Japan Geoscience Union Meeting 2011
(May 22-27 2011 at Makuhari, Chiba, Japan)

MGI031-01 Room:201A Time:May 25 11:45-12:00

Geophysical fluid data publication, search, visualization, and interactive knowledge accumulation: Gfdnavi

Takeshi Horinouchi[1*], Seiya Nishizawa[2], Chiemi Watanabe[3], Shigenori Otsuka[4], Akinori Tomobayashi[5], Tsuyoshi Koshiro[6], Yoshi-Yuki Hayashi[2], Eriko Nishimoto[4]

[1]Hokkaido University, [2]Kobe University, [3]Ochanomizu University, [4]Kyoto University, [5]Shoganji, [6]Meteorological Research Institute

In recent years, many data centers and research groups provide data on geophysical fluids such as the atmosphere and oceans through the Internet along with on-line visualization. However, their services are not available once data files are downloaded. This paper presents open-source software named Gfdnavi developed to reduce the limitation and to support data handling beyond initial quick-looks. Gfdnavi extracts metadata from scientific data and stores them in a database. They can be accessed with web browsers for search, analysis, and visualization. It supports a wide range of usage such as public data services, group data management, and desktop use. As its unique feature, Gfdnavi supports writing and archiving documents based on knowledge obtained through data analysis. The documents are linked with the original data and analysis/visualization procedures. It has a wide variety of applications such as interdisciplinary- and collaborative-study support, a realization of falsifiability, and educational use.

Keywords: Data server, Geophysical fluid, Visualization, Web application, Knowledge archive

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MGI031-02 Room:201A Time:May 25 12:00-12:15

Programmability in Web server software for geophysical fluid sciences, Gfdnavi

Seiya Nishizawa[1*], Takeshi Horinouchi[2], Chiemi Watanabe[3], Yuka Isamoto[3], Akinori Tomobayashi[4], Shigenori Otsuka[5]

[1]Kobe University, [2]Hokkaido University, [3]Ochanomizu University, [4]Shoganji, [5]Kyoto University

In recent years, increasing amounts of scientific data on geophysical and environmental fluids, e.g., in the atmosphere and oceans, are being available. Further, there is increasing demand for web-based data services. Several browser-based data servers, on which geophysical-fluid data can be analyzed and visualized, have been developed. However, they are suitable only for initial “quick-looks” and not for subsequent research processes. As a solution, we developed data server software named Gfdnavi. One of its important features is that it provides extensive support for programming (scripting). With Gfdnavi, users can easily switch between operations using a web browser and operations using scripts or command lines. This paper describes its network features: web services, which is an important part of Gfdnavi’s programmability, and the functionality to search across multiple Gfdnavi servers. To develop the web services, we adopted the REST architecture. We also developed a client library to ensure access to web services in the programming language Ruby. Using this library, data can be analyzed and visualized on either the server side or client side. It also enables data handling on multiple servers. Search across multiple web servers is made possible by a simple peer-to-peer network with a central server, with the peer-to-peer communication based on web services.

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MGI031-03 Room:201A Time:May 25 12:15-12:30

ERG-Science Center: Development of Integrated Data Analysis System for Geospace Research

Yoshizumi Miyoshi[1*], Kanako Seki[1], Tomoaki Hori[1], Yukinaga Miyashita[1], Tomonori Segawa[1], ERG-Science Center Task Team[1]

[1]STEL, Nagoya University

The ERG project is a geospace exploration mission consisting three teams, ERG-satellite, ground-based observations, and integrated studies group. Besides these research teams, the ERG project has the science coordination team and the ERG-science center.The integrated data analysis tool is a key tool for the project because various kind of data are subject for the analysis. Therefore, we are developing the integrated analysis tool as well as the interactive web analysis tool for the project. In this presentation, we will report the current status of the science center activity.

Keywords: ERG project, integrated data analysis, meta data

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MGI031-04 Room:201A Time:May 25 12:30-12:45

Physics of Seismic Wave Propagation Inferred from the 4D Volume Visualization

Kazuhisa Iwai[1*], Takashi Furumura[1], Takuto Maeda[1], Shunsuke Takemura[2]

[1]CIDIR, the University of Tokyo, [2]ERI, the University of Tokyo

Earthquakes are 4D (3D space + time) complicated phenomena which involve the radiation of seismic waves from the earthquake source fault, the propagation through subsurface structure and the amplification on sedimentary layers. In order to investigate physics of seismic wave propagation to predict strong ground motions and take countermeasures against earthquake disasters, it is indispensable to understand the earthquake phenomena correctly and quantitatively. The dense network of strong ground motion station across Japan enables us to compare the observations and result of the simulations. Supercomputers can simulate the seismic wave propagation accurately by solving equations of motion with a high-resolution structural model. As the size of simulations has been larger, the visualization of seismic wavefield has been getting more and more important because output data include a lot of features we have to categorize. The appropriate visualizations are required not only for students of earthquake to comprehend the complex phenomena of the propagation of seismic waves from the hypocenter through heterogeneous structure to the surface of the ground and give intelligible explanations for them but also for the public to raise the awareness of earthquake disaster prevention.

