Toward intelligent database of geophysical fluid data and beyond: Development of Gfdnavi

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In recent years, scientific data on geophysical and environmental fluids such as the atmosphere and ocean have been increasing explosively. Many data centers and research organizations/groups are now providing data through the Internet, some of which provides on-line visualization capabilities as well. However, once data files are downloaded by users, those server-side services are not available anymore, and they have to handle the data, sometimes in unfamiliar formats, by themselves. Therefore, there are growing needs to search, analyze and visualize data seamlessly across the Internet and desktop by scientists.

In order to reinforce the ability of data management and manipulation in the earth science community (especially in those fields to deal with earth and planetary fluids such as the atmosphere and the ocean), we have been developing a software tool named Gfdnavi (Geophysical fluid data navigator). It is developed under a collaboration of geophysical fluid scientists and database / data-engineering scientists across a number of universities in Japan (Kyoto, Ochanomizu, Kobe, Hokkaido Universities etc.). It is developed as an open source tool and available from the GFD Dennou Club (http://www.gfd-dennou.org).

In Gfdnavi numerical data in different dimensionality and formats are accessed in a consolidated way with an object-oriented library to extract metadata. The metadata are stored in a relational database along with the directory structure, where the metadata of parent directories are inherited downward to child directories. The data and metadata are provided for access with Web browsers for interactive search, analysis, and visualization. A key feature is that the system includes a custom Web server and a metadata scanner, so one can easily start up a service on desktop and use it personally to conduct researches. Yet, it can be operated with widely-used web servers such as Apache to create and operate a data server. The data analysis/visualization user interface is made flexible to support extension. Another unique feature of Gfdnavi is that it can allow users to store derived data and visualization results along with documents and analysis/visualization procedures. Thus, it can not only archive data but also knowledge and methods. To archive data, knowledge, and methods together enables its users to lively reproduce to verify the knowledge and to further apply it.

Gfdnavi is useful to handle data in broader fields rather than just in geophysical fluid sciences. For example, we have demonstrated that it is useful to store and visualize vegetation data. We are planning to enhance its capability to treat image data. We believe that it can be a platform of multi-disciplinary study for the humanosphere if further development is made in this direction.

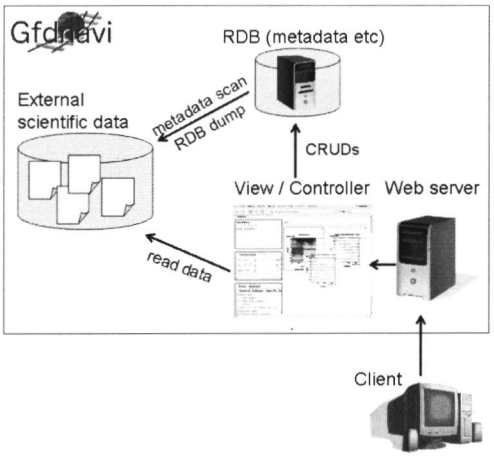

Fig. 1 Overview of the structure of Gfdnavi.

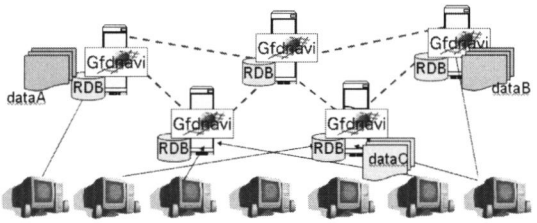

Fig.2 Schematic illustration of the proposed peer-to-pear network of Gfdnavi servers.