Demonstration of a Virtual Earth Magnetosphere System (VEMS): A new research environment for Earth and space science

B.A Ghani Nurdiyana[1], Takeshi Murata[2]

[1] Computer Sci., Ehime Univ, [2] Computer Sci,Ehime Univ

In the present study, we demonstrate a Virtual Earth Magnetosphere System (VEMS), which is a new research environment with the integration of observation data analysis and computer simulations.

The VEMS is constructed on programmable and interactive visualization tools, which work on personal or higher computers. The visualization tool provides with various kinds of visualization environments, such as drawing contour lines, streamlines, volume rendering, orthogonal slice and other visualizations. An interactive function is also required in this system, such as changing the scale, rotating and translating. The VEMS provides with a 3-dimensional visualization environment dependent on time.

We construct the VEMS on a 3-dimensional visualization tool, Application Visualization System AVS/Express Developer (hereafter AVS). The AVS, which has a programmable, interactive, visual environment and time-dependent visualization, can visualize a lot of data simultaneously without any recompilation. Here, we present a demonstration of the VEMS that we construct on AVS.

The first demonstration is a fundamental and common step of the VEMS construction, which is the setting of the Earth sphere with coastlines at the center of viewer window in the AVS and drawing of the magnetic field lines in the 3-dimensional space. The magnetic field lines are derived from either observation-based models or computer simulations. Herein we adopt the magnetic field data, which is obtained from a global MHD simulation.

On the next step, we customize the VEMS for our individual research purpose. We map a lot of observation data and computer simulation data depending on the target of phenomena. In our demonstration, we map the aurora images observed by Polar/VIS and AKR dynamic spectrum observed by Geotail/PWI/SFA.

The VEMS must provide comprehensive research environment for Earth and space science researchers to achieve new scientific findings. Since the VEMS has time axis, we can investigate time-dependent behaviors of the Earth magnetosphere. We can also examine the Earth magnetosphere at a period when researchers are interested in. For example, time sequential aurora image data could be mapped on an assigned time. This visualization is present as long as data exists, if the data file does not exist during this period, the aurora image does not appear. We will demonstrate this sequential aurora image.

This system also provides environment to study correlations between magnetospheric events since the VEMS can visualize a variety of data simultaneously. In the present study, for example, we attempt to identify the location of AKR using the VEMS. It is believed that, when the intense aurora breaks up, auroral kilometric radiation (AKR) is generated on the magnetic field lines the foot points of which the intense aurora area is located on the Earth surface. We could successfully identify the time-dependent location of the AKR source region in the 3-dimensional space. We also show this identification in demonstration.

One of the developments of the VEMS that we will demonstrate is its connection with STARS network database system. With STARS, we can download observation data files through network and we can plot any data on the VEMS.