STUDY OF GEOMAGNETIC PULSATIONS OF THE $Pi2$ TYPE AT MAGNETICALLY CONJUGATE POINTS

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Fig. 1

Figure 1: Fig. 1

Abstract

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STUDY OF GEOMAGNETIC PULSATIONS OF THE *Pi*2 TYPE AT MAGNETICALLY CONJUGATE POINTS

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1. Joint recording of geomagnetic-field pulsations at the magnetically conjugate points Sogra (58° N, 122° E) and Kerguelen (58° S, 124° E) was begun in September 1964 after the installation at Sogra of a microvariational station of Leningrad University of the B. E. Brunelli system. Recording of pulsations on Kerguelen was carried out by means of fluxmeter-type apparatus of Zelser' s design. In February 1966 a microvariational station of Leningrad University was also installed on Kerguelen, which made it possible additionally to carry out a session of simultaneous recording of pulsations on apparatus having identical parameters.

Fig. 1

For the study of *Pi*2-type pulsations, two observation periods were selected: from 18 X to 16 XI 1964 and from 4 II to 15 III 1966, which made it possible to compare the materials obtained at conjugate points on different-type and identical apparatus.

2. Over both observation periods, 176 cases of *Pi*2 pulsations were processed, the oscillation periods of which varied within the range from 40 to 180 sec. In the overwhelming majority of cases there was good agreement in the form of the *Pi*2 trains at Sogra and on Kerguelen (Fig. 1). In trains in which there is no superposition of oscillations of a shorter period, the accuracy of coincidence of the extreme values of the oscillation amplitudes and, consequently, of their period can be estimated at 2-3 sec, which coincides with the accuracy of reading the time from the magnetograms. With a more complicated configuration of oscillations

Fig. 2

Figure 2: Fig. 2

the indicated accuracy drops to 5–10 sec, which is explained by differences in the behavior at conjugate points of the pulsations that make up the microstructure of *Pi2*.

The mean ratio of the amplitudes of *Pi2* pulsations, $\alpha = A_c/A_k$, during the second period of observations proved to be equal to 1.0 for both horizontal components of the geomagnetic field. In the first period of observations, only the amplitude ratio in the H-component proved to be equal to unity; for the D-component it was 0.9. The root-mean-square values of the deviations $\Delta\alpha/\alpha$ from the mean values for both components in 1964 and 1966 did not exceed 10%.

The character of the scatter of $\Delta\alpha/\alpha$ for the second period of observations is presented in Fig. 2. As we see, the mean amplitude ratio of the D-component in 1964 differs from unity by an amount that also lies within the errors of the final result. It is possible that the observed phenomenon is the result of systematic errors in observations of pulsations with different types of apparatus at the two stations. However, it is not excluded that the predominance of the *Pi2* amplitude at Kerguelen in October–November 1964 is the result of the seasonal variation of this pulsation parameter.

Fig. 2

It should be noted that in a number of cases of *Pi2* generation, a substantial influence on the magnitude of the amplitude ratio of individual components at conjugate points was exerted by a change in the direction of polarization of the oscillations at Sogra and on Kerguelen.

Analysis of the polarization of *Pi2* oscillations showed that the sign of the oscillations of the H-component at magnetically conjugate points is the same. The sign of the D-component differs in the northern and southern hemispheres.

In view of the considerable differences in the frequency characteristics of the apparatus used in the first period of observations, the direction of rotation of the magnetic-field vector was determined only from magnetograms obtained in 1966.

A total of 102 *Pi2* trains were examined. In 27 cases the direction of rotation could not be determined reliably because of the complex character of the oscillations or owing to their linear polarization. In 72 cases the directions of rotation of the magnetic-field vector at the conjugate points proved to be opposite. For 3 trains the directions of rotation of the vector in both hemispheres coincided. All cases of *Pi2* with an anomalous character of vector rotation were recorded on 11 February 1966 from 0^h25^m to $0,1^h50^m$. For these trains there were substantial differences in the amplitude of the oscillations at the conjugate points: the *Pi2*

amplitude on Kerguelen exceeded the *Pi2* amplitude at Sogra by approximately a factor of 1.7.

3. From an analysis of the behavior of *Pi2* pulsations at Sogra and on Kerguelen, it may be concluded that the behavior of pulsations of this type is similar at both conjugate points. They are excited synchronously in the northern and southern hemispheres; their form, periods, and amplitude agree well. The coincidence of the sign of the H-components and the opposite sign in both hemispheres are characteristic, as was shown in (3), for excitation in the magnetosphere of even harmonics of standing Alfvén waves.

Such behavior of *Pi2* at magnetically conjugate points supports the mechanism of generation of *Pi2* pulsations proposed in (4). According to (4), *Pi2* generation is explained by the resonance of Alfvén waves on the night ···

on the magnetospheric side in the flux tube directly adjoining the beginning of the neutral sheet. In this tube, owing to the proximity of the neutral sheet, there is a minimum of the Alfvén velocity in the equatorial plane, which leads to the division of the magnetosphere into two symmetrical parts. Therefore, the character of the polarization of the pulsations at conjugate points will correspond to the behavior of the second harmonic of Alfvén waves, while the periods and amplitudes of the oscillations should approximately coincide with one another.

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Note: Figure translations are in progress. See original paper for figures.