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An update on the 4D-LETKF data assimilation system for the whole neutral atmosphere

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The four-dimensional local ensemble transform Kalman filter (4D-LETKF) data assimilation system for the whole neutral atmosphere is updated to better represent disturbances with wave periods shorter than 1 day in the mesosphere and 10 lower thermosphere (MLT) region. First, incremental analysis update (IAU) filtering is introduced to reduce the generation of spurious waves arising from the insertion of the analysis updates. The IAU is better than other filtering methods, and also is commonly used for the middle atmospheric data assimilation. Second, the horizontal diffusion in the forecast model is modified to reproduce the more realistic tidal amplitudes that were observed by satellites. Third, the Sounding of the Atmosphere using Broadband Emission Radiometry (SABER) and Special Sensor Microwave Imager/Sounder (SSMIS) 15 observations in the stratosphere and mesosphere also are assimilated. The performance of the resultant analyses is evaluated by comparing them with the mesospheric winds from meteor radars, which are not assimilated. The representation of assimilation products is greatly improved not only for the zonal mean field but also for short-period and/or horizontally small-scale disturbances.