Characteristic noises at Kakioka at dawn in 1-sec geomagnetic records

*Tsutomu Ogawa[1]

1. Earthquake Research Institute, the University of Tokyo

It is reported that at Kakioka Magnetic Observatory, Japan, anomalies in the vertical component of 1-sec geomagnetic records between 02:30JST and 04:00JST in the period of approximately 100s are found prior to earthquakes by 6 to 15 days of which the distances from the observatory and the depths are less than 100km and smaller than 60km, respectively, and the magnitudes are approximately larger than 4 (Han et al., 2014). The present study reassesses the result.

The technique to consider the geomagnetic induction contained in the vertical component by Han et al. (2014) is to evaluate the ratio of the observed energy to the synthetic one estimated as the first-order polynomial function of observed energy at a reference station. Since it is not accurate, the present study evaluates the energy of the residual time series from the synthetic one of the vertical component estimated as the combination of horizontal components at a reference station. Almost everyday, oscillations with prominent amplitudes are found in the residual time series at around 03:50JST in the period bands from 32s to 64s, and from 64s to 128s. It is noteworthy that the amplitude varies from day to day.

It is found that the samples of the energy of the residual time series between 02:30JST and 04:00JST from 2001 to 2010 obey the inverse gamma distribution. Since the energy decreases around the new-year day every year, it is expected that the human and social activities affect the residual time series. Defining the anomalous days with the samples exceeding the 95% upper confidence limit of the inverse gamma distribution, the new-year day is regarded as anomalous every year. It is suggested that the cause is the magnetic noises due to the DC-electrified trains in the metropolitan area exceptionally serving all night at dawn of new-year days.

The hypothesis that the anomalous days and the days of prominent earthquakes have no correlation is tested with the catalogs of anomalous days and earthquakes from 2001 to 2010, and random simulations. For three period bands from 32s to 64s, from 64s to 128s, and from 128s to 256s, the hypothesis is rejected for the significance level of 5% with the time window between 02:30JST and 04:00JST. The same tests for the time windows between 02:00JST and 03:30JST and between 02:15JST and 03:45JST, however, result that the hypothesis is not rejected for the three period bands. The result by Han et al. (2014) is expected to be caused by either the natural signals or the magnetic noises due to human and social activities between 03:45JST and 04:00JST.

Keywords: Geomagnetic variation in the ULF band, Earthquake precursory phenomenon, Random simulation

