

A statistical study for relationship between anomalous transmission of VHF band radio waves and earthquakes at Hidaka

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Electromagnetic phenomena precursors to earthquakes, such as variations of geo-electric current, total electron contents in the ionosphere and anomalous transmission of radio waves, have been observed (ex. Hayakawa, 1996). The statistical relationship between such anomalies and an earthquake has investigated statistically (Liu et al., 2011; Orihara et al., 2012).

Anomalous transmission of VHF-band radio wave beyond the line-of-sight has been investigated by many researchers (Kushida and Kushida, 2002), and anomalous FM broadcasting wave (VHF range) has observed close to the epicenter of impending (Moriya et al., 2010). Radio waves transmitted from a given FM radio station are considered to be scattered, such that they could be received by an observation station beyond the line of sight. A quantitative correlation between total duration of scattered wave transmission and the magnitude, or maximum seismic intensity has been proposed (Moriya et al., 2010).

Nevertheless, a statistical relation between the anomalies transmission in VHF-band and impending earthquakes has not been investigated yet. We carried out statistical consideration by using the anomalous transmission data documented by Hokkaido University, and discuss the significance of this relation in this study.

The anomalous VHF-band radio wave data used in this research was observed at the Erimo observatory in Hidakra area from June 1st 2012 to December 31th, 2013. To judge anomalous data, we refer to the statistical method proposed by Liu et al. (2011) that they had used to detect abnormal signals of GPS TEC (total electron content) variations. We adopt a certain standard from median of observed data, and we identified anomalies if data beyond the standard value over 10 minutes.

As a result, some earthquakes were observed precursory anomalous radio propagation, but others are not observed a precursory anomaly. If we set the standard values strictly, the numbers of misdetections are decreased.

Big noises are found because of the appearance of a sporadic E layer in the ionosphere and so on especially in summer. We have to overcome the problem that how to remove such noises.

The earthquakes that we have chosen as targets were magnitude is more than 4.0 and the distance from Erimo observatory is less than 50km as the first trial.

We will investigate the statistical method in many conditions such as duration time, threshold of anomaly, magnitude, hypocenter distance etc and also discuss reasonable method to remove big noise. After that, we need to discuss probability of prediction using the relation between the occurrence of earthquake and anomalous transmission of radio wave propagation.

Keywords: ionosphere, anomalous transmission, relation with earthquakes