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Examining the Sensitivity of the Accuracy of EFSO to Ensemble Size

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Data assimilation plays a critical role in the advancement of numerical weather prediction (NWP) via ingesting information of atmospheric observations from various platforms. As more and more observations become available, it is important to quantify the impact of assimilated observations on a forecast to help improve the use of these observations. Currently several approaches exist to estimate observational impact on the forecast skills. Ensemble Forecast Sensitivity to Observations (EFSO) is one such approach that extends upon the adjoint-based FSO method by utilizing ensemble of forecasts in replacement of an adjoint model. However, like any ensemble-based methods, EFSO also suffers from sampling error due to the use of limited-sized ensemble. This is more severe when we take ensemble-based correlations between different times. In recent years, the rapid advancement of supercomputing has facilitated the use of large number of ensemble members in NWP. Many studies have demonstrated the use of large ensembles in the context of data assimilation, however, the use of large ensemble to quantify observation impact via EFSO is yet to be explored. In this study, we implemented the EFSO method for a global atmospheric data assimilation system that consists of the Non-hydrostatic Icosahedral Atmospheric Model (NICAM) with the Local Ensemble Transform Kalman Filter (LETKF), namely the NICAM-LETKF. Using a total of 1024 ensemble members, we can examine the sensitivity of ensemble size to the accuracy of EFSO estimated error reduction via sub-sampling. We will present results from a series of EFSO experiments with the 1024-member NICAM-LETKF to conclude our findings.