AOGS 2006

ULF Geomagnetic Anomalous Changes Associated with Large Earthquakes Based on Transfer Function Analysis

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Despite its extreme importance and years of efforts, practical short-term earthquake prediction still remains to be achieved in future. However, earthquake-related electromagnetic phenomena are recently considered as a promising candidate for short-term earthquake prediction. There have been accumulated a lot of evidences of precursory signatures in a wide frequency range (DC-VHF). The ULF geomagnetic change is one of the most promising phenomena and it suggests that the short-term prediction is expected to realize because ULF emissions definitely come from the source region in the crust because of their large skin depth. Generally, the ULF geomagnetic electromagnetic phenomena are very weak and sophisticated signal processing is required to detect. We have developed some effective methods to extract earthquake-related electromagnetic phenomena. In this paper, transfer function approach with wavelet transform have been adopted to investigate the detection of the anomalous changes associated with crustal activities and the variations of inter-station transfer function and normal transfer function of magnetic fields have been investigated for data observed at Izu peninsula, in Japan. We analyzed data observed at Mochikoshi and Seikoshi stations in Izu Peninsula in the periods of 2000-2003 (4 years). The distance between two stations is about 5 km. As a reference station, Kakioka operated by Japan Meteorological Agency is used for estimating transfer functions in this paper. The distance from our stations is about 150 km. In comparison to the mechanical data, we analyzed the strain data observed Toi station, which locates about 5km from Seikoshi station. Main results are as follows; (1) There are three anomalous changes in the magnetic transfer function. (2) The above three anomalous changes are seemed to be associated with the crustal activities, which are not only earthquake activities associated with 2000 Izu island swarm and M5.1 earthquake near Izu stations but also crustal activities without earthquakes. (3) The magnetic anomalous changes are started a few days prior to the mechanical changes.