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A160/A101

AUTHORS: Mishin, V. M., Naydenova, N. Ya., Platonov, M. L.

TITLE: The diurnal variation of the probability of the appearance of the commencements, the active periods and the ends of magnetic storms

PERIODICAL: Geomagnetizm i aeronomiya, v. 2, no. 6, 1962, 1107 - 1112

TEXT: The authors investigate the probability of the appearance of the commencements, the active periods and the ends of magnetic storms on the basis of the Irkutsk Storms Catalog for 1905 - 1917 and 1925 - 1959. The catalog describes 820 storms. A total of 539 of them are storms with a gradual commencement. Figure 1 presents the curves Sнб (nb), Saп (ap) and Sa for Irkutsk. Ordinates in curve 1 represent the frequencies of the commencement of the G-storms n_{nb}, in curve 2 - the frequencies of the active hours n_{ap}, and in curve 3 - the equivalent amplitudes R^{γ}_{H}. Similar distinctions between Sa and S_{nb} were also observed at all other stations. These data, characterizing the phases of the maximum of the first harmonic of Sa and S_{nb}, are presented in a table. The authors explain these results by proposing that S_{nb} may be considered as a re-

Card 1/3

The diurnal variation of the... S/203/62/002/006/010/020
A160/A101

sult of Sa. It is followed that the probability of a contact of the corpuscular flux with the Earth does not depend on the time of the day. This conclusion is confirmed by the fact that, according to the mentioned catalog, the diurnal variation of the frequency of SC practically does not exist. The authors then investigate the total of all storm days and introduce the following four hypotheses. 1) The probability that there is a contact between the flux and the Earth, causing the storm is equal for all hours of a day. 2) The magnetic activity during the hour of the commencement of the storm A is not lower than that during an average storm $\overline{A}$: $A \geqslant \overline{A}$. 3) The values of A during the initial hours of the storms are determined by Sa on the basis of the perturbed days. 4) The length of each storm is $\geqslant$ 12 hours. The distribution of the probabilities of the commencement of the storms over the hours of the day P (T) will be as follows: P = 0 in two 6-hour intervals $T < \alpha_k - 90^\circ$ and $T > \alpha_k + 90^\circ$ (Figure 2, hatching), P = 1/24 in the 11-hour interval $\alpha_k + 90^\circ \geqslant T > \alpha_k - 75^\circ$, P = 13/24 in one hour containing the moment $T_k = \alpha_k - 90^\circ$. Such a distribution of the probability P (T) has the form of a try-square shown on Figure 2. The authors make the following conclusions. 1) It was determined that the commencements of the storms (recorded at the given station) are generally shifted to the side of

Card 2/3

The diurnal variation of the... S/203/62/002/006/010/020
A160/A101

delay - as regards the moment of the contact of the flux with the Earth. The inequality of $\tau_{nb} < \tau_{kb}$ may be explained by the fact that the G-storms have a shock front. 2) The fluxes causing the given of the clearly-expressed variations S_{nb} and S_{kb}, 3) The main result of this work is the description and the possibility of explaining these variations as a result of Sa. There are 4 figures, and 1 table.

ASSOCIATION: Institut zemnogo magnetizma, ionosfery i rasprostraneniya radiovoln SO AN SSSR (Institute of Terrestrial Magnetism, Ionosphere and Radio Wave Propagation of SO, AS USSR)

SUBMITTED: June 23, 1962

Figure 1.

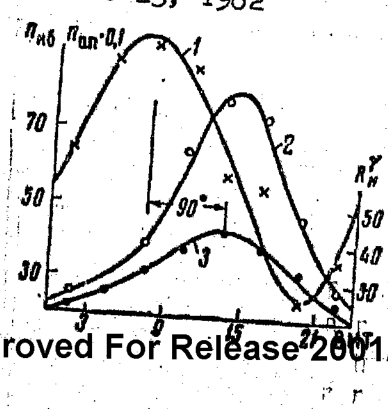
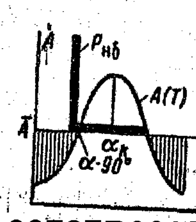


Figure 2.



