Trigger mode in the magnetosphere dynamics and the statistical properties of the Ap-index and the β parameter

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The work is devoted to the study of the Earth's magnetosphere dynamics. Earlier, we found that the dynamics of the magnetosphere activity (Ap-index) demonstrate a sharp transition (trigger mode) from the "periodic" mode to the "chaotic" mode in each 11-year cycles of solar activity. It was also shown that the trigger mode of the Ap-index is determined by the dynamics of the solar wind β parameter (β is the ratio of plasma pressure to magnetic pressure). The mode change in the dynamics of the magnetosphere is determined by the value of the β parameter. A "chaotic" and "periodic" modes are observed in the magnetosphere if $\beta < 1$ and $\beta > 1$, respectively.

In this paper the statistical properties of solar activity (Wolf numbers), the Ap-index and the β parameter corresponding to the "periodic" and "chaotic" regimes are studied. The series of Ap-index and β parameter daily values from 1932 to 2016 and from 1964 to 2016 were used respectively for the analysis.

It is shown that the averaged dynamics of the solar activity chaotic parameter and of the β parameter amplitude correlate well with each other in the 11-year cycle. It was found that the distribution of the Ap-index for "chaos" and "periodicity" regimes is described by a power law (the so-called heavy-tailed distributions). However, the exponent for "chaos" intervals is approximately twofold different from the exponent for "periodicity" intervals. In the same intervals a difference in the spectral characteristics of the Ap-index was found. It is shown that the dependence of the Ap-index on the average value of the β parameter at $\beta > 1$ is well approximated by power dependence. The dependence is practically absent when $\beta < 1$.

It is known that the change of β in the 11-year cycle of solar activity is determined by the dynamics of inclination angle of the Sun magnetic dipole axis to the ecliptic plane. Thus, the obtained results confirm the hypothesis has earlier been put forward by us that the global geoeffective factor determining the considered features of the dynamics of the magnetosphere activity is the inclination angle of the Sun magnetic dipole axis.

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