A Note on H-variation of -SI

By

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Abstract

In this short note, some characteristic behaviors of an average disturbance-time H-variation around -SI at Honolulu are shown and discussed briefly related to the solar plasma stream which are responsible for the -SI event.

Some studies of morphology on the sudden impulse of the earth's magnetic field, SI, have been worked by the present writer[1],[2]. One of the important results of those studies suggests that negative SI's (-SI's) may be caused by the reverse process of positive SI's (+SI's). Namely, it is considered that −SI's may occur when the solar plasma which is compressing the earth's magnetic field disappears suddenly from the vicinity of the earth. In this short note, another evidence is given to confirm the suggestion. The evidence can be found in the H-variation around the time of −SI.

Fig. 1 shows the average H-variation of 20 typical and intense −SI's observed at Honolulu. These −SI's are selected from the quiet day magnetograms during the years from 1950 to 1959. The average H-variation curve is obtained for the period from −24 hour to +12 hour of −SI. The total amount of the data may not be enough to reduce the contribution of Sq and day to day variations by averaging. However, these contributions are considered to be negligible, judging from the following two facts. The first one is that the curve shows a nearly constant level for the period from −24 hour to −12 hour as can be seen in Fig. 1. The other is that the said constant level is quite equal to the mean level of the preceding day. Consequently, the curve is regarded as the "disturbance-time" H-variation of the −SI's like Dst-field of SSC storms.

The curve shows the following characteristic behaviors. Before the −SI commences the earth's magnetic field begins to increase at −10 hour or so. After the −SI the field quickly turns back nearly to the initial level which represents the undisturbed state. It is notable that the field never decreases under the initial level in the present case.

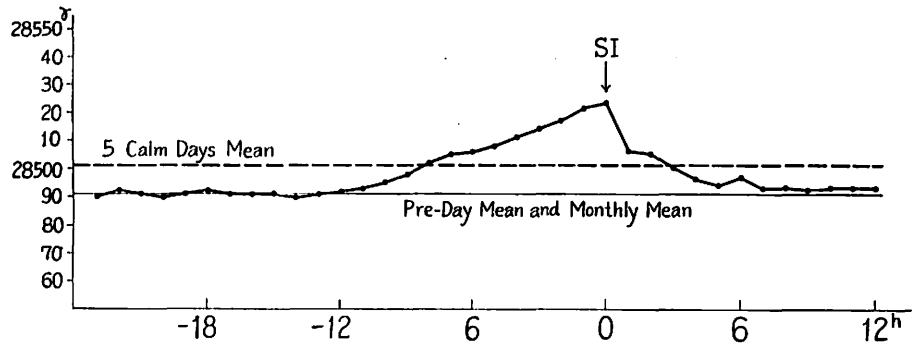

Fig. 1. Average H-variation of −SI's at Honolulu.

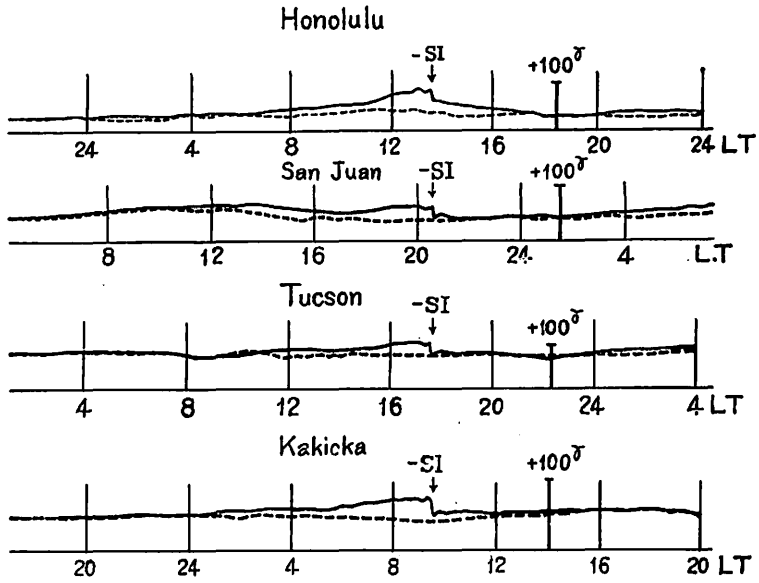

Fig. 2. Reproductions of the magnetograms of −SI which occurred on 13th March in 1953.