In this study we applied one of the visualization methods called volume rendering for various earthquakes and made animations to explore the effect of subsurface structure on the seismic wavefield. We provided learning tools of the important phenomena of earthquakes such as the radiation of seismic waves, the refraction and reflection of them and the generation and propagation of diffracted and surface waves. The volume rendering can show 3D space at a time by coloring each pixel with proper transparency corresponding to the intensity and space variation of energy. This is one of the advantages of the volume rendering which makes it possible to render waves of small amplitude such as scattered and refracted waves. Since the amplitude of waves in the area far from the source is quite small because of geometrical spreading, we should enhance small-amplitude waves to visualize them clearly. For example, the Mid Niigata Prefecture Earthquake in 2004 raised the amplification of ground motion at basin structures and generated a long-period ground motion which shook high-rise buildings. The volume rendering animation of this earthquake showed 1) the basin structure beneath Chuetsu region generated the surface wave and 2) it propagated along the surface layer slowly to the Kanto Plain and 3) the basin structure of the Kanto Plain amplified it and 4) ground motion lingered because the waves were trapped in the basin.

The study concluded that the 4D volume visualization reconstructed a variety of phenomena concerning earthquakes well and it is useful to comprehend the complex phenomena and to give adequate explanations for them.

Keywords: earthquake, visualization, simulation, volume rendering

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MGI031-05 Room:201A Time:May 25 14:15-14:30

Inter-university Upper atmosphere Global Observation NETwork (IUGONET) project

Tomoaki Hori[1*], Hiroo Hayashi[2], Yukinobu Koyama[3], Yoshimasa Tanaka[4], Masato Kagitani[5], Satoru UeNo[6], Daiki Yoshida[3], Shuji Abe[7], Takahisa Kono[1], Naoki Kaneda[6], Atsuki Shinbori[2], Hiroyasu Tadokoro[4]

[1]STE lab., Nagoya Univ., [2]RISH, Kyoto Univ., [3]WDC for Geomag, Kyoto, Kyoto Univ., [4]NIPR, [5]Dep. Of Geophys., Tohoku Univ., [6]Kwasan and Hida Obs, Kyoto Univ., [7]SERC, Kyushu Univ.

The Inter-university Upper atmosphere Global Observation NETwork (IUGONET) project (2009-2014) is an inter-university program by the National Institute of Polar Research (NIPR), Tohoku University, Nagoya University, Kyoto University, and Kyushu University to build a database of metadata (that is, data of data, such as observation period, type of instrument, location of data, and so on) for ground-based observations of the upper atmosphere since the IGY in 1950s. The IUGONET metadata database archiving such information of a variety of observations by radars, magnetometers, optical sensors, helioscopes, etc. in different locations all over the world and in various altitude layers from the troposphere up to the heliosphere will be of great help to researchers in efficiently ?nding and obtaining observational data they need. This should also facilitate synthetic analysis of multi-disciplinary data, which will lead to new types of research in the upper atmosphere. The IUGONET project is currently in the third year, and the development team is working on (1) creating metadata of archived observation data at each institution, (2) building the IUGONET metadata database system on the basis of a repository software, named DSpace, and (3) producing an integrated data analysis tool for our observational data with the TDAS (THEMIS Data Analysis Software) IDL libraries. Recently we have started a test location of the metadata database as well as a beta release of the developed data analysis tool for the community. We call for the comments on both of them from the researchers and thereby continue to improve toward the final release at the end of this year. The progress reports and future plan of the project will be presented.

Keywords: Upper Atmosphere, metadata, IUGONET

Japan Geoscience Union Meeting 2011
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MGI031-06 Room:201A Time:May 25 14:30-14:45

System Implementation and Operation of WISE-CAPS, data browsing, sharing and analysis platform for lunar and planetary e

Junya Terazono[1*], Ryosuke Nakamura[2], Shinsuke Kodama[2], Naotaka Yamamoto[2], Hirohide Demura[1], Naru Hirata[1], Yoshiko Ogawa[1]

[1]The University of Aizu, [2]AIST

More and more data are produced as the progress of lunar and planetary exploration these days. Also, more and more researchers and engineers are participating for lunar and planetary exploration. These situation demands data analysis and sharing platform in the exploration group.

We developed the system called WISE-CAPS, Web-Based Interactive Secure Environment for Collaborative Analaysis of Planetary Science, from this point of view. Its aim is to establish more efficient and smooth data browsing, sharing and analysis.

