Toward practical use of EFSO for weekly weather forecasts: Dynamics of propagation of observation impacts

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An ensemble-based forecast sensitivity to observations (EFSO) diagnosis has implemented in an Atmospheric GCM–Ensemble Kalman Filter data assimilation system to estimate the impacts of specific observations in the quasi-operational global observing system on weekly short- and medium-range forecasts. EFSO can quantify how much each observation has improved or degraded the forecast without observing-system (another data assimilation) experiments, that is, an offline diagnosis. In order to examine whether EFSO values correctly quantify the impacts of a subset of observations performed in a specific geographical spot in 6-hour to 7-day forecasts, EFSO values were compared with actual observation impacts obtained from multiple data denial experiments in each of which a subset of three radiosonde observations launched from a geographical spot was excluded. The spots were selected from three latitudinal bands comprising (1) Arctic regions, (2) midlatitude regions in the Northern Hemisphere, and (3) tropical regions during the winter of 2015/16. The results showed that all EFSO values reasonably estimated the observation impacts on short-range (6-hour to 2-day) forecasts. Furthermore, it was found that the initial Arctic observation impacts, which could be estimated by EFSO, remained in medium-range (7-day) forecasts because the Arctic is located at the upstream of dynamical propagation toward the midlatitudes where small perturbations rapidly and spontaneously grow. Therefore, EFSO can be useful for weekly forecasts for anticipating impacts of specific observations by considering dynamical propagation.