

# MHD Simulation of the Shock Wave Event on October 24, 2003

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The event of a shock wave arrival on October 24, 2003 was a mysterious phenomenon, because a large auroral electrojet, AE was observed during the time of almost northward IMF and

no occurrence of magnetic storms. Just after the arrival of shock wave at 1450 UT, the IMF turned from southward to northward, then the IMF rotated and the strong IMF  $B_y$  changed from dawnward to duskward for 1534-1538 UT (simulation time). At the near time,

the electric power of ADEOS-II satellite for earth observation went down for 1613-1617 UT.

We carried out a high resolution 3-Dimensional MHD simulation of interaction between the solar wind and the Earth's magnetosphere by using the ACE satellite observations as input of simulation.

The ACE data of simulation are the plasma density, velocity and plasma pressure of solar wind, and  $B_y$  and  $B_z$  of the IMF. The IMF  $B_x$  is not included in the simulation. The simulation was executed for 1000-1700 UT starting from a particular computation result of the earth's magnetosphere on October 22, 1999. The simulation

results after about 2 hours have small influence of the initial condition, so the simulation results after 1200 UT are discussed.

In the simulation result, we can find that the magnetosphere shrinks after the arrival time of shock wave and that the plasma flow in the plasma sheet is strongly incoming to the dayside. The reconnection region moves to dawnward in few minutes because the IMF  $B_y$  has changed from negative to positive. The convective flow in the ionosphere is

remarkably changed, the open-closed boundary of magnetic field lines expands very quickly and the new open region simultaneously appears on the dayside and dawnside. The reconnected magnetic field lines are passing the dawnward and they move to nightside.

The plasma sheet rotates and is reverse-inclined in the cross section of tail from the simulation when the IMF  $B_y$  has changed from negative to positive. An extension of the plasma sheet appears and is passing

from dawn to dusk in the northern hemisphere (inverse behavior to southern hemisphere). The separated loop of plasma sheet corresponding the plasma sheet extension is connected to the ionosphere. This means

that the plasma sheet has double layered structure. In such a mysterious and strong AE event, it is important to investigate the magnetospheric configuration and transfer of momentum and energy. Thus we have studied time variation of the configuration and linkage of the ionosphere and plasma sheet in detail from the 3D MHD simulation data.