Statistical Study and Particle Simulations about the Low Frequency Compornent of BEN observed by GEOTAIL Spacecraft

Taketoshi Miyake[1], Shou Nagayasu[1], Hiromasa Nakada[1],
Masaki Okada[2], Hideyuki Usui[3], Yoshiharu Omura[4]

1. Toyama Prefectural University, Imizu, Toyama 939-0398, Japan
Tel: +81-766-56-7500, E-mail: miyake@pu-toyama.ac.jp
2. National Institute Polar Research.
3. Kobe University.
4. Research Institute for Sustainable Humanosphere, Kyoto University.

To explore and utilize the geospace environment efficiently, it is very important to understand electromagnetic environment around the Earth.

According to PIC simulations, ESW (Electrostatic Solitary Waves) are generated from electron beam instabilities. ESW are composed by the upper frequency part of BEN (Broadband Electrostatic Noise) which is frequently observed in space plasma. The generation mechanism of the low frequency component of BEN, however, is still unexplained. To clarify whether such low frequency waves are generated, we made statistical analysis on generation conditions of low frequency component of BEN observed by Electric Field Detector (EFD) onboard Geotail spacecraft. We detected low frequency component of BEN automatically from EFD data, and made an occurrence frequency distribution of these waves. Low frequency component of BEN are observed in PS and PSBL region in the magnetosphere. We studied several plasma parameters at the time when low frequency component of BEN were observed, and found that these waves were observed in the conditions with low ion density and strong B field in these regions. Then, based on these statistical analysis, we are going to performe a series of two-dimensional electrostatic particle simulations and three-diemsional electromagnetic particle simulations with different parameters, and clarify the generation process of the low frequency component of BEN, in time as well as in space.

In analyzing time evolutions of three-dimensional spatial structure of potential, electric fields, magnetic fields, electron densities, etc., it is essential how to visualize these three-dimensional spatial structures. We are developing various visualization tools for three-dimensional spatial structures with using AVS and MATLAB. We can see spatial structures and observe their time evolutions in animation with our visualization tools. These visualization tools are useful to analyze time evolutions of three-dimensional spatial structures of various phsical parameters.

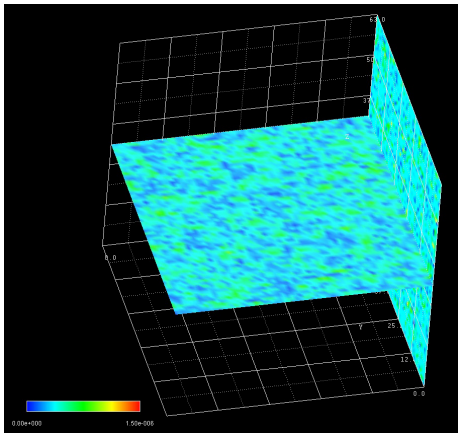

Fig.: Spatial structures of $\boldsymbol{E}$ field in the 3D particle simulation.

978-1-4673-5225-3/14/$31.00 ©2014 IEEE