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I-5-3. On the Morphology of Ionospheric Disturbances Depending on the Character of Commencement of the Geomagnetic Storms*

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This report deals with the question of mutually connected geomagnetic and ionospheric disturbances in the *F2* layer depending on the level of solar activity and counting on the sign of the fluctuations of the critical frequencies f_0F2 and character of commencement of geomagnetic storms causing anomalous phenomena in the ionosphere.

The analysis of the magnetic-ionospheric disturbances was made for different years of the cycle of the solar activity 1951–1960. For this purpose the observed data of the middle latitude ionospheric station "Moscow" and the most southern station on the Soviet Union "Ashkhabad" were used.

The deflection value of the critical frequencies of the *F2* layer from the monthly sliding median ($\pm\Delta f_0F2$) exceeding 20% was taken as a principal criterion of ionospheric disturbances. Besides there were also taken into consideration such factors as the degree of absorption of the radio-waves, the presence of diffused reflections, the time when the anomalous values Δf_0 were observed, the condition of the ionosphere during the days preceding the magnetic storm, particularly in the night hours etc.

The analysis of the received data shows that the highest percent of the negative ionospheric disturbances both in Moscow and in

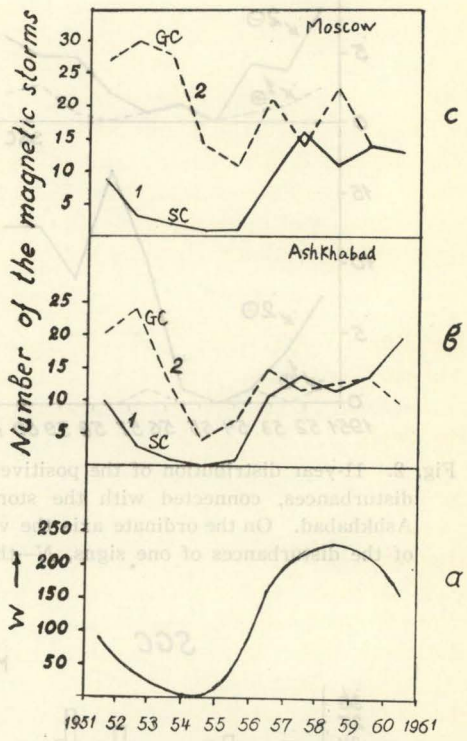

Fig. 1. 11-year distribution of the average annual relative number of solar spots (*a*) and the number of the magnetic storms with sudden (curve 1) and gradual (curve 2) commencement for Ashkhabad (*b*) and Moscow (*c*).

Table I.

Station	Character of commencement of magn. storm	Number of magnetic storms	$+\Delta f_0F2$		$-\Delta f_0F2$	
			Number of ionospheric storms	Percent	Number of ionospheric storms	Percent
Moscow	SSC	78	3	3.8	59	75.6
	SGC	195	21	16.8	68	34.9
Ashkhabad	SSC	86	12	13.6	34	38.6
	SGC	136	26	19.6	16	12.1

* This paper was read by V. A. Troitskaya.

Ashkhabad is observed for the magnetic storms with sudden commencement (SSC) (Table I).

The clearest correlation with the distribution of solar activity in the 11-year cycle is observed for the magnetic storms with sudden commencement. A less clear correlation is observed for the storms with gradual commencement (SGC) (Fig. 1 a, b, c). Besides it is also observed the fairy good coincidence between the curves of distribution of the negative ionospheric disturbances connected

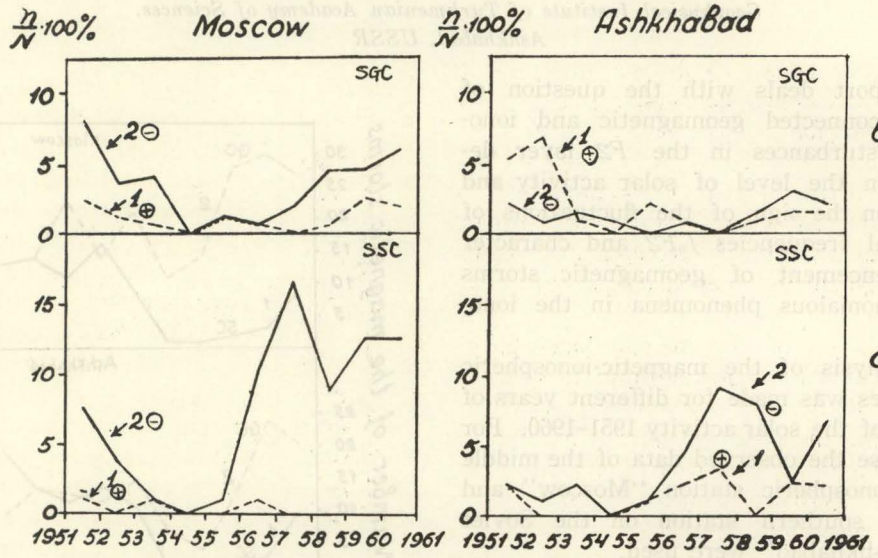

Fig. 2. 11-year distribution of the positive (curve 1) and negative (curve 2) magnetic-ionospheric disturbances, connected with the storms of type *SSC* (*a*) and *SGC* (*b*) for Moscow and Ashkhabad. On the ordinate axis the value $n/N \cdot 100\%$ is shown, where n is the number of the disturbances of one signs, N—the number of all the disturbances.