As the name of system says, all communication between system and user are web-based, via web browser. This means users do not need to install new special tools or software for using WISE-CAPS. The system is web-based, and display of maps and images are made by Web-GIS tools.

Currently, development of data browsing system are actively ongoing on WISE-CAPS, centered on data obtained in lunar exploration. Clementine data are used for base layer, and some image data captured by Kaguya mission can be browsed.

The unique feature of WISE-CAPS is user access control mechanism. Based on user ID and password, WISE-CAPS can understand digital certificates issued by proxy server receiving them. Thanks to this function, users can control access to resource in WISE-CAPS, and also form a group and grant access to the members inside the group. This feature also enables fine data control which is useful for collaborative writing of papers and research which is conducted individually.

Keywords: GIS, lunar exploration, planetary exploration, web, data sharing

Japan Geoscience Union Meeting 2011
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MGI031-07 Room:201A Time:May 25 14:45-15:00

Development of virtual reality visualization software

Akira Kageyama[1*], Kaori Murata[1], Daisuke Meno[1], Ken-ichi Yoshizaki[1]

[1]Kobe University

Visualization is a key step in computational geosciences. Researchers can find structures and dynamics that are hidden in the ”sea” of numerical data. In accordance with the exponential growth of computer hardware and simulation methods, complexity of the output data and, therefore, the difficulty of their visualizations are rocketing up these days. A new technology for visualization is strongly required and will be more in future. The modern virtual reality (VR) technology, especially the so-called CAVE system, provides an answer to this challenge. We have been developing, in these several years, visualization tools for CAVE-type VR systems and combined them into a framework, VFIVE. We have applied VFIVE to analyze various types of geophysical simulations. Recent study of our VR visualization will be reported. New visualization methods implemented in VFIVE are (i) Interactive Time Line Method for frozen-in vector fields, and (ii) Interactive Force Line Methods for general vector fields. We have also started to implement our VR visualization framework on a new API, VR Juggler. The status of the development will also be reported.

Keywords: visualization, virtual reality, CAVE

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MGI031-08 Room:201A Time:May 25 15:00-15:15

Development of Volume Visualization Software of 3-D Simulation Data for Google Earth

Shintaro Kawahara[1*], Takeshi Sugimura[1], Fumiaki Araki[1], Keiko Takahashi[1]

[1]JAMSTEC

We are promoting a project ”EXTRAWING” to effectively express geophysical and environmental fluid simulation data using the Google Earth technology, and to send this information to the general public. Results of this project have already been exposed as a Web application. In this application, users can freely observe the visualization results of simulation data using Google Earth API. Users can also view plain descriptions about the visualization result on Web browser.

In the presentation, we will describe the visualization technique is used in this project. In this project, volume rendering method using layered color contour images is used as one of the methods to express the visualization results of simulation data to represent on Google Earth. To represent visualization results by this method on Google Earth, the file format must be KML and COLLADA. However, when converting simulation data into KML/COLLADA, it is necessary to determine various parameters (transfer function, numbers of color contour images, and so on), and it requires much skill. Therefore, we developed a GUI-based content creation software. By using this software, it becomes easy to determine various visualization parameters, and we aimed to streamline content creation for Web application. In the presentation, we will do a demonstration of content creation using developed software, and introduce its technical content.

Keywords: Volume visualization, Google Earth, EXTRAWING

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MGI031-09 Room:201A Time:May 25 15:15-15:30

New visualization tool for volume data, for both quick 3D-texture rendering and ray tracing.

Takaaki Takeda[1*]

[1]National Institute of Natural Science

Visualization of simulation/observation data is important not only for research but also for public outreach.

The tools of scientific visualization are often designed for the former purpose. However, visualization for outreach purpose with these tools have often difficulties, because they often lack the functions such as camera work editing or drawing of modelled objects, texturing, etc. On the other hand, using general purpose 3DCG softwares, it is easier to visualize objects with higher quality. However, converting the data to the format which can be read by these softwares requires skills of computer graphics, and researchers do not have it in general.

We are now developing a GUI application to visualize volume data.

Our intension is to connect between these visualizations with different purposes.

For quick visualizations for research, we adopt video-board based volume rendering with 3D-texture, while automatically making Pov-Ray scene files for higher quality rendering with ray tracing.

We named it Oosawa. Oosawa implemented following features.

Support for multi-channel time sequence data, and time line based parameter settings, enabling us camera-path editing with dynamically moving data.

Partial support for octo-tree based high resolution data.

Filter stacking, such as blurring, level-adjustment, tracking, data-clipping, etc.

Making and exporting of isosurface mesh.

GUI settings for ray tracing options for Pov-Ray (radiosity, photon mapping, focal blur, etc.)

