IMPACT OF INCREASING THE HORIZONTAL RESOLUTION OF A REGIONAL FORECAST AND ANALYSIS SYSTEM BASED ON THE A ENSEMBLE KALMAN FILTER: A REAL CASE STUDY.

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ABSTRACT

In this study the impact of increasing the model resolution upon the quality of an ensemble based data assimilation system is investigated. This is done by performing data assimilation experiments with real observations over the Western North Pacific during a 40-day period of the 2008 typhoon season. Two ensembles of initial conditions with horizontal resolutions of 20 and 60 km are generated using the Local Ensemble Transform Kalman Filter (LETKF) and the Weather Research and Forecasting (WRF) model. 72-hour forecasts are initialized every 6 hours using the initial conditions generated with the different horizontal resolutions. Another set of forecasts is initialized with the NCEP operational Global Data Assimilation System (GDAS) analyses.

The results show that increasing the horizontal resolution results in a 10% error reduction in the representation of the atmospheric flow using GDAS analyses as a reference. This improvement is also observed in the forecast quality of winds, temperature, surface pressure and accumulated precipitation. However, the forecast of tropical cyclones does not show a clear improvement when the resolution is increased from 60 to 20 km. The skill of the forecasts initialized with the 20 km analysis is lower than the skill of the forecasts initialized with the GDAS analysis. This may be because GDAS assimilates satellite radiances that were not used in the LETKF. The satellite data are particularly important over the oceans where observations are generally sparser. This suggests that even though the increment of the analysis horizontal resolution is a key element in the improvement of forecast skill, such improvement may be limited by the amount of available observations that are ingested in the assimilation system.

Key words: data assimilation, horizontal resolution, short range forecast, WRF