

Effect of Spatial Scale on Estimation of Spatial Structure of Sporadic E Layer 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. In this study, we performed FDTD simulations with different types of electron density profiles in the lower ionosphere, uniform ionospheric layer model and oval shape electron cloud model, and then confirmed characteristics of MF wave propagations in the lower 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 estimate spatial structure in the lower ionosphere by analyzing altitude profile of magnetic field intensities. 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. 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. We compared simulation results and results observed by S-310-40 sounding rocket, but were not able to identify spatial structure of the sporadic E layer, because the scale of the spatial structure of the sporadic E layer assumed in the simulation was too small. In this study, therefore, we are going to perform 2-dimensional FDTD simulations with different spatial scales of the sporadic E layer, and investigate the influence that a scale of the space structure gives electric wave propagation. Figure 1 shows an example of our 2-dimensional FDTD simulations. We extract the altitude profile of wave strength from the spatial profile of wave strength in the ionospheric FDTD simulation, then compare these simulation results and sounding rocket observations.

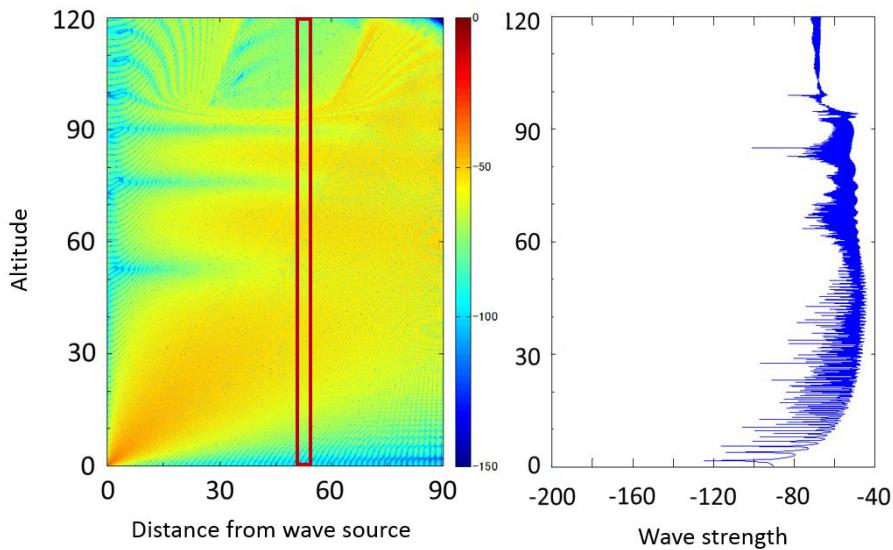


Fig.1: Spatial profile and altitude profile of wave strength in the ionospheric FDTD simulation