With these features, both quick visualization and time-consuming high quality rendering are achieved with single procedure. On the now, Oosawa is not implemented with the features for multiple values (such as combinations of temperature and density), or visualization of vector fields. We will add these features to Oosawa as the future works.

The binary and source code is published to the web. http://th.nao.ac.jp/˜takedatk/COMPUTER/OOSAWA/oosawa.html

Keywords: Visualization

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MGI031-10 Room:201A Time:May 25 15:30-15:45

Examinations on NICT Science Cloud

Ken T. Murata[1*], Shinichi Watari[1], Keiichiro Fukazawa[1], Kazunori Yamamoto[1], Yasuhiro MORIKAWA[1]

[1]NICT

Main methodologies of Solar-Terrestrial Physics (STP) so far are theoretical, experimental and observational, and computer simulation approaches. Recently ”informatics” is expected as a new (fourth) approach to the STP studies. Informatics is a methodology to analyze large-scale data (observation data and computer simulation data) to obtain new findings using a variety of data processing techniques.

At NICT (National Institute of Information and Communications Technology) we are now developing a new research environment named ”OneSpaceNet”. The OneSpaceNet is a cloud-computing environment, which connects many researchers with high-speed network (JGN: Japan Gigabit Network). It also provides the researchers rich resources for research studies, such as super-computer, large-scale disk area, licensed applications, database and communication devices. What is amazing is that a user simply prepares a terminal (low-cost PC). After connecting the PC to JGN2plus, the user can make full use of the rich resources via L2 network. Using communication devices, such as video-conference system, streaming and reflector servers, and media-players, the users on the OneSpaceNet can make research communications as if they belong to a same (one) laboratory: they are members of a virtual laboratory.

We present two initial results using the OneSpaceNet for large-scale computer simulation data transfer and virtual observation data transfer system.

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MGI031-11 Room:201A Time:May 25 15:45-16:00

Metadata Technology in WMO Information System

Eizi TOYODA[1*]

[1]Japan Meteorological Agency

The World Meteorological Organization (WMO) is working to organize the WMO Information system (WIS), which is the single coordinated global infrastructure responsible for the telecommunications and data management functions of all programs of WMO. It will be core component of the GEOSS Information System of Systems for weather, water, climate.

According to agreement in the Fifteenth World Meteorological Congress in 2007, WIS is developed in two parallel parts. The Part A is evolution of the Global Telecommunication System (GTS), which has served for time-critical and operation-critical data since 1960s. The Part B is newly-extended information services through flexible data discovery, access, and retrieval to authorized users, as well as flexible timely delivery services.

The WIS network consists of three kinds of centers: the Global Information System Centre (GISC) relays data for global distribution, and centralizes metadata of entire WIS to provide online catalog (clearinghouse); the Data Collection and Product Centre (DCPC) is a hub of regional data distribution and/or provider of specialized product; and all WMO members operates the National Centre (NC). Technical developments for online catalog involves ISO I9115 standard, OAI-PMH and SRU protocols.

This talk will also present lessons from experiences in Japan Meteorological Agency.

Keywords: Meteorology, WMO, Telecommunication, Clearinghouse, Metadata, GEOSS

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MGI031-12 Room:201A Time:May 25 16:00-16:15

ICSU World Data System (WDS)

Takashi Watanabe[1*]

[1]STELAB, Nagoya University

The ICSU World Data System (WDS) has been created through a decision of the 29th General Assembly of the International Council for Science (ICSU) held in October 2008. WDS builds on the 50-year legacy of the ICSU World Data Centre system (WDC) and the ICSU Federation of Astronomical and Geophysical data-analysis Services (FAGS), but WDS will cover wider disciplines raging from natural sciences to social sciences. The new WDS will support the mission of ICSU and objectives, ensuring the long-term stewardship and provision of quality-assessed data and data services to the international science community and other stakeholders. Goals of WDS are (from the Constitution of WDS):

Enable universal and equitable access to scientific data and information
Ensure long term data stewardship for ICSU programs
Define agreed data standards
Establish and oversee the procedures for the review and accreditation of existing and new WDS facilities
Facilitate better access to data
Strive for simpler access to data
Provide quality-assured data and information
Reduce the digital divide

The WDS Scientific Committee (WDS-SC) has been appointed by ICSU to implement and administer the activities of the WDS. In early 2011, WDS-SC will accept applications from data centers to be members of WDS (http://icsu-wds.org/). The WDS International Program Office (WDS-IPO) will be established in Japan at National Institute of Communications Technology (NICT) in FY 2011. The WDS Conference, which will be the first international meeting of WDS, will be held in Kyoto, on 3-6 September 2011 (http://wdc2.kugi.kyoto-u.ac.jp/wds2011/).

Keywords: Data, Data Center, ICSU, WDS