

Triggering of the IPDP ULF waves (Vinogradova-Maltseva effect)

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The Vinogradova–Maltseva effect was discovered by Soviet/Russian geomagnetologists in 1971. It consists in the fact that after pulsed injection of energetic protons from the magnetotail to the region of closed magnetic shells, frequency-modulated irregular pulsations of a decreasing period (IPDP, 0.1–5 Hz) are excited. Pulsations are generated in such a way that in the evening sector of the magnetosphere an azimuthal movement of the oscillation source at a given fixed frequency from east to west is observed. The present paper studies the effect of the western drift of the IPDP frequency from the results of simultaneous observation of oscillations at the Mondy and Borok observatories separated in the geomagnetic longitude by 60 degrees. Our interest is motivated, firstly, by the fact that IPDP belongs to the class of trigger events. Secondly, the interpretation of the frequency modulation of the IPDP and, in particular, the interpretation of the Vinogradova – Maltseva effect makes it possible to penetrate the essence of the whole complex of physical processes accompanying the origin and evolution of geomagnetic storms. We will demonstrate the analyzed effect on the new observational material, discuss the problems of excitation and propagation of IPDP, and point out ways of using IPDP to diagnose the magnetosphere and to predict space weather. In particular, we draw attention to the important fact that the observed properties of IPDP appear to contain useful information about the strength and possible duration of a geomagnetic storm. The work was done with the financial support of the RFBR project 19-05-00574, Program No.28 of the Presidium of the Russian Academy of Sciences, as well as the Basic Research Programs of the IPE RAS (No. 0144-2014-00116) and the ISTP SB RAS (FNI II.16).