

R005-32

B会場：9/25 PM2 (15:45-18:15)

15:45～16:00

ペナルティ付き動体検出に基づいた時系列イオノグラム画像における電離圏エコー抽出モデルの開発

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Extraction model of ionospheric echoes for time-series ionogram images based-on penalized motion detection

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The ionosphere affects the operation of various systems, such as satellite and shortwave communications. For example, fluctuations in the ionospheric environment cause disturbances such as satellite positioning errors and absorption of shortwave radio waves. Therefore, it is important for space weather forecasting to continuously observe the ionospheric environment in quasi-real time, in order to alert and mitigate propagation disturbances. One of the methods of ionospheric observation is ionogram, which provides the height distribution of electron density in the ionosphere. However, ionograms contain not only ionospheric echoes but also noise due to measurements and computational processing. Those noises in ionograms are more abundant than the ionospheric echoes and comparable in the intensity to the ionospheric echoes.

The purpose of this work is to develop a method to generate ionogram images that are robust to such noise and easy to measure parameters of ionospheric echoes. We propose a method to remove noise from ionograms and extract only the ionospheric echoes automatically based on motion detection algorithm. By focusing on the time variability of the ionospheric environment, we apply Background Subtraction Algorithm, one of the motion detection methods, to the parameter scaling of the echoes.

Proposed model consists of two processing parts: weak signal reduction and penalized motion detection. As a preprocessing step, a threshold based on the distribution of ionospheric echoes was established for each ionogram image, and weaker signals were removed. Then, the motion detection was performed on the denoised ionogram time series data to separate signals into ionospheric echoes and background noise. The motion detection method used in this work is a background subtraction method with a penalty based on echo characteristics. We evaluated our model on 960 ionograms with high noise content (January 1, 2019, Sasaguri, Japan, using FMCW radar). We found that the penalized motion detection can extract ionospheric echoes from ionograms with a large amount of noise.