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INTERNATIONAL CONFERENCE ON COSMIC RAYS AND THE EARTH STORM Part II

II-1B-8. The Microstructure of *ISc* of Geomagnetic Storms

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The sudden commencement of geomagnetic storm *Sc* is one of the most important geomagnetic phenomena. Owing to its wide view of the problems one of the recent work by Chapman S. and Akasofu S.-I.[1] is of great interest. Outstanding results have been achieved in this field by Japanese geophysists Kato Y., Watanabe T., Saito T., Fukushima N.[2-6] and others. The author of this paper investigated some characeteristics of the initial phase of geomagnetic storm following immediately after *Sc*.

First a few words from the point of view of symbolics and terminology. Specializing in storms with sudden commencement, the storm begins in the moment *Sc*. It is necessary in my opinion to keep this symbol for the moment only when the event breaks out. It cannot be connected with what follows.

The initial phase of geomagnetic storm, following immediately after *Sc*, manifests itself in numerous ways. Nevertheless some characteristic features are prevailing, for example the increase of horizontal component H by several tens of γ (in case of Sc^+). The initial phase is caused by the first impact of the solar plasma front on the outer boundary of the exosphere and by its distortion including the "frozen" lines of force and hydromagnetic phenomena accompanying exclusively this first impact[7]. All these phenomena usually last for no longer than a few minutes altogether. The length of this interval can be indicated *ISc*. The beginning of this interval is thus given by the moment *Sc* (*Si* may be used in addition to *Sc*). The end is less clear and is estimated approximately from the magnetogram. For determining the length of *ISc* the magnetometric quick-run records are suitable, *e.g.* by the La Cour apparatus.

The total value by which H increased in the course of *ISc* can be denoted by *ASc*. These amplitudes differ for different storms and depend on the time of day.

The symbols *Sc*, *ISc* and *ASc* represent the basic characteristics of the initial phase of the geomagnetic storm with a sudden commencement (Fig. 1).

Further the dependence of *ASc* on *ISc* was investigated from the quick-run records on the Budkov observatory $\lambda=14°01'E$, $\varphi=49°04'N$. The storms in the years 1958-1960 have been investigated. 45 best registered and analysable were selected. For each storm *Sc*, *ISc*, *ASc* were determined. The result of the analysis is given in Fig. 2, where the points corresponding to plotted values of *ISc* and *ASc* fill in a band in which the dispersion of individual values from its axis is

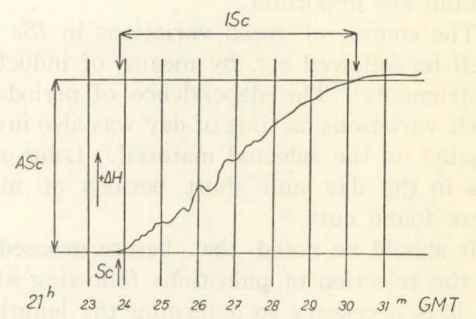

Fig. 1. The initial phase of geomagnetic storm with pronounced characteristics *Sc*, *ISc*, *ASc*.

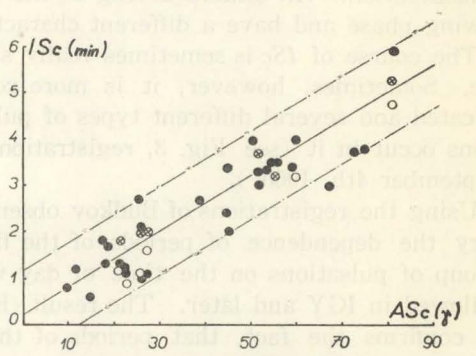

Fig. 2. The dependence of *ISc* on *ASc*.
●-La Cour instrument
○-with the use of induction variometer
⊗-with the use of earth-currents recording instrument

caused by inaccuracy in estimating the length of *ISc* and the varying steepness in the course of the record-curve in *ISc*. The graph shows positive correlation.

The relation in the figure is slightly idealized by the very selection of storms. The advantage is that it is a material from one station. In my opinion it would be necessary to study this relation for each station separately and carry out the morphological research afterwards.

And now to the microstructure of *ISc*. In numerous cases rapid variations are observed in the interval *ISc* which soon disappear. Some authors stated that pulsations usually follow immediately after *Sc* and they partly investigated them. I suppose that it would be wise not to investigate pulsations registered randomly after *Sc*, but systematically to study the laws governing the occurrence of pulsations in the whole *ISc*. As a basis for the analysis a technically perfest recording, a reliable determination of sensitivity and timing are important.