Card 3/3

FIRM NO.	CLASSIFICATION UNCLASSIFIED	PROCESSING DATE JUN 1962	FDG

CODE	COUNTRY	PS	AF CHART	ACTIVITY CODES
491	USSR	1131		404

LOCATION	S/T	NAME OF INSTALLATION	PL. NO.
IRKUTSK		MAGNETIC IONOSPHERE STA	

DATE/INFO DA MO YR	DATE/SOURCE DA MO YR	CONTROL NO.	SOURCE	EVAL
- - -	26 DEC 61		CIA/OSI-RA/61-11 SCIENTIFIC INTELLIGENCE RESEARCH AID	

PRINCIPAL RADIOTELESCOPES OF THE SOVIET UNION

OVER

IRKUTSK SOLAR STATION

Alternate Name: Laboratory for Solar Study

Subordinate to: Institute of Terrestrial Magnetism, Ionosphere and Radiowave Propagation, Moscow. In 1959 subordinate to the Irkutsk Ionosphere-Magnetic Station of the Ministry of Communications

Location: Meget, near Irkutsk, RSFSR
52° 28' N- 104° 02' E

Functional Description

Technical Description

Personalities

Other Information

Approved For Release 2001/03/26 : CIA-RDP96-00787R000500130080-7

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22 Nov 22 22 JUN 1961

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AID Report 61-69

31 May 1961

PHENOMENA IN THE UPPER ATMOSPHERE

REVIEW OF SOVIET LITERATURE

AID Work Assignment No. 3

Report 13

Science and Technology Section

Air Information Division

This is the thirteenth in a monthly report series reviewing Soviet developments in astrophysics and geophysics. Beginning with this report the series identification is changed to read AID Work Assignment No. 3, replacing the previous designation Project 521007, Task 3. The report is based on materials received at the Air Information Division in May.

Materials in this report deal with the following topics:

II. Solar radiation and the ionosphere
III. Van Allen belts and cosmic rays
IV. Telluric currents
V. Atmospheric electricity
VII. Satellite and missile data

influenced not only the value of the earth current variations, but their [illegible] earth current field has a regional character must therefore be reexamined.

In 1956 work was concentrated along two routes, the Voyenno-Gruzinskaya highway and in the Kartliyskaya plain. The route was extended along the Surami-Dzirula highway immediately on the crystalline rocks of the Dzirul'skiy massif. Correlation of results showed the EW component to play the dominant role. Thus, the 1956 studies confirmed the existence of an approximately latitudinal direction of the telluric currents, corresponding to the direction of the folding of the Caucasus range. A high value of the telluroparameter was noted in the region of Cretaceous limestones (Chartali, Pasanauri) and shales (Krestovyy pereval). The Darial'skiy granite massif (Tamaris-Tsikhe) showed a high value. The measurements made in the Kartliyskaya plain (Medzhvriskhevi, Kveshi, Tkviavi, Muguti) completely confirm the data of 1955, and measurements at points near outcroppings of the crystalline massif (Plevi) or on the very massif (Rikoti, Khevi, Vertkvi'Chala) confirm conclusions made to the effect that there is a sharp increase in the values of the telluroparameter, the closer the crystalline rocks approach the surface, or in measurements made on outcroppings of crystalline rocks.

The investigations showed that it is possible to study the geological structure with the telluric current method, both by short period variations and by data on the daily march of variations. The latter method is preferred. Particularly good qualitative results may be obtained in investigating structures resembling the Kartliyskaya plain, i.e., relatively good conducting rocks underlain by high-resistance fromations. The matter of obtaining accurate quantitative data on the thickness and depths of beds of a given geologic formation is quite difficult and requires further systematic investigations.

Comment: The method used by the authors is sound and the results obtained prove the feasibility of applying the telluric current method to geologic prospecting. It cannot be used for prospecting at great depths, however.

