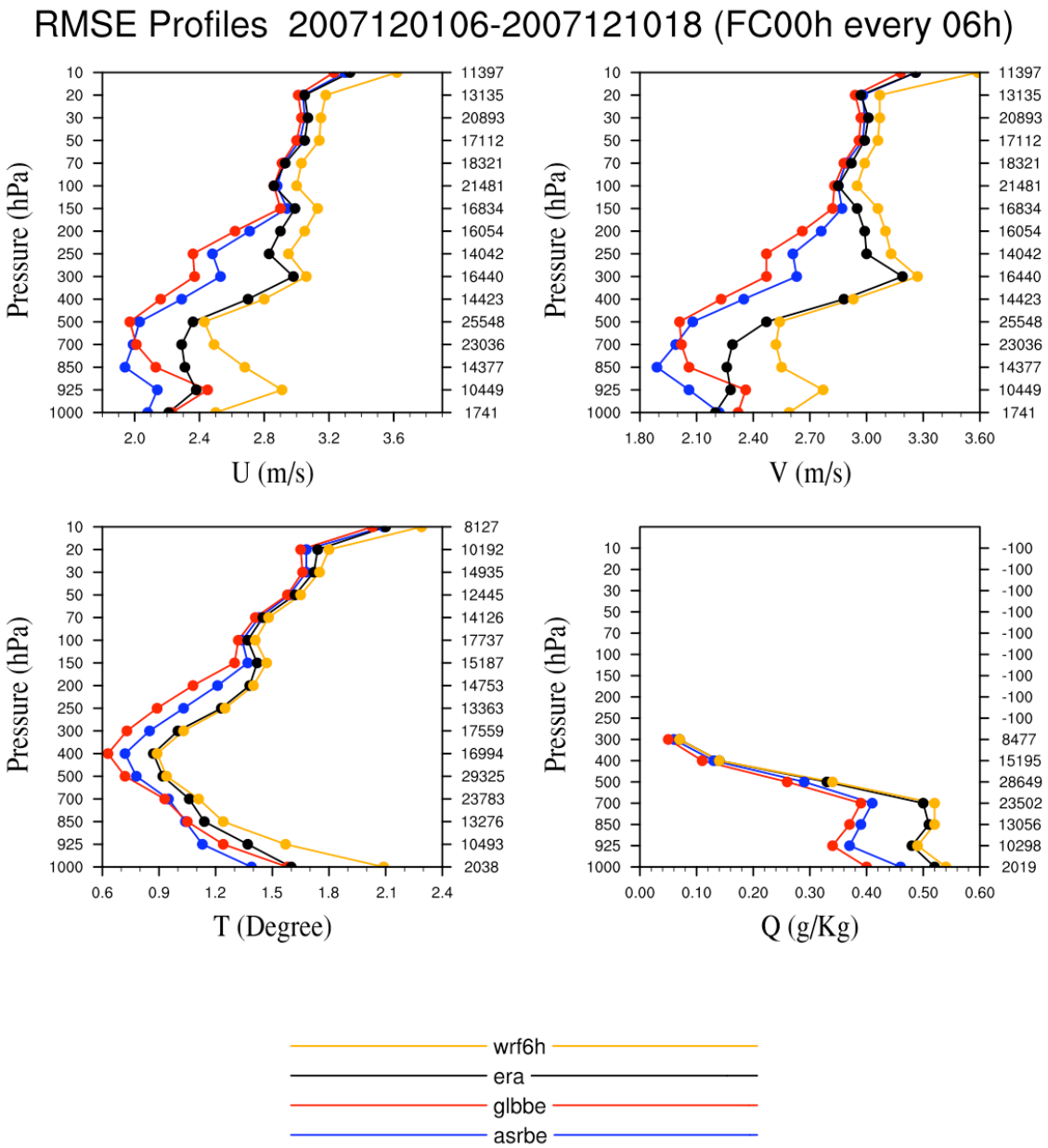

Figure 4

Regional domain-specific BE has smaller variances, therefore the analysis increments are generally smaller and the analysis fit to observations are not as close as those with global BE. However, when comparing the forecast scores, the regional domain-specific BE assimilated initial conditions generally slightly outperform the global BE runs, except for the near surface temperatures, as seen in Figure 5-7.

