

Study on spatial structure of lower ionosphere with 2-dimensional FDTD simulations

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We developed a 2-dimensional FDTD simulation code which can treat wave propagations in magnetized plasma. FDTD simulations can be performed with much less computer resources than those necessary for full particle simulations, in memories as well as cpu times. Since space plasma is magnetized, it is necessary to incorporate the dielectric tensor with anisotropy and dispersibility in FDTD simulation code, in order to calculate the electromagnetic field in space plasma. In this study, we performed FDTD simulations with two-types of electron density profiles in the lower ionosphere, ionospheric layer model and electron cloud model, and confirmed characteristics of MF wave propagations in the ionosphere. According to sounding rocket experiments, we can only obtain altitude profile of wave intensity. In this study, therefore, we are going to try to estimate spatial structure in the lower ionosphere by analyzing altitude profile of wave intensity. Simulation results indicate that spatial structure in the lower ionosphere can be estimated by analyzing altitude profiles of different waves emitted from different wave sources with various frequencies. Effects of spatial structure in the lower ionosphere are shown especially on propagation characteristics of MF waves above the altitude of the spatial structure itself.