2-dimensional FDTD simulations of plasma wave propagations in the ionosphere

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We developed a 2-dimensional FDTD simulation code which can treat wave propagations in magnetized plasma. Though we need to perform full-pariticle simulations in order to recognize accurate characteristics of waves propagationg in space 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. We use PLRC method to formulization FDTD scheme to reduce numerical errors. In FDTD simulation, it is essential that how to realize an effective absorbing boundary. We developed PML (Perfectory Matched Layer) abosrbing boundary condition with anisotropy and dispersibility, and succeeded to realize very effective absorbing boundary. In this study, we are performing a series of FDTD simulations with FAI model as the electron density profiles in the ionosphere. We investigate effects of FAI on MF wave propagation characteristics in the ionospheric E region via these simulations.

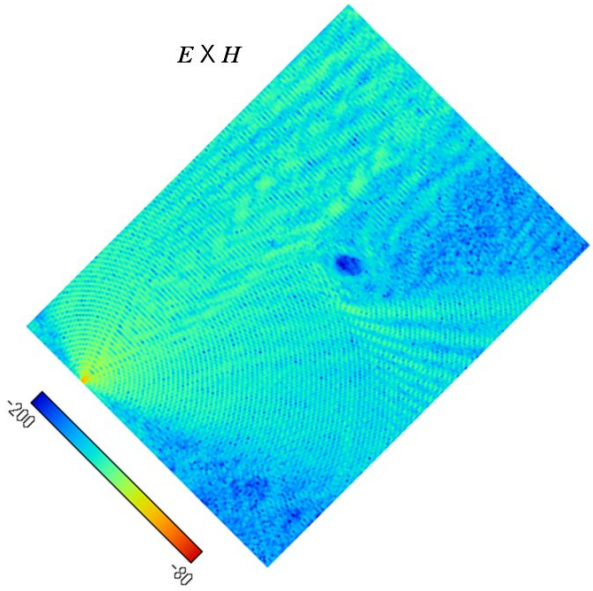

Fig.1: Spatial profile of Poynting vectors in the ionospheric FDTD simulation