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Long-term variations in pulsation activity and their relationship to solar wind velocity, geomagnetic activity, and $F2$ region electron density

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Abstract

Significant 11-year, annual, and semiannual variations of the total pulsation activity at the mid-latitude station Nagycenk are reported and compared with solar wind velocity, geomagnetic activity, and $F2$ region electron density. Monthly average data from 1957 through 1989 were analyzed using the discrete convolution filtering technique. The 11-year variation of the total pulsation activity is closely related to the 11-year solar wind cycle supposedly through solar wind controlled pulsations. Its annual variation reflects the combination of two effects: one is the annual variation of the solar wind due to interstellar wind, and the other is some damping mechanism related to $F2$ region electron density. The nature of this ionospheric damping has not been clarified yet. The semiannual variation of the total pulsation activity, however, seems to be controlled mainly by the geomagnetic activity. Occurrence frequency and amplitude data for pulsations in 12 period bands ranging from 1 s up to 10 min were also involved in order to clarify the contribution of different types of pulsations to the total pulsation activity. It was found that the total pulsation activity refers mainly to Pc3 pulsations and, that the pulsations with a period of 20–25 s, which correspond to the eigenperiod of field line resonance at $L < 2$, have the strongest correlation with solar wind velocity.

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