# Spatial movement of ionospheric planetary waves in sporadic E-layer parameters

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Detection and research of planetary waves in ionosphere are very important for solution of problem of general circulation in the upper ionosphere and forecast of ionospheric weather. In this work ionospheric planetary waves in frequency parameters of sporadic E-layer are investigated by analysis of the 30-year ionospheric data (1960–1990) of midlatitude ionosondes. The amount of ionosondes varying from year to year in the interval 15–25 allows to investigate amplitudes and the phases of planetary waves with mode number $n$ from 1 to 3. Large-scale disturbances ($n$=1) are of special interest because they make the most significant contribution into the wave structure of the lower thermosphere. Statistic data processing was performed to build the histograms with respect to the periods of the planetary waves existed in sporadic E- layer. Obtained data allowed detecting presence of highly expressed periods of the planetary waves in all seasons. Strong periodicity manifests in spring and in summer, it seems to be connected with the spring transition of circumpolar cyclone and stratospheric warmings, which directly affect on processes occurring in the upper atmosphere. The shift velocities of planetary waves were investigated. Prevailing motion direction was found to be westward. Predominant velocities are from 5 to 30 m/s. The character of observed waves is quasiperiodic, i. e. periods with unchanged or slowly changed phase interleaved with periods with sudden change of phase during 1–2 day. Thus new planetary wave with stable phase has another initial phase. Typical periods 4–6 ($n = 2$) and 20–24 ($n = 1$) days are determined for these waves.

The initiation of planetary waves occurs in two different geographic sectors 30–60°E and 210–240°E. It is noticeable that difference between these centers is 180°. Such effect may be explained by influence of orography of these regions where the high likelihood of cyclone and anticyclone occurrence was observed. Internal gravity and planetary waves generating in these sectors can partially propagate into the lower thermosphere, what is in accordance with obtained results.