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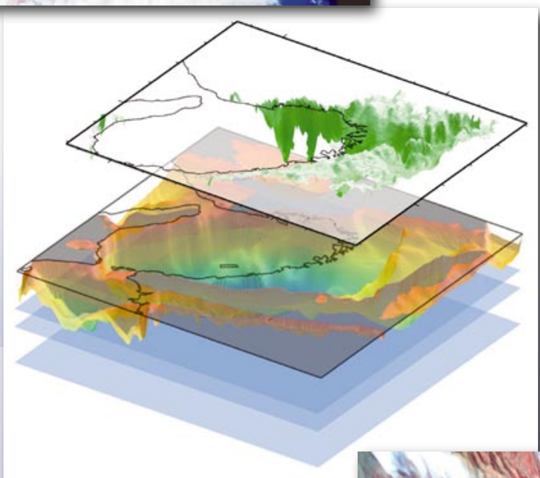
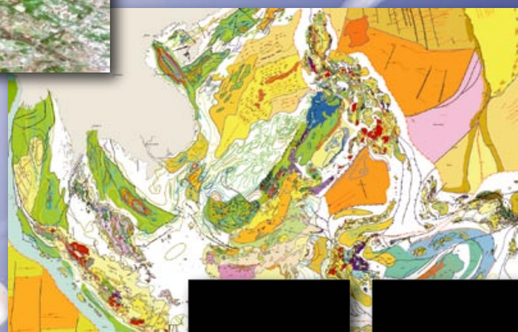
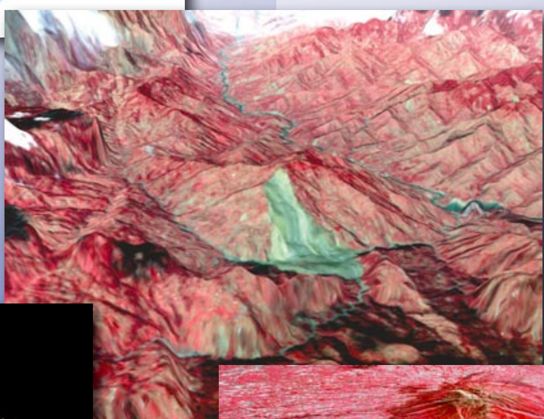
Earth Sciences for Society

