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Tse-Chun Chen

P-13 "No-cost" Proactive Quality Control (PQC) by the Use of Linearly Approximated Analysis

Operational numerical weather prediction (NWP) systems occasionally exhibit "forecast skill dropouts" in which the forecast skill drops to an abnormally low level, due in part to the assimilation of flawed observational data. Recent studies have shown that a diagnostic technique called Ensemble Forecast Sensitivity to Observations (EFSO) can detect such observations (Kalnay et.al 2012; Ota et al. 2013, Tellus A). Based on this technique, a new Quality Control (QC) scheme called Proactive QC (PQC) has been proposed which detects "flawed" observations using EFSO after 6 hours from the analysis when the analysis at the next cycle becomes available for verification and then repeats the analysis and forecast without using the detected observations (Hotta et al. 2014). PQC has been proven, with the NCEP's quasi-operational system, to significantly reduce the occurrences of "forecast skill dropouts" and thus its operational implementation is highly desired. An issued to be resolved before the operational implementation is the necessity to perform analysis twice: operational NWP systems generally impose very tight schedule to ensure real-time delivery of products and thus may not be able to afford to perform additional analysis. It would thus be necessary to somehow minimize the computational cost. In this study, we propose to circumvent this issue by using linear approximation to the analysis rather than repeating the analysis: the approximation for the Kalman gain matrix used in the derivation of EFSO formulation can be used to estimate the change in the analysis that would result by not assimilating a certain subset of the assimilated observations. This approximation is computationally much less expensive than re-running the costly analysis and thus, if the approximation is accurate enough, the feasibility of PQC in a real-time environment can be significantly enhanced. In this presentation, we will present the results of comparison between the approximated and the un-approximated analyses to demonstrate the feasibility of PQC in real-time operational NWP systems.