

## **Detection of anomalous VHF radio wave propagation associated with earthquake by artificial intelligence**

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Research of the geophysical electromagnetic phenomena with seismic activity is important for hazard-resistant strategy. The purpose of our research is to find out any relation between occurrences of earthquake and anomalous line-of-sight propagation in the VHF waves.

We have been observed FM broadcasting waves from line-of-sight region for several years. Our observatory for the VHF radio waves established in Kiryu city which is located about 100km north from Tokyo. After long-term observation we found out the relationship between anomalous propagation in the VHF radio waves and earthquakes. The anomalies in the VHF waves sometimes occurred a few days prior to earthquakes, especially seismic magnitude larger than 4.5, shallower depth of hypocenter than 50km, epicenter located within 100km from the propagation path.

We sometimes detected anomalous propagation NOT associated with earthquakes too, because we have simply regarded larger fluctuation in radio wave strength as the anomalous propagation. However, anomalous propagation may be likely caused by meteorological conditions other than earthquakes. In order to distinguish the anomalous propagation associated with earthquakes or NOT, we adopted new detection method with use of artificial intelligence. In the new method, data of anomalous fluctuation were extracted from all observation data, which were beyond the three times standard deviation. Using the AI, we discriminated between the data of anomalous fluctuation associated with earthquakes in a few days and NOT associated. Data associated with earthquakes were labeled "1" and NOT associated data were labeled "0", and both labeled data were fed into artificial intelligence for training data. Observation data of NHK FM Tokyo (82.5MHz, Sky Tree) period from April 23 2012 to Dec. 31 2015 were used for training data. The iteration number of machine learning was 5,000. After machine learning, we tested the discrimination capability of artificial intelligence. Observation data period from Jan. 1st 2016 to Dec. 31 2017 were used as test data, they fed into the AI for accurate detection of anomalous propagation. As the results of test, detection accuracy by using the AI increases than simple conventional method.

However, accuracy improvement is not enough of earthquake forecast. Therefore, it is in future work.