Effects of Assimilation Window Length on Diurnal Features in a Mars Atmosphere Reanalysis

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Effective simulation of diurnal features is an important aspect of many geophysical data assimilation systems. For the Martian atmosphere, thermal tides are particularly prominent and contribute much to the martian atmospheric circulation and dust transport. To study the Mars diurnal features (or thermal tides), data assimilation based on the GFDL Mars Global Climate Model (MGCM) with the 4D-Local Ensemble Transform Kalman Filter (4D-LETKF) is used to perform a reanalysis of satellite observed temperature retrievals. Since the traditional 6-hr assimilation cycle induces spurious resonance in the Kelvin waves represented in both surface pressure and mid-level temperature, different assimilation window lengths are introduced in 4D-LETKF. In order to compare the performances of different assimilation window lengths, 6-hr and 12-hr forecasts based on the hour 00 and 12 reanalysis are evaluated and compared. The shorter windows show improved forecast root mean square difference with respect to observations, and not only removes the spurious resonance but also improves the analysis of the 50-pa temperature, wave number 2, and westward propagating semi-diurnal wave .