Detection of lower ionospheric anomaly preceding earthquake using nonlinear autoregressive neural network

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It is possible to monitor the state of the lower ionosphere by observing the VLF (Very Low Frequency) transmitter radio waves with a frequency band of 10 to 50 kHz propagating between the Earth and the ionosphere. In recent years, NARX - NN (Nonlinear Auto Regressive with eXogenous Input - Neural Network) has been applied as a highly accurate modeling and prediction method of temporal variation of VLF band transmitter radio wave amplitude. As a result, we obtain the extremely high prediction accuracy of cross correlation coefficient 0.9 or more between predicted and observed amplitude. Meanwhile, anomalies in the VLF band transmitter radio wave amplitude have been reported indicating the disturbance of the lower ionosphere at night from a week to few days before large earthquakes. Since the accuracy of anomaly detection is not high yet, this study aims to improve the detection accuracy of the lower ionospheric disturbance by analyzing the nighttime amplitude of the VLF band transmission wave using NARX - NN. By specifying the external factors that affect the lower ionospheric disturbance preceding the earthquakes and statistically investigating the difference between observed and predicted values of the VLF amplitude, we contribute to understand occurrence mechaism of lower seismo ionospheric anomalies.

