Influence of three-dimensional and electron inertial effects to thesturucture of MHD-scale Kelvin-Helmholtz vortices

Takuma Nakamura[1]; Masaki Fujimoto[2]

[1] Earth and Planetary Sci., TITech; [2] DEPS, TITECH

The MHD-scale (large scale) Kelvin-Helmholtz (K-H) vortex has been considered as an important phenomenon for understanding various space plasma systems such as the mixed plasma feature of the low latitude boundary layer (LLBL). In order to understand the detailed structure of MHD-scale K-H vortices, we have performed three-dimensional MHD simulations and two-dimesional simulations by a two-fluid system including finite electron inertial effects.

As a vrtex highly rolls-up, the vortex flow produces more smaller region within the vortex. This important nature of a vortex says that the cross-scale coupling tends to take place within the highly rolling-up vortex even when the size of the vortex is MHD-scale. Therefore, in this study, we have firstly studied on the condition for a vortex highly rolling-up by 3D MHD simulations in a LLBL like situation.

Secondly, we have simulated 2D two-fluid simulations including electron inertial effects on the condition for a vortex highly rolling-up. In this case, magnetic reconnection within the MHD-scale vortex occurs by the electron inertial effects when the vortex highly rolls-up, stretching the field lines into an anti-parallel geometry overcoming the tension of in-the-plane magnetic field. The number of the magnetic islands formed by reconnection and the degree of the electron acceleration in the islands depend on the size of the vortex measured by the ion inertial length and the electron inertial length, respectively. Futhermore, in-the-plane magnetic intencity is extremely different between two sides, we observe the magnetic islands to be injected into the side with the weaker field.

We will present more details pointing to the general importance of 3D and electron effects in an MHD-scale K-H vortex and discuss its relevance to dynamics of the LLBL.