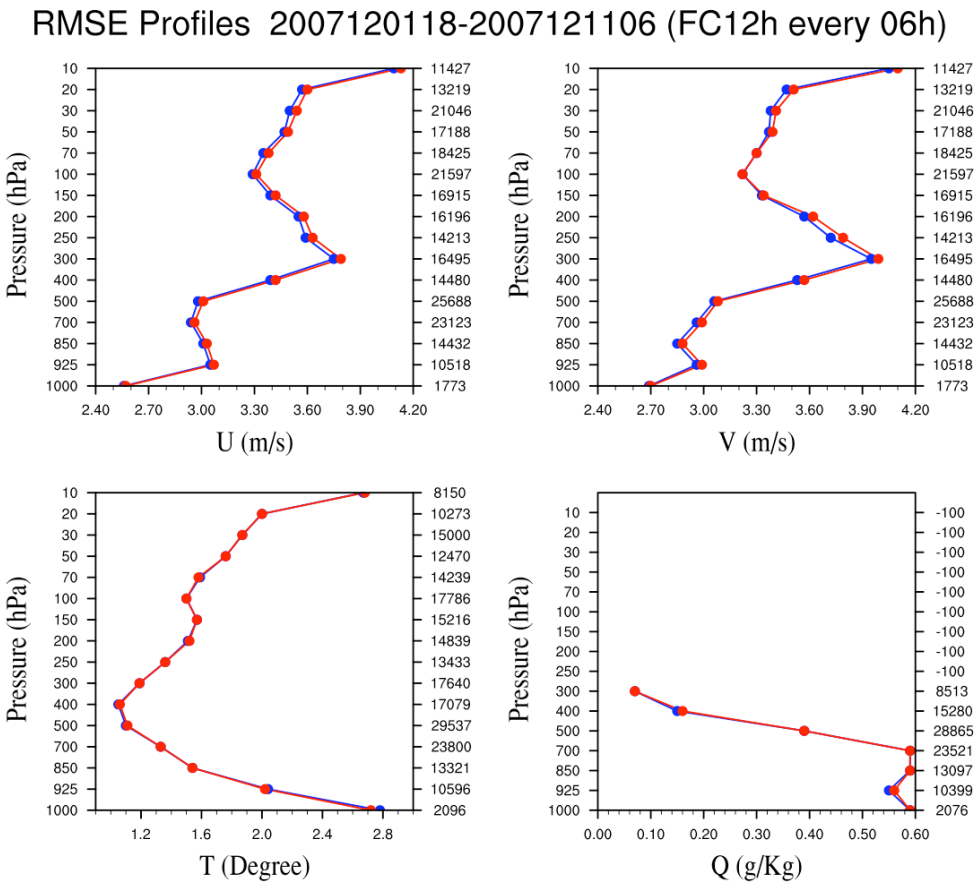

Figure 5: WRF 12h forecasts verified against soundings. Blue: experiments with regional domain-specific BE. Red: experiments with global BE.

