a tail;

(c) increased absorption when the sun is above about 97°.

In contrast auroral events are usually local, very variable in time and shows different incidence at widely spaced stations.

JOURNAL OF THE PHYSICAL SOCIETY OF JAPAN Vol. 17, SUPPLEMENT A-I, 1962
INTERNATIONAL CONFERENCE ON COSMIC RAYS AND THE EARTH STORM Part I

I-2-4. Sudden Cosmic Noise Absorption at the Moment of Geomagnetic Storm Sudden Commencements*

J. ORTNER,** T. R. HARTZ,*** O. HOLT,**** B. HULTQVIST,**
R. R. BROWN,***** H. LEINBACH****** and C. G. LITTLE*******

As has been reported by Brown (1961) bursts of X-rays have been observed at balloon altitude at the moment of SC of magnetic storms and sudden ionospheric absorption has been measured simultaneously with the X-rays by means of riometers in North America and Scandinavia. The original riometer records for the event of 27 June, 1960, are shown in Fig. 1. At the moment of the SC both the College and Kiruna records showed SCNA simultaneously, while the absorption during the rest of the interval represented in the figure does not show any marked correlation at the two observatories. This indicates that the electron bombardment of the upper atmosphere giving rise to the X-rays occures on a large scale.

Brown et al. (1961) raised the question if the short influx of electrons at the specific moment of the sudden commencement of a geomagnetic storm could be interpreted either

(1) by a "dumping" of electrons from the outer radiation belt brought about by the rapid geomagnetic field change at the time of the sudden commencement or

(2) by the escape of electrons from the plasma cloud encountering the geomagnetic field.

Since Brown's observations were made riometer information has been collected and studied for all SCs listed by Bartels in his three-hour-indices plottings for the period July 1958 to Dec. 1960. In this study all riometers situated in the northern hemisphere will be included. These are about 25 in number distributed between 56.4° and 88.0° geomagnetic north. At the present time data from the 5 Alaskan riometers are missing but it will be available in the near future. The report is therefore preliminary. The first results of this study are summarized in Table I.

For 31 of the 75 investigated sudden commencements a definite SCNA effect at all stations was observed. In 10 cases the effect was only visible on the European side of the earth, and in 3 cases only on the American part. The remaining 31 SCs were not associated with any effect at all. In order to eliminate the possibility that the described SCNA effect might be auroral absorption coinciding with the sudden commencement, all cases were eliminated for which the riometer recorded absorption already before the sudden commencement. Even then, however, there remain 20 cases, for which the effect can be definitely observed on both the day and night side of the earth within the same minute.

The data show also clearly a pronounced latitude effect with regard to the strength

---

* This paper was read by B. Hultqvist.

