



## **ULF geomagnetic changes possibly associated with the 2008 Iwate-Miyagi Nairiku earthquake**

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There are many reports on earthquake-related electromagnetic phenomena. Anomalous ULF geomagnetic field changes associated with earthquake is one of the most convincing and promising phenomena due to deeper skin depth. Since ULF signals associated with large earthquakes are weak, effective signal discrimination methods should be required. Several methods for the signal discrimination have been developed so far: which are spectrum density ratio analysis, geomagnetic transfer function analysis, fractal analysis, principal component analysis, direction finding analysis, and so on. [U+3000] In this study, we investigate ULF geomagnetic changes possibly associated with the 2008 Iwate-Miyagi Nairiku earthquake based on spectral density ratio analysis and fractal analysis. Geomagnetic data observed at Esashi, where the epicentral distance is about 47 km and Kakioka, the distance is about 317 km, and as a reference station have been analyzed. Wavelet transform have been performed for the spectral density analysis instead of the conventional FFT method. Before the earthquake, the variation of spectral density ratio, Sz/Sx and Sz/Sy, at the nearest station of Esashi exhibits an apparent increase from the trend. On the contrary, there are no corresponding significant changes at a remote station of Kakioka. After investigating the singularity of the increase using normalized spectrum density ratio, the enhancement is the most significant in intensity and simultaneously results of fractal analysis show abnormal behavior. The lead time is about 3-4 weeks before the earthquake. These facts suggest the anomalous change is a possible candidate of earthquake-related ULF magnetic change.