PLANETARY WAVE TYPE OSCILLATIONS IN THE IONOSPHERE: DISTINGUISHING SOLAR FORCING AND COUPLING FROM BELOW

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The ionosphere is mainly influenced by the sun through electromagnetic radiation and particle precipitation. Additionally, upward propagating waves like planetary waves (PW), tides and atmospheric gravity waves (AGW) from the lower and middle atmosphere contribute to the ionospheric variability. PW, mainly originating in the lower atmosphere, have a large impact on the dynamics of the middle atmosphere at middle and high latitudes during winter. Theoretically they are not capable to directly penetrate the F2-region of the ionosphere. However, an indirect impact on the F2-region variability through PW is expected. Planetary wave type oscillations (PWTO) which are observed in F2-region parameters are supposed to be the effect of middle atmosphere PW.
The DLR Neustrelitz provides regional maps of the total electron content (TEC), which are calculated from GNSS measurements, since 1995. Hemispheric TEC maps of the North Pole region are consistently available since 2002. These maps are analyzed concerning PWTO. The PWTO are compared with parameters estimating the solar influence. 38-40% of the variations of the relative differential TEC can be described through variations of the solar wind, the F10.7cm radio flux and the geomagnetic activity. They are identified and removed using wavelet analyses. The residual PWTO are compared with PW analyses on stratospheric reanalyses and locally with mesospheric wind measurements. There is a general agreement in the seasonal variation of PW and PWTO. The modulation of tides is suggested to be a mechanism transporting PW energy into the ionosphere. Good agreements are found between the modulation of the semidiurnal tidal wind in the mesosphere and PWTO in TEC.

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