Frequency-direction analysis of geomagnetic pulsations *)

Part II. Pulsations pc3 (Bpc3)

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2. DATA

The records of 104 samples of $pc_3$ pulsations from the Budkov Observatory ($\varphi = 49^\circ 04'$ N, $\lambda = 14^\circ 01'$ E, $\alpha = 49^\circ 02'$, $\phi = 96^\circ 02'$, LT = UT + 1 hr) recorded during the summer months of June and July 1968 and 1969, were used to compute the spectra in the two components $X(\text{NS})$ and $Y(\text{EW})$. Most of these samples had already been used in earlier papers [5, 6]. The pulsations were recorded by an induction instrument with a permalloy core, recording speed 15 mm/min and scale value in the $pc_3$ range about 0.1 to 0.3 $\gamma$/mm in both recorded components.

The length of the pulsation samples was chosen with a view to their beating structure to cover 7—8 mins. Since the amplitudes of the pulsations on the Z-component records were negligibly small, the oscillations in the $XZ$- and $YZ$-planes were not treated. The samples of the pulsations were chosen as far as possible to cover the whole interval of their diurnal occurrence, i.e., 3—7 samples per day. For 16% of the samples used the $K$-index was equal to 1, for 54% $K = 2$, for 27% $K = 3$ and only for 3% of the samples $K = 4$. The results of processing the data, therefore, refer to a disturbance period of the field of $K = 2$ — 3.

3. FREQUENCY-DIRECTION DIAGRAMS FOR $Bpc_3$

For the frequency-direction diagrams ($f - \psi$ diagrams) of all selected $Bpc_3$ samples the spectra in the X- and Y-components were computed in the same way as in [6, 7]. Their $f - \psi$ diagrams differ in the same way as the spectra of isolated components differ with different pulsations. Samples of nearly monochromatic $Bpc_3$ pulsations can be observed. Other pulsations have a more complicated structure. The $f - \psi$ diagram provides a very good picture of the internal structure of the pulsation. It is possible to determine the distribution of the fundamental frequency components of the pulsation as regards the frequency, the relative amplitude, the direction of the major axis, and the ellipticity of the polarization ellipse, as well as the sense of rotation of the disturbance vector.

Figures 1a—f show some of the typical cases of the $f - \psi$ diagrams. The horizontal axis is the frequency axis. The vertical $\psi$-axis represents the deviation from the NS direction, positive to the east and negative to the west. The parallels with the frequency axis represent the amplitude spectrum of the projections of the signal into the given $\psi$-direction. The amplitude is proportional to the degree of darkening of the surfaces like on a sonagram.

Figure 1a represents an $f - \psi$ diagram for one of the simple cases of a nearly monochromatic pulsation with one expressive main peak in the spectrum at 37 mHz. The series of other weaker peaks which accompany it, belongs to considerably weaker frequency components (denoted below as FC), which contribute to the beating structure of the pulsation. The main spectral amplitude dominating FC (denote below as MFC) is elliptically polarized, and the direction of the major axis of the polarization ellipse is deviated from NS ($\psi = 0^\circ$) by 30$^\circ$ to the NE. The disturbance vector rotates along the ellipses clockwise. The sense of rotation is determined for an observer viewing from above towards the Earth's surface.

An important category of $Bpc_3$ pulsations is represented by pulsations with two