Ensemble Forecast Sensitivity to Observations Verified with Multiple References

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Abstract

It is important to evaluate the impact of assimilated observations on forecast skill in numerical weather prediction (NWP). Several methods have been proposed to estimate the impact of observations with adjoint-based or ensemble-based sensitivity analysis. Most studies evaluate the observational impact using their own analyses as a verification reference. This study investigates the sensitivity of the impact estimates to the choice of the verification reference. We implemented the ensemble-based forecast sensitivity to observation (EFSO) method proposed by Kalnay et al. (2012) with a global atmospheric data assimilation system NICAM-LETKF (Terasaki et al. 2015 and follow-on studies), which comprises the Nonhydrostatic ICosahedral Atmospheric Model (NICAM) and Local Ensemble Transform Kalman Filter (LETKF). We evaluate the impact of observations with the moist total energy norm verified against the NICAM-LETKF's own analysis and the ERA Interim reanalysis. In addition, we implemented an observation-based verification metric proposed by Sommer and Weissmann (2016) and Cardinali (2017).

The results suggest that the observational impact be overestimated in 6-h forecasts if the NICAM-LETKF analysis is used for the verification reference. However, no overestimation is observed if we use the ERA-Interim reanalysis and radiosonde observations for the reference. The results imply that the impact of observations at the analysis time would persist in the analysis 6-h later. In the observation-based verification metric, each type of observations mainly contributes to the improvement of the observed variable. For instance, assimilation of the AMSU-A radiances significantly improves the first guess of the AMSU-A radiances at the next assimilation cycle, but this is not necessarily true to other observations. This presentation will include the most recent progress up to the time of the symposium.