The course of rapid variations in *ISc* can well be followed *e.g.* by means of inductive instruments. The dependence of periods of such variations on time of day was also investigated on the selected material. Long periods in the day and short periods at night were found out[6),8)].

It should be noted that before proceeding to the selection of pulsations following after *Sc* it is necessary to determine the length of *ISc* and in the investigation only those occurring in this interval should be taken into consideration. All others belong to the following phase and have a different character.

The course of *ISc* is sometimes really simple. Sometimes, however, it is more complicated and several different types of pulsations occur in it (see Fig. 3, registration of September 4th, 1960[9)]).

Using the registrations of Budkov observatory the dependence of periods of the first group of pulsations on the time of day was followed in IGY and later. The result (Fig. 4) confirms the fact, that periods of these pulsations in diurnal hours show 30 sec whereas at night only a few seconds. The dependence however requires a further detailed investigation using a greater number of first-class quick-run magnetograms. Also here it

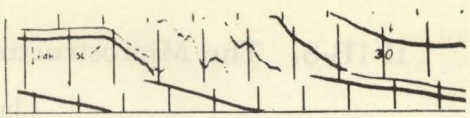

Fig. 3. Sudden impulse *Si* of geomagnetic storm on 4, Sept. 1960 21^h24^m GMT, recorded with La Cour apparatus, 6mm/min-Budkov.

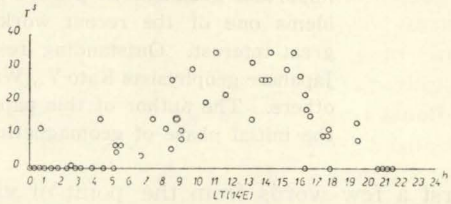

Fig. 4. The dependence of periods of the first group of pulsations in the interval *ISc*. Budkov observatory (La Cour) 1958-1960.

is necessary to plot a graph of stated dependence for each observatory separately and not to use magnetograms of different stations for one graph as it sometimes happens and to carry out the morphological research afterwards.

Conclusions

The complicated and variable characteristics of the first phase of geomagnetic storm is investigated by means of analysing magnetograms of the quick-run Budkov observatory.

1) The basic characteristics of this phase have been defined.

2) The dependence of the increase of *H* on the length of the initial phase on selected cases was investigated and a positive correlation has been found.

3) There are several types of rapid variations occurring in the course of the initial phase. The pulsation periods of the first group in daytime are about 30 sec and at night only a few seconds.

References

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Discussion

Saito, T.: I think dotts of *ISc* plotted against *ASc* do not distribute on such a fine linear belt, but very scattered. For example, the ratio *ISc*/*ASc* is very large in the case of gradual commencement of the storm, while it is small at the time of sharp beginning which often follows the severe storm.

Bouška, J.: I am aware of the facts that the relation in the figure is slightly idealized by the selection of storms. Only best registered and apt to be analyzed *Sc* were selected. The dependence is most simple and requires a detailed investigation using a greater number of first-class quick-run magnetograms. However the positive correlation is clear.

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II-1B-P1. Geomagnetic Rapid Variations during IGY and IGC

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This paper is simply a presentation of some of results which can be obtained with the monthly data sent to IAGA Com. 10 on Geomagnetic Rapid Variations for the period of IGY and IGC (July 1957-December 1959).

The phenomena reported are: 1) pulsations (*pt*) and bays, 2) storms sudden commencements and sudden impulses, 3) solar flare effects and 4) pulsations from rapid run magnetograms (*pt* and *pc*).

We shall not deal with solar flare effects because the data reported are too incomplete and we shall not say anything about storm sudden commencements because the hour of occurrence of them have been already reported and no new feature, as daily or seasonal variation could be derived from the existing material.

§ 1. Trains of Pulsations (*pt*)

In this statistical study of *pt*'s we deal only with *pt*'s reported from normal magnetograms. There have been 70 observatories reporting *pt*'s as separate from bays and there seems that a uniform criterion for selection has not been applied: some observatories have only reported 1, 2 or 3 *pt*'s in 30 months and others have given 670 and 543 for the same period.

The geographical distribution is shown in Fig. 1 (underlined symbols). The observatories are distributed into 8 latitude zones in accordance with their geomagnetic latitude as recommended for the IGY:

polar stations	$L \geq 60$
subauroral	$45 > L > 60$
minauroral	$20 > L > 45$
equatorial	$0 > L > 20$

and following their local time. As it is immediately seen, there is still a great majority of stations in the northen hemisphere (49 in the North and 21 in the South) and some latitude zones are very poorly represented.

We have studied the daily distribution of *pt*'s: we plotted for each observatory the