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INTERNATIONAL CONFERENCE ON COSMIC RAYS AND THE EARTH STORM Part I

I-2-15. Daily Variations of Blackout Appearances*

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Investigating magnetic activity it was long when one could note the similarity between a curve of latitudinal dependence of daily variation activity maxima and Shtermer's spiral of particle intrusion[1]. Lately, voluminous literature has been devoted to investigation of spiral distribution of geophysical phenomena. In particular, paper[2] investigates maxima distribution of blackout appearances and compares them with magnetic activity distribution. The authors of this paper have also investigated daily distribution of blackouts, using the data of 42 ionospheric stations of the northern hemisphere for 18 months of the IGY. Blackout period were defined by tables** f_{min} where the full absorption by symbol "B" is usually indicated. As an example figure 1 gives the graphs of daily distribution on number (n) blackouts at the stations: Anchorage (to the south from the auroral zone), Dixon (in the zone) and Godhavn (in polar cap). The figure shows rather big differences between daily variations in different seasons which did not allow to combine the data for the year on the whole. As it is known, one differs three blackout types, of different nature: the first type blackouts or Dellinger effects, the second type blackouts connected with magnetic storms and the polar cap blackouts, caused by rapid particles (the 3rd type). For the whole period considered at the middle-latitudinal stations Moscow and Washington one has observed 6 and 45 blackouts. We can see from this that even if all these cases of full absorption are the 1 type blackouts, their number is much less than the whole number of blackouts, observed at high latitudinal stations. Therefore one can consider that the influence of Dellinger effect on

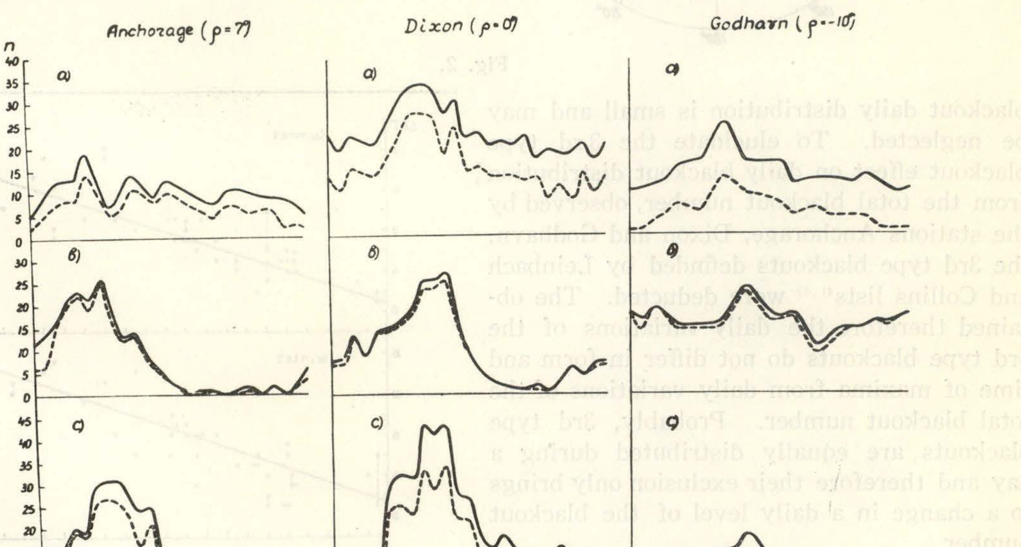

Fig. 1.

* This paper was read by N. V. Pushkov.

