Relation between changes in strain and magnetic field at Kakegawa and magnetic field at Kakioka at the times of geomagnetic storms

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We reported temporal change in the proportionality between the outputs of the three-component strainmeters at the Kakegawa and Haruno stations and the geomagnetic field at Kakioka (Suganuma et al., 2005). In that paper we pointed out that the response coefficient of the strainmeter increased with time at first, and then, the tendency changed in the midst of 2000. At the Kakegawa station a three-component ring core fluxgate magnetometer is installed at a place 30m to the north from the borehole of the strainmeter at a depth of 10m from the ground surface. The strainmeter is installed at a depth of 500m. Therefore, it is expected that some information about electromagnetic structure beneath Kakegawa could be obtained by investigating relationship between the proportional coefficient of the strain, amplification of the magnetic field at Kakegawa and magnetic field at Kakioka.

We calculate the proportional coefficient of the strain and the magnification of the magnetic field at Kakegawa for three frequency ranges of the period of 7.5-15, 15-30, and 30-60 minutes, using one-minute data at the times of geomagnetic storms from April 1998 to December 2005. Altogether 125 geomagnetic storms were observed in that period.

The correlation between the magnetic field at Kakegawa and that at Kakioka is very good for all the three frequency ranges. The variational amplitude at Kakegawa is larger than that at Kakioka for longer periods, but is a little bit smaller for the shortest period. In accordance with the feature the proportional coefficient is larger and the difference of the proportional coefficient between the frequency ranges is clearer when the strain is compared to the magnetic field at Kakioka.

A change of the trend in the magnification coefficient of the magnetic field at Kakegawa is not such clear as that observed in the proportional coefficient of the strain. However, a kind of relationship is recognized between the magnification coefficient of the magnetic field and the proportional coefficient of the strain and a change in the relationship is discerned in the summer of 2000, suggesting that magnetic field at a depth of 500m and magnetic field at the surface changed in parallel temporarily. A fact that the change in the trend is clearer for the proportional coefficient of the strain at a depth of 500m than that for the magnification coefficient of the magnetic field indicates that the source which caused the change is in the depth not near the surface.

References

Suganuma, I., K. Miyaoka, and A. Yoshida, 2005, Change in the response coefficient of strain to the geomagnetic field observed by the Ishii-type three-component strainmeters installed at Kakegawa and Haruno, Zisin (in print).