

## Estimation of spatial structure of Es layer with 2-dimensional FDTD simulations

Taketoshi Miyake<sup>1\*</sup>, Shintaro Isokawa<sup>1</sup>, Toshimi Okada<sup>1</sup>, Keigo Ishisaka<sup>1</sup>

<sup>1</sup>Toyama Prefectural University

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 three-types of electron density profiles in the lower ionosphere, uniform ionospheric layer model, round shape electron cloud model and oval shape electron cloud model, and then confirmed characteristics of MF wave propagations in the ionosphere. According to sounding rocket experiments, we can only obtain altitude profile of wave intensity, especially magnetic field intensity. In this study, therefore, we are going to try to estimate spatial structure in the lower ionosphere by analyzing altitude profile of magnetic field 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.

Keywords: Sporadic E layer, FDTD simulation, electron density profile, plasma wave