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Derivation of shape of cross-section of frontal sporadic E by the HF Doppler spectral analysis

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As for shape of cross-section of frontal sporadic E(Es), it has been revealed that had a shape of thin cylindrical structure by a past study [1]. However, there are no observation data about the shape of cross-section along Es front concerning we have developed a new method of analysis HF Doppler spectrum multi-state network in Kanto with high resolution.

At first I observe shape of cross-section of frontal Es passing HFD middle reflection point of Kanto and demand three dimensions of details data of the electric field strength every Doppler shift frequency at the near midway point passage time. We are able to consider the change to be the incidence angle dependence of the equivalence of value dispersion cross section when an radio wave was incident on a slim Es shape of cross-section from the lower part in time for field strength that cut and brought down these data every constant frequency. Because the baseline halfway point between each transmission and reception points are different, We can estimate cross-section of frontal Es reflection surface finely. I find a movement direction and the speed of frontal Es by performing this analysis at the many observation point and derive the sectional structure of the reflection whole shape of cross-section of frontal Es in detail.

A change really demands an average change from the electric field strength graph which cut and brought down observation data in the frequency direction by a quadratic equation fitting by the least-squares method because it is difficult to greatly analyze it directly. We found width based on this average change at the biggest strength every the Doppler shift frequency and the time, 3 dB time width. We found the width of cross-section of frontal Es from the product of 3 dB time width and the horizontal mobility speed, and the irregularity of shape of cross-section from the biggest strength and the time.

I applied the above mentioned method of analysis and checked the frontal Es which occurred at 23:00 JST on July 23, 2009 in detail. Shape of cross-section of frontal Es which advanced in 102 m/s, the southwestern direction, and the width of shape of cross-section was found with approximately 12 km. This shape of cross-section of frontal Es knew that structure and the asymmetry structure that there were not only one simple mountain-formed sectional structure but also two mountains existed when I looked at the shape of cross-section of the Es in resolving power of Fresnel zone approximately 4 km.

From the above results, I knew that I could derive shape of cross-section of frontal Es on the scale of the Fresnel zone by checking HF Doppler spectrum in detail at each observation point. I derive a regularity of the structure of shape of cross-section of frontal Es by performing this analysis for more frontal Es and can expect that I understand deeply to an atmosphere change to be concerned with Es generation.

[1]Ichiro Tomizawa and Kotaro Fujii: HF propagation model reflected by frontal Es, JPGU 2013, PEM29-01, 2013.5.

Keywords: ionosphere, HF Doppler, Sporadic E