** The data are received from the Centre B2 of IGY.

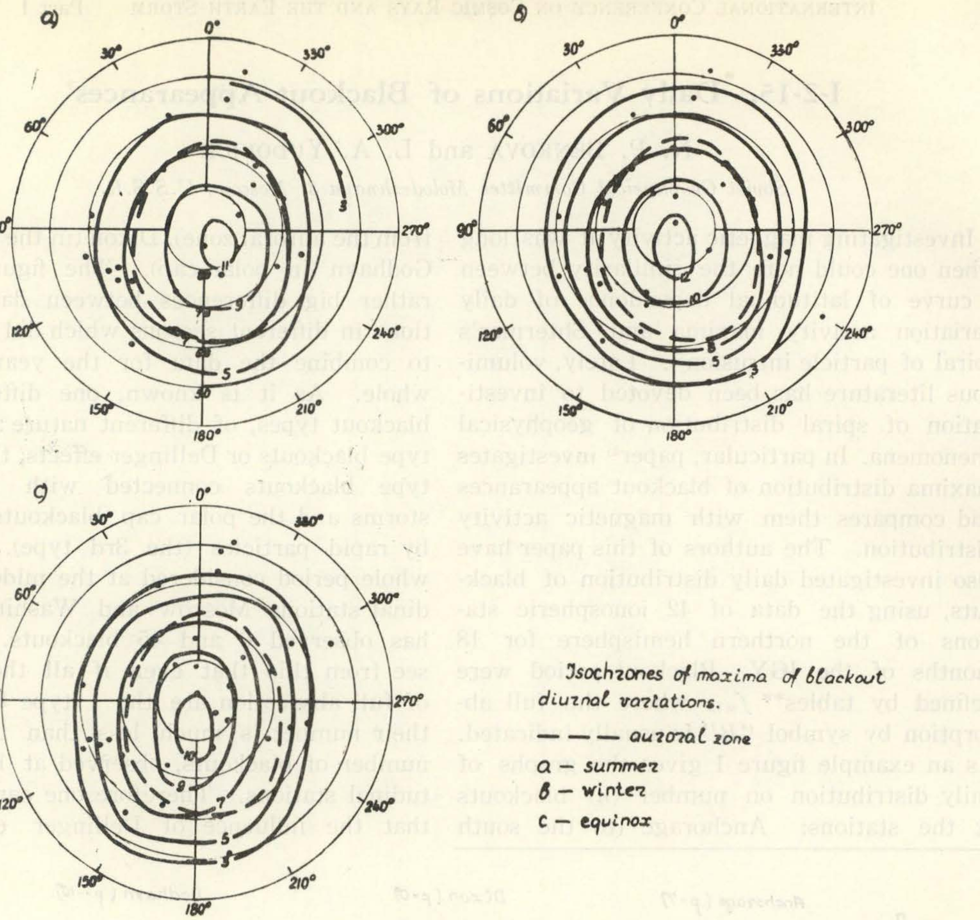

Fig. 2.

blackout daily distribution is small and may be neglected. To elucidate the 3rd type blackout effect on daily blackout distribution from the total blackout number, observed by the stations Anchorage, Dixon and Godhavn, the 3rd type blackouts definded by Leinbach and Collins lists[4),5)] were deducted. The obtained therefore the daily variations of the 3rd type blackouts do not differ in form and time of maxima from daily variations of the total blackout number. Probably, 3rd type blackouts are equally distributed during a day and therefore their exclusion only brings to a change in a daily level of the blackout number.

In accordance with this the times of daily variations maxima of the total blackout number characterise the times of the greatest frequency of the 2nd type blackouts, connected with corpuscular streams of usual speeds.

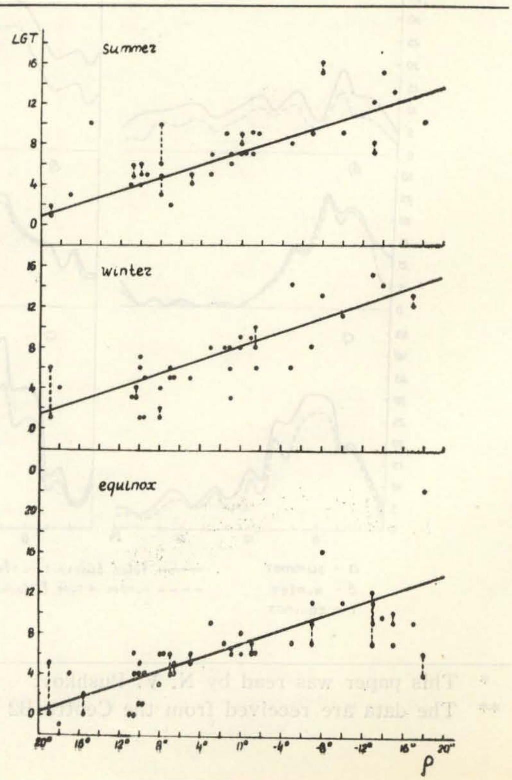

Fig. 3.

The times of blackout maxima, defined for all the stations by the curves of daily variations of the blackout number analogous to those in Fig. 1, were drawn on the charts of the northern hemisphere. The charts are drawn in Fig. 2. Geomagnetic coordinates and the used time t is local geomagnetic time. On the charts the location of auroral zone is also drawn by the data of paper[6]*. By analogy with papers[2),3)] isochrone systems were built to find out general regularities of t_m distribution. Fig. 2 shows that for all seasons isochrones are of an oval from which is controlled by the auroral zone. Nearer to the pole the time of maximum occurs at day hours instead of night ones, that is, maximum occurs as later as greater the geomagnetic latitude is or more exactly as farther from the auroral zone the station is situated. In winter the time of maximum frequency of blackout occurs at later hours compared with the summer season.

For a more detailed analysis of blackout latitudinal distribution the graphs of t_m the distance to the auroral zone ρ were drawn. In Fig. 3 positive values of ρ mean a distance to the south from the auroral zone, negative to the north. In spite of great dispersion of point the dependence $t_m(\rho)$ which is rather dear, in the first approximation may be taken as linear.

