Ensemble Kalman filtering for assimilation of mesospheric and lower thermospheric observations

Tomoko Matsuo[1]; Jeffrey L. Anderson[2]

[1] CIRES, CU-Boulder; [2] IMAGE, NCAR

In this paper the ability of the Ensemble Kalman Filter (EnKF) to assimilate a realistic set of space-based observations currently available in the Mesosphere Lower Thermosphere (MLT) region is examined. An EnKF assimilation system has been constructed using a time-dependent, dynamical, chemical stratosphere-mesosphere-thermosphere model with the National Center for Atmospheric Research (NCAR) Data Assimilation Research Testbed (DART). While dynamics of the MLT region exhibit considerable internal variability, the region is strongly controlled by the tropospheric conditions. The model error growth in the MLT region, resulting from a complex interplay of internal variability and external forcing, and its interaction with the EnKF are crucial in controlling the quality of the assimilations. On the other hand, it is important to account for estimation of external forcing in the EnKF to reduce systematic inconsistency between observations and model states. The EnKF application to the MLT is further challenged by a rather irregularly distributed sparse observational network. We discuss roles of auxiliary algorithms (such as adaptive covariance inflation and localization of covariance) in the EnKF to cope with these challenges.