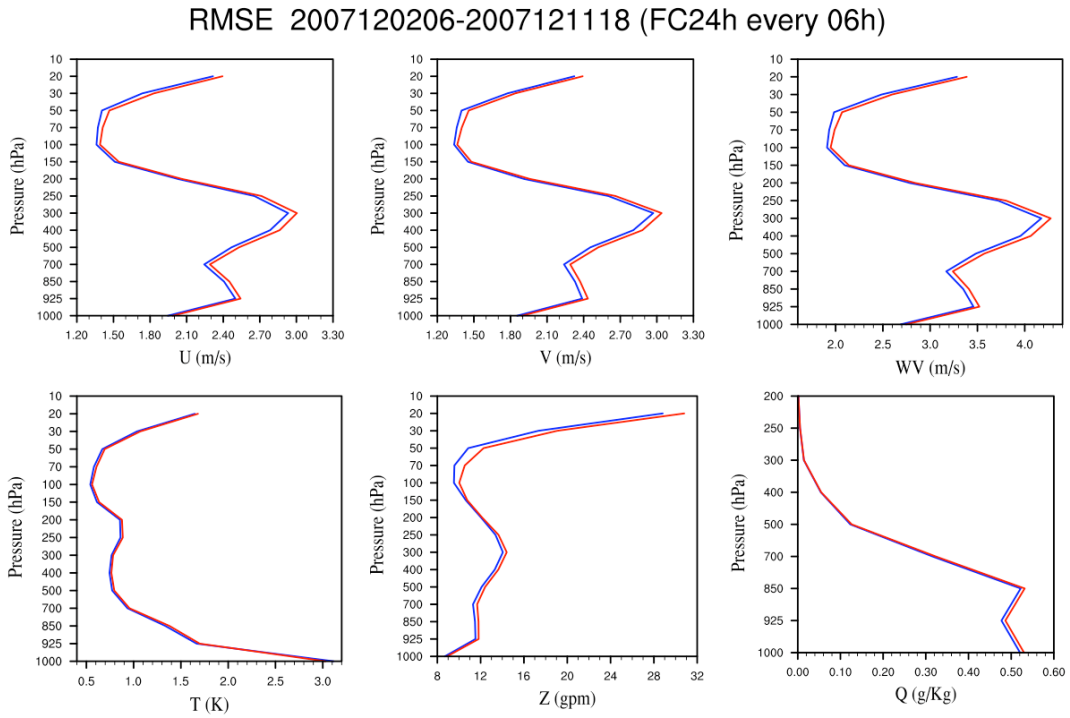

Figure 6: WRF 24h forecasts verified against ERA-Interim analysis. Blue: experiments with regional domain-specific BE. Red: experiments with global BE.

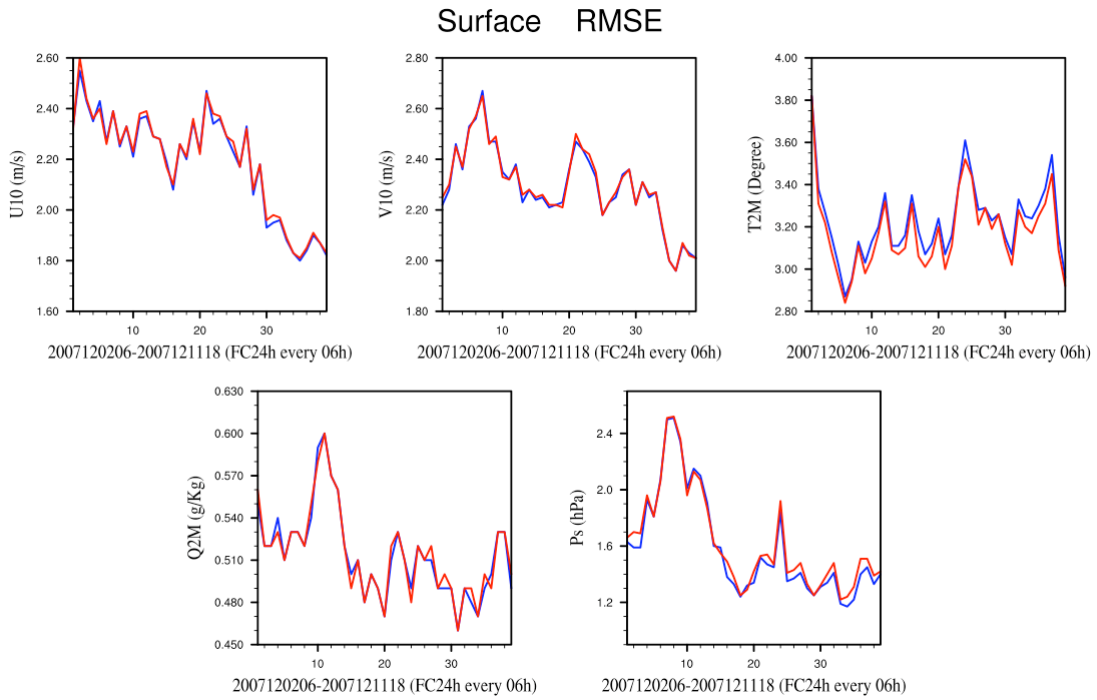

Figure 7: WRF 24h forecasts verified against synops. Blue: experiments with regional domain-specific BE. Red: experiments with global BE.