

Time variation of the electromagnetic field transfer function by using a wavelet transformation

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The Inter-Station Transfer Function (ISTF) method is one of the plausible methods for detecting the possible changes of the electric conductivity structure in the crust associated with large earthquakes and volcanic eruptions. However, in this method, there is one weak point, i.e., the inter-transfer function can be largely affected by transient artificial noises. In order to overcome this difficulty, applying the wavelet transform has been proposed. To use the wavelet transformation, the effect of the artificial noises would be limited to a certain time-frequency range and the detectability of the electric conductivity structure changes has been improved. In this study, the Morlet wavelet was used as a mother wavelet, which is characterized by a sinusoidal function with a Gaussian window allow making the inverse transform.

In the present study, the modified ISTF method was applied for the data collected at the Nakatatsu mine, Fukui Prefecture. We used Kakioka geomagnetic observatory data from 1998 to 2002 for the reference and obtained that 20% of ISTF changes were detected around June 2000. These variations of ISTF can be interpreted as the changes of underground electrical structure, however, it is difficult to identify which station actually changed the structure. During the observation period, NW Off Ishikawa-ken Earthquake (2000 June), and Earthquake swarms near Miyake-jima Island (2000 June - 2000 Aug.) were occurred at that time. Therefore, we further applied the method. We used another magnetic station data (Mt. Iwate) to confirm which magnetic station is real cause of such ISTF changes. The ISTF was calculated every 1 months interval as well as the apparent resistivity and phase data. We confirmed that the cause of ISTF changes of 20 % were due to the Nakatatsu mine.