Structure of the migrating diurnal tide in the Whole Atmosphere Community Climate Model (WACCM)

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The Whole Atmosphere Community Climate Model (WACCM) is the next generation general circulation model currently being developed at the National Center for Atmospheric Research (NCAR). The model spans from the surface of the Earth to an altitude of 140 km. Important mesospheric and lower thermospheric dynamical features such as the atmospheric tides and global scale planetary waves are excited self-consistently in the model and are free to interact. In an effort to validate the tidal structure of WACCM, we compare the wind and temperature fields of the migrating diurnal tide generated by version 3 of WACCM to similar tidal results from the Global Scale Wave Model (GSWM), a linear mechanistic model that has undergone extensive comparisons with mesospheric and lower thermospheric wind and temperature observations.

The general structure and seasonal variation of the WACCM migrating diurnal tidal response is found to be in general agreement with observations from UARS and ground-based radar as well as with the results of classical tidal theory. The tidal response in the horizontal wind field reaches maxima in the tropical lower thermosphere and at the equator in the temperature field. The migrating diurnal tide exhibits a seasonal structure with maximum response at equinox, and minimum response at solstice as expected from the annual change in tropospheric heating. While the large scale features of the WACCM migrating diurnal tide agree with observations and the GSWM, there are still differences in the details of the WACCM and GSWM migrating tidal fields. The WACCM tidal response displays a greater degree of hemispheric asymmetry as well as a smaller response in the lower thermosphere than the GSWM. Possible factors that may contribute to these differences include differences in tropospheric heating, dissipation, and the structure of the zonal mean zonal winds. Nonlinear processes present in WACCM but absent in GSWM may also play a role.

In this presentation we will present the WACCM response for the migrating diurnal tide in the horizontal wind and temperature fields. The results will be compared with the GSWM to highlight specific differences. Analysis of the tropospheric heating profiles from WACCM will be compared with those from previous studies. The zonal mean wind and dissipation fields will also be presented.