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A simulation of the influence of DE3 tide on nitric oxide infrared cooling

Zhipeng Ren[1], Weixing Wan[1], Jiangang Xiong[1], and Xing Li[2]
[1]Institute of Geology and Geophysics, Chinese Academy of Sciences, Division of Geomagnetism and Space Physics, Beijing, China (zpren@mail.iggcas.ac.cn)
[2]School of Space and Environment, Beihang University, Beijing, China (lixing@buaa.edu.cn)

Using GCITEM-IGGCAS model, we simulate the influence of the eastward propagating non-migrating diurnal tide with zonal wavenumber-3 (DE3) on nitric oxide (NO) infrared cooling rate. We find that the DE3 tide can drive a DE3 signal in lower thermospheric NO cooling rate, and the simulated altitudinal and seasonal variations are according with that of DE3 signal in equatorial lower thermospheric NO cooling rate observed by Oberheide et al. [2013], which is based on the TIMED/SABER observations during the solar minimum year 2008. This signal mainly shows an annual variation, which is stronger between June and September, and weaker near November. The maximum of the absolute signal, whose value is about $0.35*10^{-9}$ W/m^3, occurs near the height of 130 km, but the relative signal mainly shows its peak with a value of 40% near the height of 100 km. Due to the difference of the driving mechanism, the distribution of NO signals in different latitudinal regions shows obvious difference. The middle- and low-latitude NO signal show smooth variation, while the high-latitude signal is discontinuous. The DE3 signal in NO cooling rate is mainly controlled by DE3 temperature tide and DE3 NO tide, meanwhile, the influences of DE3 neutral density tide on the DE3 signal can be ignored. The relative contributions of the DE3 NO tide and of the DE3 temperature tide vary with geographic latitude. The DE3 cooling rates in middle- and low- latitude and in high-latitude are respectively mainly driven by the DE3 temperature tide DE3 NO tide. DE3 tide may not only drive the DE3 signal, but also affect the lower thermospheric zonal mean NO cooling rate. The maximum of the absolute influence, whose value is about $0.12*10^{-9}$ W/m^3, occurs above the height of 140 km, but the relative influence mainly shows its peak with a value of 10% near the height of 100 km.