2.) Vinogradov, P. A. Diurnal distribution of steady short period oscillations of the terrestrial electric field according to observations at the Uzur station (Lake Baykal). IN: Akademiya nauk Gruzinskoy SSR, Tiflis. Institut geofiziki. Trudy, v. 18, 1960, 43-52. QE500.A55 [illegible] Station [illegible] Irkutsk Magnetic-Ionospheric Station of the Scientific Research Institute of Terrestrial Magnetism, the Ionosphere, and Radio Wave Propagation

A station was set up on Ol'khon Island in Lake Baykal to make uninterrupted recordings of short period Pc (steady) oscillations in the terrestrial electric field using equipment with a sensitivity (0.02 mv/km/mm) higher than had hitherto been possible. It was thus possible to record Pc oscillations of a very small intensity. The station operated constantly from 10 Sep 1955 to 17 May 1957. The length of the east-west pickup line was 1000 m, while the north-south line was 500 m. The observational data obtained, chiefly on the daily distribution of Pc oscillations, provided information on the characteristics of short-period oscillations, the terrestrial electric field, and the influence of the screening properties of the ionosphere.

Of 322 days examined 288 (89.5%) had P_c oscillations. The minimum number of days without Pc oscillations was noted in March and September, while the greatest number occurred in February and July. Daily Pc distribution has the highly pronounced form of a simple wave with a daytime maximum and a nighttime minimum. A slight shift in the time of onset of extremal values from winter to summer was observed. In winter the greatest number of steady oscillations are observed at 14-1500 hours, while in summer, at 12-1300 hours, local time. The amplitude of the daily Pc curve during the equinoctial periods is somewhat smaller than at other times of the year. The Pc excitation frequency in the period of least development (00-0300 hours, local time) is about three times less than the frequency of appearance in the period of maximum development of these oscillations (11-1500 hours, local time). Comparison of Pc distribution curves according to the value of the period shows that in the equinoctial months the predominance of Pc recurrence with a period of 20-30 sec over Pc with other periods is noticeably higher than at other seasons of the year. Results did not resolve the question as to whether the short period oscillations are excited simultaneously throughout the world (a view held by V. A. Troitskaya) or whether they occur according to local time (the view of R. A. Zevakina and V. V. Kebuladze). In some cases the Uzur station reported Pc excitation time to occur at intervals established by Troitskaya, while in other cases the excitation was connected with local time.

The Uzur station could find no direct relationship between the daily distribution of the frequency of Pc appearance and the screening of the earth's surface by the ionosphere, since the most intense Pc and most frequent short period oscillations are observed at hours when the greatest screening action of the ionosphere, depending upon the [illegible] conductivity of the latter, should be observed. The following suggest that Pc observations are observed simultaneously over large areas and that their excitation is connected with upper atmospheric processes.

In the summer of 1955 simultaneous recordings of short period oscillations were made in Zuy and on Ushkaniy Island. Processing of the records by the conjugate ellipse method showed a sufficiently steady relationship between Pc components in the form:

$$u = ax + by, \quad v = cx + dy$$

where x and y are the Pc components on Bol'shoy Ushkaniy Island and u and v are the Pc components in Zuy. Comparison showed that the Pc amplitude on Ushkaniy is about 12-25 times greater than the amplitude of the same oscillation in Zuy. In cases when almost total Pc attenuation is observed, the traces on the Ushkaniy records disappear somewhat later and appear earlier, than in Zuy, but sharply pronounced Pc within the limits of measurement accuracy are excited simultaneously. These Pc excitation characteristics are, apparently, determined by the location of Ushkaniy Island and its geologic structure. The thickness of the sedimentary sequences in Zuy exceeds 1000 m, while Ushkaniy Island is composed of metamorphic Precambrian rocks. The recurrence of certain types of oscillations in the same hours of several days was detected in the Pc records. Thus, for example, from 1 Apr through 10 Apr 1952 intensive Pc, having about the same regime at the same time of the day, were observed. These oscillations were connected with a very stable and geophysically active region of the sun observed at that time.

