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The linear interpretation of semi-annual oscillations of migrating and nonmigrating diurnal tides in the mesosphere and lower thermosphere, revealed from different general circulation models

N. Grieger (1) , U. Achatz (1), G. Schmitz (1), H. Schmidt (2), C. McLandress (3)

(1) Leibniz-Institute for Atmospheric Physics, Kuehlungsborn, Germany,

(2) Max-Planck Institute for Meteorology, Hamburg, Germany

(3) Department of Physics, University of Toronto, Canada

(grieger@iap-kborn.de / Phone: +49 38293 680)

Atmospheric tides are forced by solar irradiation in the different layers of the atmosphere and can propagate with increasing amplitudes up to the thermosphere. Using three general circulation model (GCM) outputs from a 20-year run of HAMMONIA (Max-Planck Institute for Meteorology, Hamburg, Germany), a 2-year run of the CMAM (Canadian Middle Atmosphere Model, Department of Physics, University of Toronto, Canada) and a one-year output of WACCM-1 (Whole Atmosphere Community Circulation Model, National Center of Atmospheric Research, Boulder, USA) we analyze the diurnal tides for their migrating (spatial wave number (s) one) and the most important nonmigrating components (s: 2, 0, -1,-2,-3) in the mesosphere and lower thermosphere (MLT), where positive wave numbers describe westward travelling, and negative ones describe eastward travelling components.

The differences between the individual results and observations are discussed. The migrating component and the nonmigrating one with s=2 show a strong semi-annual oscillation signature with amplitudes of 12 m/s and 5 m/s in the meridional wind tides, respectively. For the nonmigrating components with s=0, -1 the amplitudes are lower than 3-4 m/s.

Using the linear tidal propagation model LINKMCM, taking into account the horizon-

tal and vertical dissipation as well, one finds that the quasi semi-annual oscillations (s=2, 1) are mainly controlled by the propagation terms. This indicates that mostly the seasonal dependence of background wind fields up to the lower mesosphere (about up to 70 km height) is responsible for the tidal structure in the MLT. Only for the non-migrating components (s=0, -1) the seasonal dependence of the tidal forcing shows a remarkable influence onto the seasonal cycle of the tide.

Comparing the linear results with and without planetary waves in the background fields we find a clear evidence for a planetary-wave influence onto the tidal MLT structure. The strongest influence can be found for the s=2 (up to 60 %) and s=-2, -3 components (about 30 %).