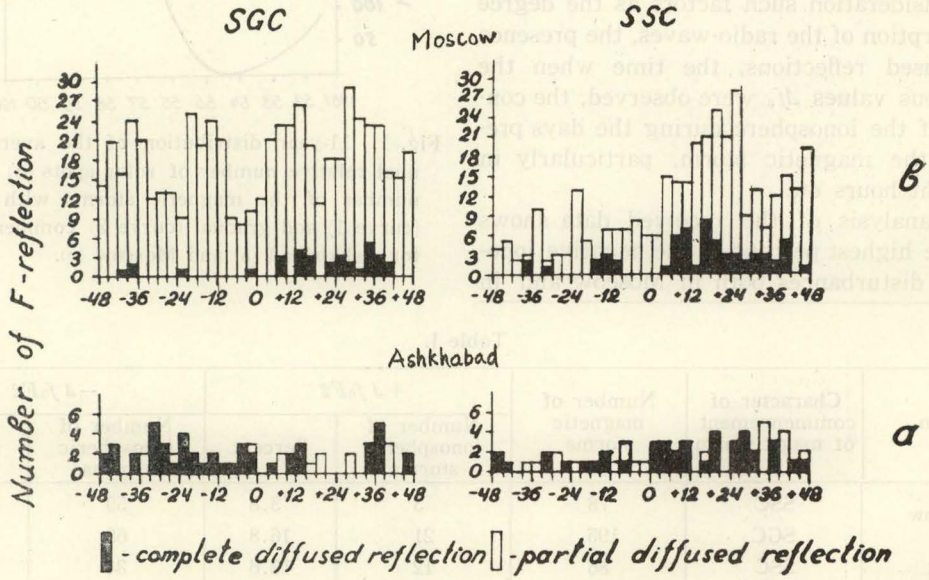

Fig. 3. The distribution of the number of the *F*-reflections for two days before the beginning of the magnetic storms with gradual (*SGC*) and sudden (*SSC*) commencement and for two next days for Ashkhabad (*a*) and Moscow (*b*).

with the magnetic storms of the type SSC and average annual relative numbers of solar spots during the above mentioned period of time (Fig. 2a). Most of such magnetic-ionospheric disturbances are observed in the years of maximum of solar activity, least number— in the years of minimum.

The ionospheric disturbances both positive and negative, connected with the storms of the type SGC have similar 11-year distribution, which is conformed with the curve of the relative number of solar spots (Fig. 2b). The most interesting peculiarity is a good correlation between the positive disturbances of the ionosphere connected with the magnetic storms with gradual commencement and the 11-year distribution for the storms of this type in the latitude of Ashkhabad (Fig. 2).

The examination of the mutual connection between the diffused condition of the *F2* layer of the ionosphere and the level of geomagnetic activity depending on the character of commencement of the magnetic storms shows that the number of the diffused reflections abruptly increases in Moscow and insignificantly in Ashkhabad during the geomagnetic storms with sudden commencement.

The received results allow to make the following conclusions:

1) The geomagnetic storms with sudden and gradual commencement differently influence the ionosphere at the middle latitudes. The magnetic storms with sudden commencement cause in the large majority of cases abrupt decrease of the critical frequencies of *F2* layer and increase of the diffused condition of the layer.

The magnetic storms with gradual commencement at the middle latitudes more rarely cause the deviation of some parameters of the *F2* layer from the normal distribution. In the latitudes of Ashkhabad the pointed effects are considerably weakened and the character of these differences of influence on the ionosphere is likely to be different in the lowest latitudes.

2) Taking into consideration the clear correlation of the negative magnetic-ionospheric disturbance for the storms of type SSC and the level of solar activity, and the fairy little percent of the positive ionospheric disturbances connected with the storms of this type it may be suggested that in the middle latitudes the critical frequencies during geomagnetic storms are principally conditioned by the direct corpuscular influence on the upper atmosphere.

The positive magnetic-ionospheric disturbances in these latitudes in most cases may be not connected with the corpuscular radiation of the Sun.

Discussion

Martyn, D.F.: Some years ago I found it possible to get positive or negative f_0F2 disturbances at a middle latitude station simply by selecting storms of suitable local commencement time. This might explain the data described.