A sharp Pc increase after the commencement of geoelectric field storms is sometimes observed. This Pc intensity increase is particularly noticeable when the commencement of the storm occurs during hours of weak Pc development. Another characteristic of Pc excitation, connected with terrestrial electromagnetic storms and auroras, is the broadening of the spectrum of short period oscillations during the phenomena. It is noted that on quiet days chiefly Pc with a period from 10 to 30-40 and more seconds are observed, while during auroras, oscillations with a period from 1 to 60-70 and more seconds are observed. Of all oscillations of the indicated spectrum those with a period of about 1-2 sec are particularly evident; oscillations with a period of about 2 sec occur more often than oscillations with a period of about 1 sec. An almost complete constancy of the period for the entire interval is characteristic of oscillations of both groups.

Comment: Vinogradov's investigation of the steady telluric current oscillations and the dependence of their amplitudes upon the seasons is of import. The data obtained show that the local geological structure of the ground determines the period and amplitude of oscillations. The character of oscillations can be used as a means for studying the ground composition.

3.) Kebuladze, V. V., and A. S. Lashkhi. Results of investigations of telluric currents made in 1957 at the Dusheti electrotelluric station. IN: Akademiya nauk Gruzinskoy SSR, Tiflis. Institut geofiziki. Trudy, v. 18, 1960, 53-70. QE500.A55

Continuous round-the-clock recordings of telluric current variations have been conducted at the Dusheti station from the autumn of 1947 to 1 Jul 1957 on mutually perpendicular overground lines with a recording speed of 20 and 40 mm/hr. In the spring of 1957 the existing pickup lines were reconstructed and new equipment introduced to record variations at three rates. A detailed description is provided of the lines and electrodes, the 80 mm/hr recording equipment for earth current variations, the 20 mm/hr equipment, and the 30 mm/min recording equipment for short period variations.

The 1957 tellurograms were processed with the aim of studying the daily solar march of the earth current potential gradients and of investigating the question of the periodicity of protracted electrotelluric disturbances. In addition, since 1 Jul 1957 independently flowing bay-shaped disturbances with and without pulsations, sudden commencement disturbances, separated impulses, trains of oscillations and short period oscillations of a stable regime were studied. The methodology of processing observational materials is described in detail elsewhere (Trudy Instituta geofiziki AN GSSR, v. 12, 1953). After taking the ordinates from the 20 mm/hr tellurograms, monthly tables of the mean hourly gradients of potential for the EW and NS components were compiled, then hourly values of the daily march in $\frac{mv}{km}$ were calculated, and on the basis of these data the daily solar march according to month, season, and yearly mean were deduced. Analysis of this material produced a curve of the mean yearly daily-solar march of the EW component similar to curves obtained in 1948-56. The mean yearly daily march of the EW component is a double wave with basic maxima between 8-1000 and 16-1800 hours, and basic minima between 05-0700 and 13-1500 hours local mean solar time. The amplitudes of the daily march in the summer and equinoctial months considerably exceed the amplitudes of the winter months. The daily march curve of the NS component is very weakly expressed. The mean yearly hodograph of the horizontal component extends latitudinally, indicating a predominance of latitudinal currents in the region of the electrotelluric station.

The yearly march of the electrotelluric disturbances, lasting from several hours to several days, was studied by compiling monthly tables of hourly values of the maximal amplitudes of variation, daily evaluations according to 3-point hourly characteristics, and by compiling a catalog of electrotelluric storms and distrubances. Hourly values of maximal amplitudes were determined for both disturbances and quiet days. Curves were found to be analogous with those of former years. A maximal number of disturbed hours occurred from 18-2200 hours, and minimal from 03-0600 hours, universal time. In regard to the yearly march curve of 1957, the greatest number of disturbed hours took place in the equinoctial months, and the least in the months of the summer and winter solstice. Electrotelluric activity in 1957 was considerably higher than in 1948-56. The number of disturbed hours in 1957 was 1250-1300, while in the earlier period it had averaged 1100 per year.

