NOTE

A Comparison of Magnetic Disturbance at Resolute Bay and Baker Lake, Canada[1]

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In a recent paper, ALFVÉN (1955) has discussed the possibility of an inner auroral zone with a polar distance of 5—10°, and pointed out the need to check his theoretical predictions against observations of aurora and geomagnetic disturbances.

The Dominion Observatory has operated two magnetic observatories in the Canadian Arctic since 1948. One of these is situated at Baker Lake, N.W.T. (lat. 64.3° N, long. 264.0° E) and the other at Resolute Bay,

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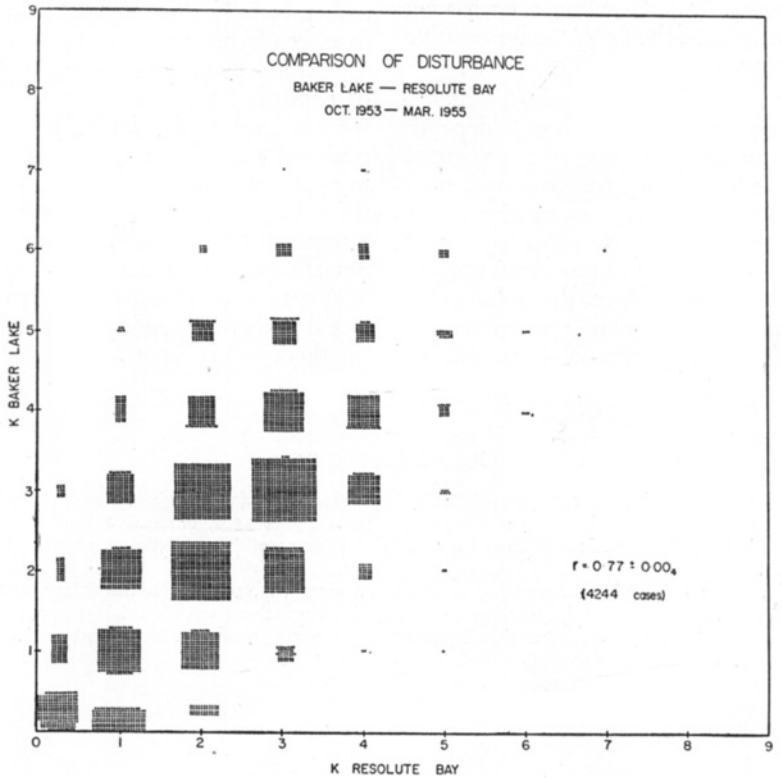

Fig. 1. Comparison of disturbance for intervals of three hours between Resolute Bay and Baker Lake Magnetic Observatories, October, 1953 to March, 1955.