In polar coordinates (local geomagnetic time and the reduced geomagnetic latitude $\varphi' = 6\zeta^\circ - \rho$) the relative $t_m(\rho)$ shows for all seasons the spiral distribution of t_m (see Fig. 4), analogous to the spiral distribution of mag-

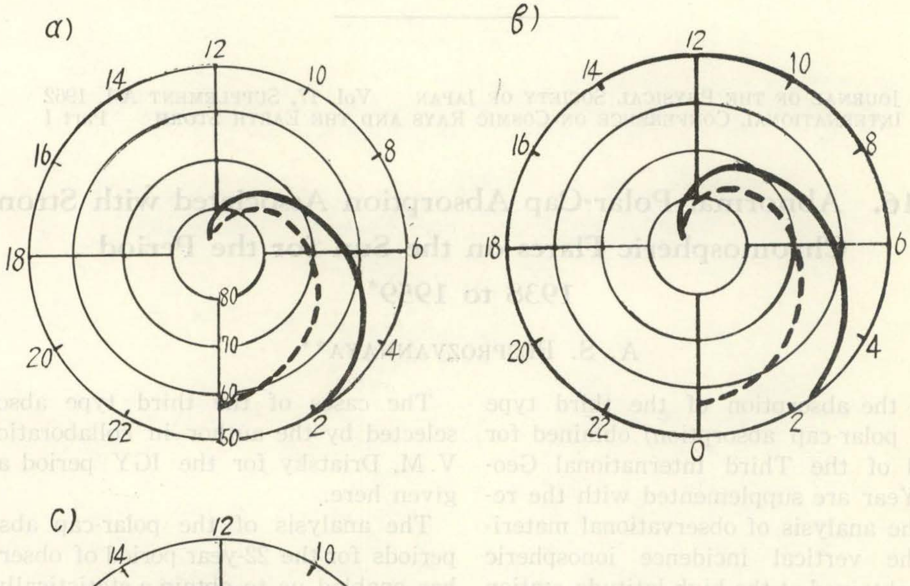

Fig. 4.

* The form of auroral zone in the paper 6) do not differ much from that of others papers 7).

netic activity maxima on Fig. 4 are given for comparison spirals distribution of magnetic activity Q-indexes (the data for winter and summer are taken from[8] and for equinoxes they are obtained by the authors).

Both the magnetic and ionospheric spirals untwist in a counterclockwise directive. For all seasons the maximum of magnetic disturbance appears earlier than the maximum of blackouts (at the latitude $\varphi=60°$ it appears 2–3 hours earlier) while passing to higher latitudes the blackout delay, compared with magnetic activity, decreases. The results obtained differ from the results[2], which show a good coincidence of the both spirals.

References

1) Н. П. Бенькова Труды НИИЗМ 1947 6.3 (13), 15–40.
2) L. Thomas and W. R. Piggott: Some ionospheric results obtained during International Geophysical Year, Brussel (1959) 61–71, 72–81.
3) V. Agy: J. Geophys. Research, 59, 267, 1954 a; 59, 499, 1954 b.
4) H. Leinbach and G. C. Reid: Symposium URSI/AGI, Brussel, 1959.
5) C. Collins, D. H. Jelly and A. G. Matthews Canadian Journal of physics, January 1961, Vol. 39, N1, 35.
6) Я. И. Фельдштейн сб. "Исследования полярных сияний" No. 4, 1960.
7) Н. П. Бенькова Труды НИИЗМ в. 10 (20), 1953.
8) Я. И. Фельдштейн "Геомагнетизм и аэрономия" (в печати)

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INTERNATIONAL CONFERENCE ON COSMIC RAYS AND THE EARTH STORM Part I

I-2-16. Abnormal Polar-Cap Absorption Associated with Strong Chromospheric Flares on the Sun for the Period 1938 to 1959*

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Data on the absorption of the third type (abnormal polar-cap absorption) obtained for the period of the Third International Geophysical Year are supplemented with the results of the analysis of observational materials of the vertical incidence ionospheric sounding obtained at the high-latitude station Tikhaya Bay (80.3°N) for the previous years.

All the cases of the long-duration abnormal absorption at Tikhaya Bay from January 1938 to July 1957 have been selected. Basing on a series of properties of the third type absorption found in the IGY materials, all the selected periods may be referred to the type of " abnormal polar-cap absorption ".

In Table I a list of these periods with the indication of the starting time of absorption, its duration and a number of blackouts (according to hourly data) is given.

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The cases of the third type absorption, selected by the author in collaboration with V. M. Driatsky for the IGY period are also given here.

The analysis of the polar-cap absorption periods for the 22-year period of observations has enabled us to obtain a statistically based conclusions on the distribution of the third type absorption in a cycle of solar activity and during a year, as well as the character of connections with magnetic storms and active formations on the Sun.

§ 1. Secular variations.

In the frequency of the polar-cap absorption occurrence a remarkable dependence on the phase of a solar cycle is revealed.

Absorption periods are more frequent in the years of high solar activity and are completely absent in the years of low activity (Fig. 1). In the epochs of the solar-spot