Catalog data show the highest intensity disturbances took place in the equinoctial months. The greatest number of bay-shaped disturbances took place in December and August. They are completely absent in June, and in September only one was recorded. Further processing and correlations are necessary before final conclusions may be drawn.

Comment: Although the authors' investigation relates to a limited area only and characterizes the march of telluric currents at but one point, it is of interest insofar as it shows the march of the telluric current state throughout the year together with its seasonal peculiarities.

4.) Vinogradov, P. A. Changes in the potential gradient of the electrotelluric field at different depths of Lake Baykal. IN: Akademiya nauk SSSR. Baykal'skaya limnologicheskaya stantsiya. Trudy, v. 18, 1960, 380-392. DK771.B3A18

The equipment used in the Lake Baykal region from 20 Feb through 1 Apr 1955 to make continuous recordings of the variation of the potential gradient of the electrotelluric field consisted of a photogalvanograph and five pick-up lines, three of which lay in an east-west direction and two in a north-south direction. The electrodes of the eastern lines were submerged to depths of 5,200, and 1,100 m; those of the northern line to depths of 5 and 400 m. All electrodes in the same direction were in a single vertical plane. $0.4\ m^2$ lead plates served as electrodes. Each line was 500 m long. ПСМ wire was used to link the electrodes to the recording equipment. The insulation resistance for the lines exceeded 10 mg ohm/km. Properly shunted self-leveling mirror galvanometers operated in the regime of critical damping. Periodic measurements of the ground resistance of the electrodes showed a constant 170 ohm during all observations. Oscillograph recordings were made at rates of 4, 10, 20, and 90 cm/hr. Simultaneous recordings were made from two pick-up lines. The station was located on the ice of the lake near the town of Listvenichnoye, a permanent telluric station operated in Zuy.

Two types of short period oscillations, differing from each other by the nature of their oscillatory regime, are distinguished. Type 1, once begun, continue for hours, while Type 2 are observed in groups or trains of from 1-10 oscillations. Type 1 may be further divided into 3 forms as follows: 1) complex harmonic short period oscillations, the amplitude and period of which change irregularly; 2) sinusoidal short period oscillations, the amplitude of which changes irregularly, but which are more stable than Form 1; the period remains almost constant for several tens of years; and 3) sinusoidal short period oscillation, the oscillatory process of which consists of separate packets, containing from 3 to 10 and more oscillations, the amplitude of which after a smooth increase to about the center of the packet gradually lessens. Analysis of electrograms shows that most often Form 2 oscillations are excited, and only very rarely the packet form. The difference in the nature of the flow of these oscillations is, apparently, connected with modifications in the factors causing them.

The following conclusions are made from the observations: 1) Short period Type 1 and Type 2 oscillations as well as bay-shaped disturbances of the electrotelluric field at different depths of Lake Baykal and on land (Zuy) are, within the limits of measurement accuracy, excited simultaneously, coincide completely in their parallel march, and have a similar period. Because of the complete similarity (with the exception of amplitude) of all the oscillations and impulses, the oscillatory regime of the electrotelluric field at different depths in Lake Baykal and on land has the same character. 2) The amplitudes of Type 1 and Type 2 oscillations and of the bay-shaped disturbances in Baykal and Zuy correspond to the electrical resistance of the medium of these points. 3) A slight lessening of amplitude with depth was detected in Type 1 and 2 oscillations. The value of the attenuation, computed from the observational materials, is in agreement with the value of attenuation obtained from examination of the absorbing effect of Baykal's waters on the variable electrotelluric field. 4) Local electric currents, connected with the water currents in Baykal, were detected. The change in the potential of the field of these currents represents a series of uneven oscillations with a period of 2-7 sec and an amplitude of 0.1-0.8 mv/km. 5) Type 1 short period oscillations in both Zuy and Baykal are excited chiefly in the interval from 00-1200 hours, while Type 2 occur from 12-2400 hours, universal time. The greatest recurrence of bay-shaped disturbances occurs during nocturnal hours.

Comment: The results obtained by the author are interesting insofar as they show the character of telluric current oscillations as dependent upon the earth's rotation and the medium through which the current passes.