

Observation of FM radio wave propagation anomaly at Shimabara area and the anomaly before 2016 Kumamoto earthquake

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VHF-band radio-wave propagation may indicate short-term precursor of earthquakes; physical preparatory processes of earthquakes may produce/attract electromagnetic scatterers in the area over the source of the impending earthquake (Moriya et al., 2010). Hokkaido University has been monitoring this anomalous propagation in several regions in Japan, for example Erimo; Hokkaido, Shimabara; Nagasaki. To evaluate the statistical significance of the tendency that such anomalies precede impending earthquakes in that region, we made a spatio-temporal map of earthquake alarm (Morita et al., 2016, AGU). From the above, the case of Erimo, which has long term data than that of Shimabara, obtained some statistical significance of the correlation between VHF propagation anomaly and earthquake, however the case of Shimabara, we could not get the significance clearly. And then, we could not distinguish the receiving data due to the impending earthquake from not (e.g. caused by Sporadic E layer [Es]), and could not make out the path of out-of-line propagation.

In this study, by the method of Maeda and Heki (2016), we created a system that automatically detects the occurrence of Es from the short-term change of the total electron content. This system made it possible to check if Es is responsible for the detected FM wave propagation. Before the Kumamoto earthquake, April 13, 2016, VHF propagation was received at Shimabara station, but Es was not detected at the same time.

At the Shimabara receiving station, to identify the direction of the received data signal, we set the 6 antennas toward various azimuths. In the observation data before the occurrence of the Kumamoto earthquake on April 16, 2016, the intensity of the received data of the 15th day preceding the Kumamoto earthquake was stronger from the east direction. This means that we could identify the direction of the radio wave.