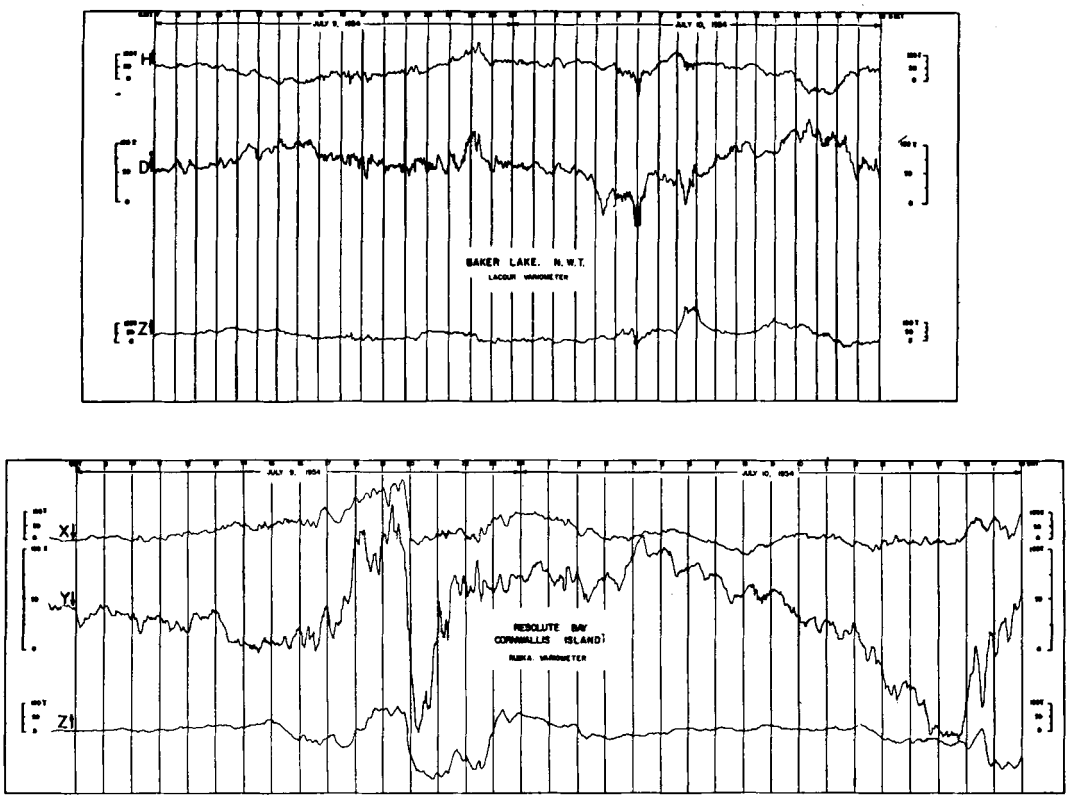

Fig. 2. The magnetograms from Resolute Bay and Baker Lake Magnetic Observatories during July 9th and 10th, 1954.

Cornwallis Island (lat. 74.7° N, long. 265.1° E). The geomagnetic coordinates of these observatories are $\Phi = 73.7°$, $\Lambda = 315.3°$ for Baker Lake and $\Phi = 83.0°$, $\Lambda = 289.0°$ for Resolute Bay. Thus the polar cap observatory at Resolute Bay is excellently situated with respect to Alfvén's estimated position of the inner auroral zone, whilst the disturbance observed at Baker Lake is typical of that at a station on the northern edge of the auroral zone. A detailed analysis of the transient magnetic disturbance at both stations is under way; in the meantime it seemed advisable to comment on Arctic disturbance using the K indices for the two stations which have been measured on a routine basis for some time.

The ranges for K index measurements for the two stations have been determined: the lower limit of $K9$ corresponds to a 2,500 gamma range at Baker Lake and a 1,500 gamma range at Resolute Bay. The frequency distribution curves of K values are then quite similar for the two observatories. Fig. 1 shows a comparison of the K indices for corresponding intervals of three hours. The correlation coefficient is high and equal to 0.77; this rises to a value 0.89 when the sums of the K indices for the day are compared. In view of Alfvén's suggestions, it is of special interest to examine the magnetograms at the times when the K index at Resolute Bay is appreciably greater than that at Baker Lake. Although such a selection is rather arbitrary in view of the non-linear nature of the K-scale, the six cases when the difference exceeds two were carefully examined. In five cases there is marked agreement in the form of disturbance shown in the two magnetograms, and no evidence for disturbance at Resolute Bay occurring independently of that at Baker Lake.

We believe this general conclusion is independent of the value adopted for $K9$ in the measurement of K indices. Copies of the magnetograms for the two observatories around the exceptional period 18 to 21 hr. G.M.T., July 9th, 1954 are shown in Fig. 2. It can be seen that until 19.30 hr. G.M.T. approximately, there are appreciable movements in X, Y and Z at Resolute Bay with no evidence of corresponding disturbance at Baker Lake. After 19.30 hr., both stations are disturbed, but not excessively. The first interval does not apparently correspond to the initial phase of a storm.

A preliminary analysis of storms at Resolute Bay has been completed, and so the magnetograms from Baker Lake at the corresponding times were also examined. The storm patterns are complex and difficult to systematize, but no unusual initial phases appear at Resolute Bay.

The fifteen cases when Baker Lake is appreciably more disturbed than Resolute Bay were investigated. With one exception only, these correspond to the presence at Baker Lake of marked bay activity: very large bays appear between 03 and 09 G.M.T. with the corresponding currents to the south of Baker Lake and flowing approximately north-west. In all these cases, however, a less distinct form of disturbance can still be resolved in the magnetograms from Resolute Bay.

With two stations only in high geomagnetic latitudes it is not possible to look for a minimum of disturbance at an intermediate latitude, and the use of K indices in correlating polar cap and auroral zone activity is not ideal. However, this simple approach is of interest in confirming qualitatively the idea that the circuits of the currents of the auroral zone are closed over the polar cap, and in showing there is no outstanding evidence for an inner zone of precipitation in the Canadian Arctic.

It is of interest to note further that the secondary zone of high magnetic perturbations at geomagnetic latitudes 80—85° suggested by Russian Arctic research (ANONYMOUS, 1954) is of spiral shape, and is not shown extended westwards into the Arctic Islands of Canada beyond Baffin Island.

REFERENCES

ALFVÉN, H., 1955: *Tellus*, **7**, p. 50.
ANONYMOUS, 1954: *Izv. Akad. Nauk. Ser. Geog.*, **5**, p. 3, (Translated by E. R. Hope, D.R.B., Canada).