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ULF seismo-magnetic phenomena in Izu and Boso Peninsula, Japan during 2000-2010

Peng Han[1*], Katsumi Hattori[1], Hisashi Ishikawa[1], Takuya Hirano[1], Yuki Ishiguro[1], Chie Yoshino[1], Febty Febriani[1]

[1]Graduate School of Science, Chiba Univ.

Earthquakes are one of the most destructive of natural hazards, and it has been long a dream of scientists to achieve effective prediction. Recently electromagnetic phenomena have been considered as a promising candidate for short-term earthquake prediction. In order to clarify the earthquake-related ULF (ultra low frequency) magnetic phenomena, a sensitive geomagnetic network has been installed in Japan and plenty of data associated with moderate-large earthquakes have been accumulated. In this study, we have analyzed geomagnetic data observed during the past decade in Izu and Boso Peninsula, Japan.

First, the ULF magnetic signals at the frequency 0.01Hz have been investigated. We have applied wavelet transform analysis to the 1Hz sampling data observed at three magnetic observatories in Boso Peninsula (Kiyosumi, Uchiura, and Fudago) and Izu Peninsula (Seikoshi, Mochikoshi, and Kamo) , respectively. The signature at the 0.01Hz frequency band has been revealed and daily average energy has been computed. In order to minimum artificial noise, we only use the midnight time data (LT 0:00˜3:00). And to remove influences of global magnetic perturbations, three standard geomagnetic stations (Memambetsu, Kakioka, and Kanoya) operated by the Japan Meteorological Agency have been selected as reference stations and PCA method has been applied to the yearly energy variation of the 0.01Hz signals at the three stations. The first principal component which contains more than 95% energy is considered to be global background.

After comparing the results at the stations in Boso and Izu Peninsula with global background, it is found that there are several local energy enhancements which only appear in Boso or Izu area. Statistical investigation has also been carried out and detailed results will be presented in our presentation.

Second, we have investigated the geomagnetic diurnal variation observed at each station in both Boso and Izu Peninsula from 2000 to 2010. Usually for a region that is not large, diurnal variation in magnetic stations should be stable and quite similar to each other. However, the situation could be changed if there were some strong local underground activities such as earthquakes and volcanoes which may cause electromagnetic emissions and/or underground resistivity changes. In this study, we have applied PCA method to the diurnal variation hoping to extract information about local underground resistivity and electromagnetic anomalies.

It is found that the contribution of the second principal components, which may relate with the local underground conductivity structure and/or the local electromagnetic disturbance, has some significant anomalous behaviors during the past ten years. Especially before the 2005 M6.1 and M6.0 earthquake, very clear anomalies have appeared.

Keywords: ULF seismo-magnetic phenomena, Wavelet transform, Principal component analysis (PCA)