These behaviors can be seen on the individual magnetogram at the low latitude stations, too. The magnetograms of such examples are reproduced in Fig. 2 for the same event at Honolulu, San Juan, Tucson and Kakioka. The broken lines in the figure are the respectives on the preceding day. Each curve shows the same characteristic behavior of H-variations clearly as the average.

From these facts, it may be possible to consider the characteristic behavior of the solar plasma stream which is responsible for −SI events. The solar plasma

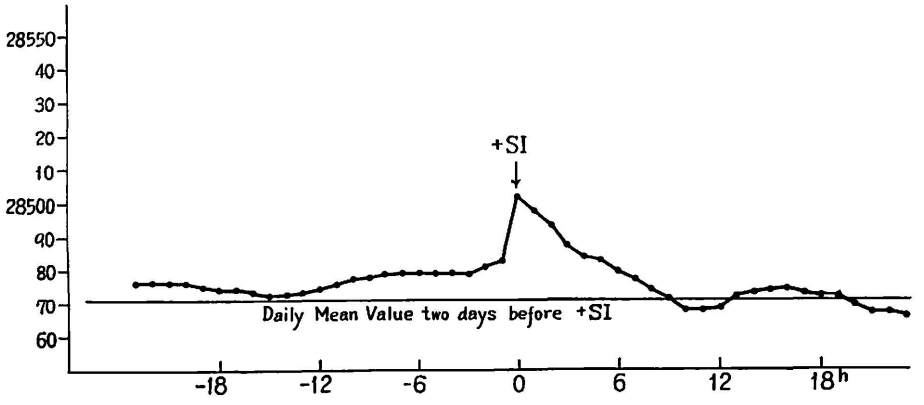

Fig. 3. Average H-variation of +SI's at Honolulu.

stream flowing towards the earth may be intensified gradually before −SI. Then, the earth's magnetic field increases more and more corresponding to the growing compression due to the stream. Some hours later, the solar plasma stream may be weakened suddenly. Simultaneously, the earth's magnetic field decreases as a result of its expansion. This sudden decrease of the field is just the −SI event. The solar plasma stream concerned here has not sufficient energy to form a ring current in comparision with the stream which is responsible for SSC storms. These statements are just the same as described in the first place of this note.

In order to compare the H-variation of −SI with that of +SI, the average H-variation of +SI's is obtained by the same method as in the case of −SI. This variation is shown in Fig. 3. The curve of the variation is the mean of 26 +SI's selected from the magnetograms of Honolulu during the years from 1950 to 1959. As can be seen in the figure, the curve seems to include some detectable contributions of Sq and the day to day variation in comparison with that of −SI. And the rather greater depression of the earth's magnetic field occurs after +SI. In spite of these ambiguity, it is still safe to say that the curve does not show so distinct increase of the earth's magnetic field before +SI. It goes without saying that +SI is caused by the same process as SSC.

In conclusion, the present writer wishes to express his sincere thanks to Dr. T. Yoshimatsu and Dr. K. Yanagihara for their encouragements and helpful advices given during the study.

References

(1) Sano, Y. : Memoirs Kakioka Mag. Obser., Vol. 11, No. 1, 1962.
(2) Sano, Y. : Memoirs Kakioka Mag. Obser., Vol. 11, No. 2, 1963.

−SI の水平分力変化

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概要

Honolulu における −SI の H-成分変化の特性を示し，その特性から想像される −SI を起すであろう太陽微粒子流の様相について簡単に議論する。