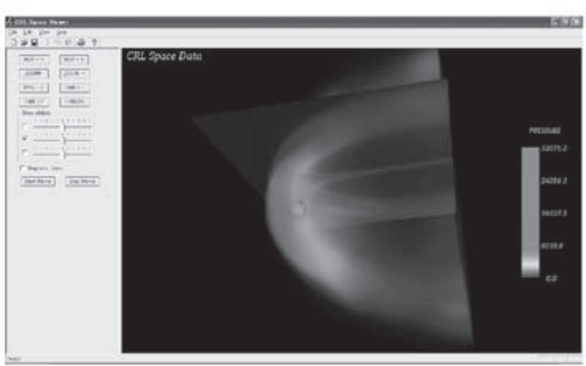
§40. A Glassless Stereo-Type Visualization System for 3D MHD Real-Time Earth's Magnetosphere Simulator

Den, M., Kuwabara, T. (Adv. Com.), Ogawa, T. (Kitazato Univ.), Tanaka, T. (Kyushu Uni.), Goncharenko, I. (3D inc.), Amo, H. (NEC)

We developed a 3D visualization system for our real-time Earth's magnetosphere simulator. On-line visualization of 3D magnetosphere data is still a challenge-able task in the community of researchers using numerical simulations because of relatively large simulation data sizes and high requirements imposed on processing and rendering time. The task is becoming more difficult if one takes into account the fact that the simulated data are non-uniformly distributed, while the standard graphical procedures require the data given in 3D rectilinear grids for fast rendering. We describe a 3D visualization system for volumetric rendering of magnetic pressure and magnetic field lines with output on standard and glassless stereo-displays. The core of the system is the fast 3D-gridding methods simplifying the graphical rendering.

There are three main steps in the dataflow scheme:* original data transfer via the network;* preprocessing (3D-gridding and smoothing);* 3D scene rendering at the client sites. 3D rendering includes volume/iso-surface rendering, 3D magnetic field line rendering, layout and annotation display. The whole rendering time depends on the selected methods of volume rendering (software-based ray casting or 2D-texturing done by OpenGL), density of magnetic field lines calculated by Runge-Kutta integration, and the size of preprocessed 3D-grids. Typically, with high-quality 3D-gridding, slight smoothing by fast 3D Gaussian filter, the usage of OpenGL-based volume rendering method gives sufficient visual quality. The whole OpenGL system is based on VTK 4.2 on top of OpenGL, with a thematic core graphical library developed especially for magnetosphere visualization. Other part of software includes network support, stereographic tools, preprocessing library, and GUI. All the rendering methods rely on fast 3D-gridding procedure described in our paper.

The partially cropped volume of the plasma pressure is shown in Figure 1.



With the system, it is possible to visualize high-quality graphical scenes including volumes, surfaces, and streamlines at a frequency rate sufficient for on-line monitoring through standard and glassless stereo-displays.