Estimation Technique of Electron Density Profile from Ionogram Using the Full Wave Method

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It is difficult to investigate the lower ionosphere directly as the altitude is lower than satellite orbit. Ionograms are effective data to know the lower ionospheric conditions from the ground. The ionogram is made by pulse wave intensities of the ionosonde and shows frequency characteristics of the virtual height *h'* calculated by time delay of the pulse wave received after traveling in the ionosphere. So, the ionograms have information of both virtual heights and reflection coefficients on observation frequencies. With the textbook, only the virtual height *h'* derived by the ray theory is considered in relation to the electron density profile [1]. We suggest a method that estimate the virtual height from the electron density profile and the collision profile by the full wave calculation [2]. Our method can simultaneously obtain the reflection coefficients. We checked the availability of our method from the simultaneous experiment of the rocket and the ionogram at Kagoshima Space Center [3].

On the other hand, the International Reference Ionosphere (IRI) can give the electron density profile from latitude, longitude, time, and so on [4]. Figure 1 shows an example estimated an electron density profile from a observed ionogram. First, as shown in figure 1(b), the observed ionogram at the Kokubunji site [5] was compared with theoretical ionogram calculated by the IRI profile of Fig. 1(a) . The theoretical *h'* values of the E and F2 layer is nearly agreement with the observed *h'* values, but the theoretical *h'* values of the F1 layer is not agreement. Next, the electron density profile has been modified so that the theoretical ionogram closely matches fits the observed ionogram [6]. As a result, the electron density profile in Fig. 1(a) and the theoretical ionogram in Fig. 1(c) were obtained. In this presentation, we talk about current estimation technique of the electron density profile from ionogram using the full wave calculation.

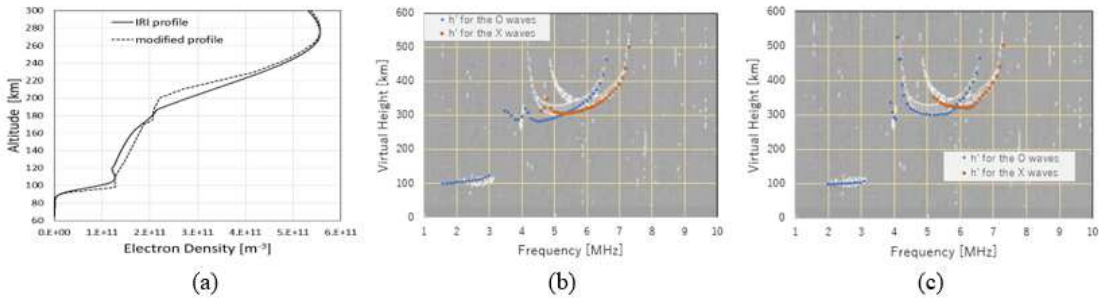

Figure 1. An estimation example ((a) the IRI electron density profiles and the modified profile, (b) the ionogram for the IRI profile and the observed ionogram, (c) the ionogram for the modified profile and the observed ionogram).

References

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