

The mean flow influence on the seasonal and interannual variations of the migrating diurnal tide

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The amplitude migrating tide in the mesosphere and lower thermosphere is observed to vary on a seasonal time scale, with maximum amplitude during the March equinox. It is also observed to vary from year to year, with some evidence that the tide amplitude is correlated with the phase of the quasi-biennial oscillation (QBO). Many mechanisms that govern tide amplitude variability have been proposed, including variations in tide source strength, mean-flow modulation of the gravity wave interaction with the tide, and the direct interaction of the mean flow with the tide itself.

This paper will present simulations with a tide model that reproduce the tide amplitude variability observed by the High Resolution Doppler Imager (HRDI) aboard the Upper Atmosphere Research Satellite (UARS) from 1992-1999. The model includes diurnal water vapor heating calculated from observed water vapor content in the troposphere, ozone heating calculated from UARS ozone measurements, and zonal mean winds and temperatures from the UARS Reference Atmosphere Project. The model also includes gravity wave interaction with the tides parameterized using the Alexander-Dunkerton scheme that has been tuned to reproduce the observed tide phase structure. Gravity wave forcing and eddy diffusion are held constant throughout the simulations.

Further experiments were run that isolate the mechanism responsible for the variability in the model. These experiments show that the primary mechanism governing the model tide variability is the mean flow modulation of the response to the diurnal component of ozone heating. Analysis will be presented that shows why the response to ozone heating is sensitive to the mean flow structure.