EGU22-4146
https://doi.org/10.5194/egusphere-egu22-4146
EGU General Assembly 2022

Spectra of Tides and Planetary Waves from Ionosonde and MERRA-2 Data

Elizaveta Maksakova, Nikolai M. Gavrilov, and Andrey V. Koval
Saint-Petersburg State University, Physics Department, Russian Federation (max.elizaweta@yandex.ru)

Previous studies disclosed oscillations of ionospheric parameters, in particular, the critical frequency of the F2 layer, f_0F2, with periods longer than 2 days. This allows suggestions that planetary waves (PWs) propagating from the lower atmosphere can influence the ionospheric electron density. However, someatmospheric modeling showed that PWs with observed periods may have difficulties for direct propagation to altitudes above 110 km. Since 2018, regular observations of ionospheric parameters with the DPS-4 ionosonde are been performed at the Peterhof Scientific Station of Saint Petersburg State University (60° N, 30° E). In this study, we analyzed results for spectra of oscillations of ionospheric parameters in the range of periods 0.5 – 40 days according to these measurements. In addition to these spectra we analyzed similar spectra obtained from the MERRA-2 data of meteorological reanalysis for different locations in the lower and middle atmosphere. Lomb-Scargle spectra were obtained for 90-day running intervals. They contain maxima at periods 1 day and 0.5 day, which may correspond to the diurnal and semidiurnal tides. The spectra also have maxima at periods 2 – 40 days, which can be associated with planetary waves (PWs). The analysis shows that big amplitudes of oscillations with periods τ ~ 2 – 40 d are frequently observed in the northern spring and summer months, when westward stratospheric winds prevent PW propagation from the lower to the upper atmosphere. However, the analysis of atmospheric waveguides revealed that PWs can cross the equator above altitudes of 60 km. Therefore, PWs observed in summer ionosphere can, in prinsiple, propagate from the lower wave sources located in the winter hemisphere.Obtained correlation coefficients between variations of the spectral densities at ionospheric and tropospheric heights at different latitudes demonstrate sufficient statistical confidence for PWs with periods of several days. This gives evidences about possible PW coupling between dynamical processes in the lower atmosphere and ionosphere. The spectral analysis was supported by the Russian Science Foundation (grant #20-77-10006) and the analysis of PW coupling was supported by the Ministry of Education of the Russian Federation (agreement 075-15-2021-583). Used ionosonde data were acquired in the “Geomodel” Resource Center of SPbSU.