

Long-term and seasonal changes in the geomagnetic disturbance at the Showa station and the Kakioka observatory

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We investigated long-term and seasonal changes in the geomagnetic disturbance at the Syowa station and the Kakioka observatory using the data of the K-index. Our objectives are to find out differences in the changes between the two sites.

1. Long-term change and variation of 11-year period

(a) Variation of 11-year period is observed in both of the data.

There is a tendency that the peak of the disturbance is delayed 3-4 years compared to the solar maximum.

(b) A correlation is recognized between the changes in the annual average of the K-index at the two stations.

It is notable that the data for 1980 and 1982 are outliers in the correlation diagram. The former is due to smallness of the value at the Syowa station, and the latter is due to largeness of the value at Kakioka.

(c) No long-term change is discerned in the data at Kakioka, but the annual mean value at the Syowa station appears to have been becoming large.

The increase at the Syowa station is clearly seen in the ratio of the mean values at the two stations for each year. The ratio of the annual mean value at the Syowa station to that at Kakioka is larger than 1 except 1980 and 1982: It is about 1.1 in the end of 1960s and is 1.4 in recent years.

(d) The inclination of the least-square line in the diagram showing the correlation between the daily sum of the K-index at the Syowa and Kakioka stations in each year (the K-index at the Syowa station is taken in the ordinate) appears to have been becoming small.

An inverse relation is recognized between the change/variation in the inclination and the change/variation in the annual mean value. The inclination is small for the years of large annual mean values.

(e) A tendency is recognized that the number of the K-index larger than 5 or 6 has been increasing at the Syowa station

Many large K-index values are counted especially in 1984, 1991, 1994 and 2003. These years are not in the max of the solar activity but are in the decay period except 1991.

2. Seasonal variation

(a) Seasonal variation that the geomagnetic field is more disturbed in spring and fall than in summer and winter is observed when data during 40 years from 1966 through 2005 are stacked.

The seasonal variation, however, is not clear in the data of each year generally.

(b) A tendency is recognized that the inclination of the least-square line in the diagram showing the correlation between the daily sum of the K-index at the Syowa and Kakioka stations (the data at the Syowa station is taken in the ordinate) is small in the summer season in the Antarctic (Nov. Dec. Jan. Feb.) and large in the winter (May, Jun., Jul., Aug.).

The inclination is smaller than 1 in the summer of the Antarctic and larger than 1 in the winter.

The increase of the annual mean of the K-index at the Syowa station may be caused by migration of the Geomagnetic Pole. It is interesting to note that the geomagnetic disturbance in 1980 was anomalously small in spite of the fact that the year was in the maximum period of the solar activity. The geomagnetic disturbance at Kakioka was also small in 1980, but the degree of the anomaly was more remarkable at the Syowa station. The feature that the inclination of the least-square line in the correlation diagram between the daily sums of the K-index at Syowa and Kakioka stations is inversely related to the variation of the annual mean of the K-index indicates that the variation of the magnetic disturbance associated with the change in the solar activity is more prominent at the Syowa station than at Kakioka. In the winter season the inclination is larger than 1, which indicates that the K-index at the Syowa station is smaller than that at Kakioka in quiet time. However, the K-index is larger in disturbed situation even in the winter in the Antarctic.