** Kiruna Geophysical Observatory, Kiruna C. Sweden.

*** Radiophysics Laboratory Defence Research Telecommunications Establishment, Ottawa, Canada.

**** Norwagian Defence Research Establishment, Kjeller, Norway.

***** Department of Physics, University of California, Berkeley, California, U.S.A.

****** Geophysical Institute, Univ. of Alaska, College, Alaska, U.S.A.

******* C.R.P.L., National Bureau of Standards Boulder, Colorado, U.S.A.

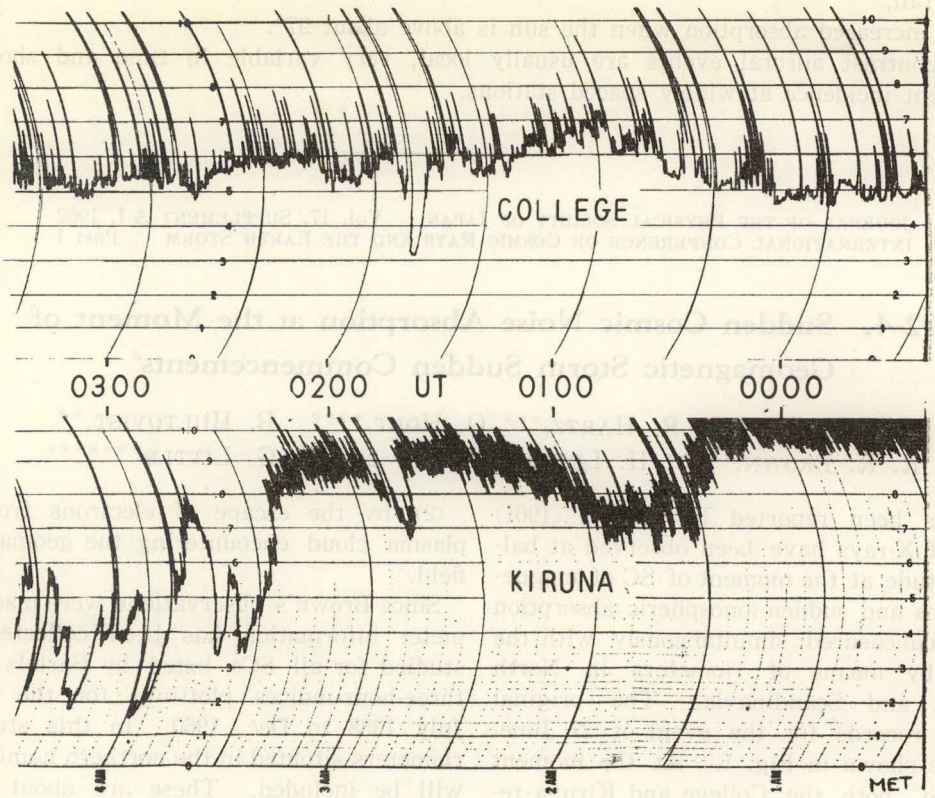

Fig. 1.

Table I.

Period	Number of SCs	SCNA effect observed			
		at all stations	partly		at no station
			Europe	America	
July–Dec. 1958	16	8	0	0	8
Jan.–June 1959	15	1	3	0	11
July–Dec. 1959	10	1	2	0	7
Jan.–June 1960	18	11	2	2	3
July–Dec. 1960	16	10	3	1	2
July 1958–Dec. 1960	75	31	10	3	31

of the effect. Considering the amount of absorption at the various stations at the moments of the SC, the peak absorption is reached in 80% of the cases within the latitude range 65 to 67° geomagnetic latitude. The remaining 20% sudden-commencement correlated SCNA events showed the maximum to the north of this latitude range.

This latitude dependence seems to indicate that the effect is not due to "dumping" of electrons from the outer Van Allen radiation belt, because if it were so the observed effect should probably have its maximum a few degrees to the south of the auroral zone. On the contrary, the data show that this type of SCNA occurs well within the auroral zone.

Thus it might be concluded, that the high energetic electrons responsible for the ioniz-

ing X-rays come from the main solar plasma cloud reaching the earth's magnetic field at the time of the sudden commencement. This electron precipitation does evidently not always occur all around the auroral zone, and in a large fraction of the geomagnetic SC cases no particles seem to be released from the solar plasma cloud at its first interaction with the geomagnetic field.

References

Brown, R. R.: X rays accompanying the magnetic storm of June 27, 1960. Arkiv för Geofysik, Bd. 3, **21** (1961) 435–439.

Brown, R. R., Hartz, T. R., Landmark B., Leinbach H. and Ortner J.: Large-scale electron bombardment of the atmosphere at the sudden commencement of a geomagnetic storm. J. Geophys. Res. **66** (1961) 1035–1041.

Discussion

Knecht, R.W.: Is there any relation between the severity of the subsequent magnetic storm and whether or not an increase in absorption occurred simultaneous with the sudden commencement?

Hultqvist, B.K.G.: We have not yet looked into this question.

Obayashi, T.: Instead of increase absorption of the ionosphere at the time of SC, there are several occasions of sudden decreases of absorption. They are the case when PCA event is in progress before the SC. This may be attributed by the sudden increase of the cut-off rigidity of incoming particle at the SC.

Hultqvist, B. K. G.: Decrease instead of increase of the absorption at the SC in several of the first great PCA effects observed in Scandinavia. We have not yet been able to find any regularities in the change being positive or negative. For instance it seems not to have to do with whether the observing place is on the day or the night side of the earth. We are going to study this in more detail.