

Study of the characteristics of MF radio wave propagation in the north polar ionosphere with Full-Wave method

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The International Standard Ionosphere (IRI) model is usually used as the index of the standard electron density profile in the ionosphere. Since it is difficult to identify the accurate electron density below the altitude of 65km,

however, IRI model cannot describe the electron density profile in the lower part of the ionosphere. To observe the electron density profile in the lower part of the north polar ionosphere, the Alaska rocket experiment, named SRP-4 experiment, is planned at Alaska Poker Flat rocket yard on March, 2002. This rocket experiment is carried out in collaboration of University of Alaska Fairbanks (UAF), Toyama Prefectural University and Tokai University. In this experiment, the electron density profile is estimated with two different methods, one is an in situ measurement with Langmuir probe, and the other is an estimation method by analyzing the characteristics of MF radio waves propagated from the ground. In this presentation, we explain the latter method, which uses the characteristics of MF radio waves.

We assume an electron density profile, then calculate the characteristics of MF radio waves propagating through the lower ionosphere, by performing Full-Wave simulation. Next, we compare the characteristics of MF radio waves of this calculation result and those obtained by the rocket experiment. We continue to perform Full-Wave simulation with changing the assumed electron density profile, until the calculated characteristics of MF radio waves consistent with those observed by the rocket experiment. Finally, we can estimate the electron density profile in the lower ionosphere by analyzing the characteristics of MF radio waves.

In addition, the necessary sensitivity and dynamic range of the MF radio wave receiver can be estimated by performing this Full-Wave simulation. We performed several Full-Wave simulations with parameters of the Alaska rocket experiment and assuming the electron density profile in the lower ionosphere, and decided necessary performance the MF radio wave receiver onboard our sounding rocket. On the basis of this calculation, we succeeded to develop the MF radio wave receiver with sufficient sensitivity and dynamic range. After the Alaska rocket experiment, we will estimate the electron density profile in the lower ionosphere below the altitude of 65km by analyzing the characteristics of MF radio waves obtained by the rocket experiment and Full-Wave simulations.