Development of the Global Simulation Model of the Magnetosphere with the Nested Grids

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The inner boundary of the current global MHD simulation of the Earth's magnetosphere is set at 3-5R_E from the Earth. This distance is come from the numerical stability and the computation time which are determined by the Alfven velocity that is the characteristic velocity of the MHD and increases at the high magnetic field region, where is the vicinity of the Earth. It is thought that these inner boundaries does not so much affect to the global configuration of the magnetosphere but it arises a problem when we want to run the simulation of the coupling between the magnetosphere and ionosphere. This is why there is the space among these two regions so that we cannot connect directly the magnetosphere with ionosphere in the simulation. Thus now the simulation result of magnetosphere is mapped to the ionosphere along the magnetic field lines, however this cannot apply to the middle and low latitude ionosphere due to not calculating the vicinity of Earth.

To overcome these problems, I develop the global simulation model with 1R_E inner boundary. To establish this model, I introduce the nested grids to the MHD simulation. Using the nested grids, the numerical calculation in the each grid can treat the multiple time steps so that the calculation time can be cut off. On the other hand, it is necessary to transfer and interpolate the data among each gird. The numerical errors due to the interpolation greatly affect to the MHD simulation. In this study I focus on how to treat the numerical error and I will present the method of high precision interpolation and the errors cleaning filter with the states of model development.