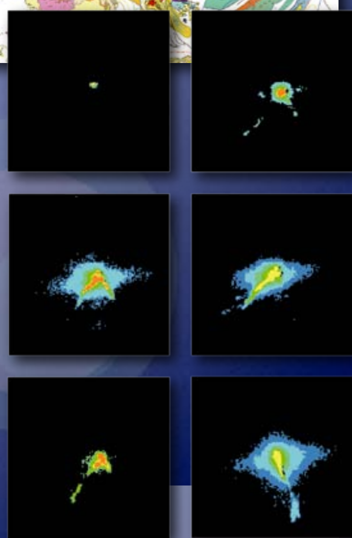
GEOGrid

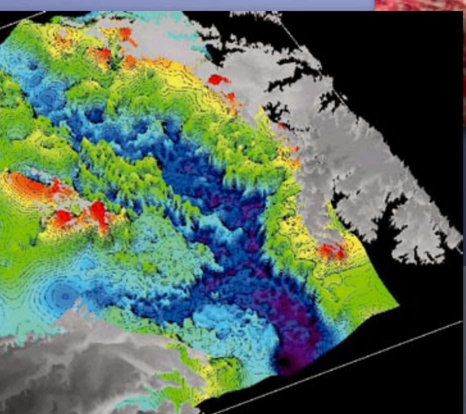
Innovation in Global Earth Observation









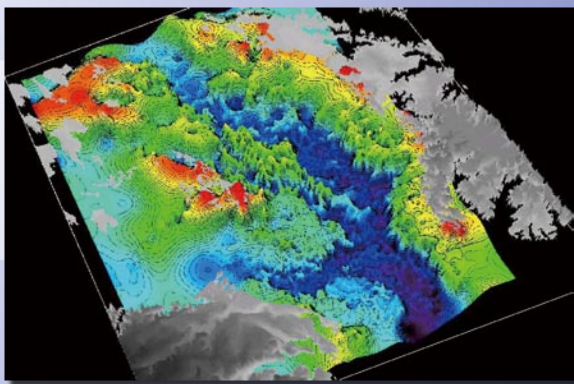


National Institute of
Advanced Industrial Science
and Technology
AIST

http://www.geogrid.org/

GEO Grid

Innovation in Global Earth Observation



Significance of in-depth understanding of earth observation

Dream of integrating global earth observation information

The various global problems that our society faces today must be solved on the basis of common knowledge of the people, by providing information of the earth where we live. Construction of GEO (Global Earth Observation) Grid system is indispensable as it promises high reliability and continuity for solving problems related to precise predictions for preservation of global environment, efficient use of energy resources, reduction of natural disasters, etc. It minimizes future risk and helps in building a society which is safe and secure. It would not be an exaggeration to say that people around the whole world are demanding a system that might become a common base for all. However, there is not an integrated system as yet which can be used freely to handle an enormous quantity of information under the present conditions.

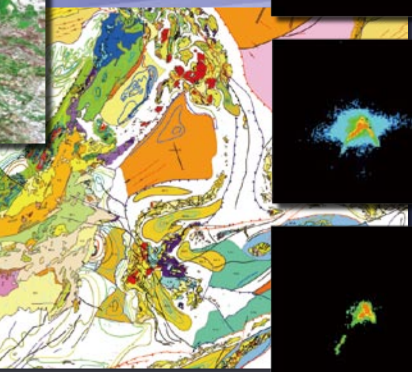
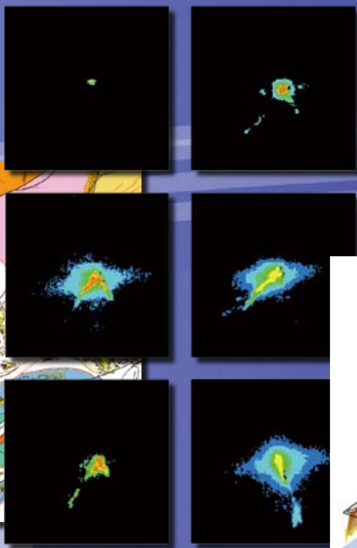
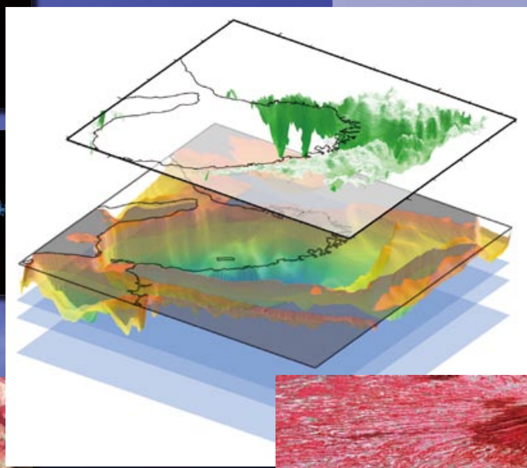
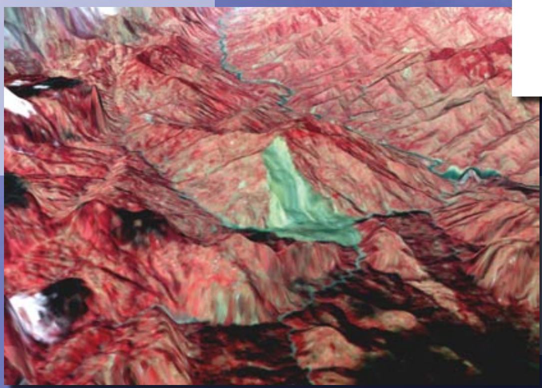
We handle large quantities and various types of information existing as complex entangled data under different administrative bodies. It is not a simple task to construct a system keeping in mind that it must be user-friendly. But we seek to cross this “Valley of Death” and aim to realize a society that assures our future vision of a sustainable society and pursue our dream of “integrating global earth observation information”. For that purpose, we are promoting GEO Grid as an important tool. Through the development of GEO Grid, a large-scale earth observation information archive is set up which can retrieve from satellite observation data to ground as well as underground information and we are aiming at the development of technology for providing safe and high speed data through an integrated service of various observation databases and GIS (Geographic Information System) data at the AIST. We are involved in merging the diverse research fields including geology / energy / environment technology / information technology.

Anticipating Earth Observation Unification System

In the 3rd Earth Observation Summit held in Brussels in February, 2005, the ten years enforcement plan that was applied in the construction of GEOSS(Global Earth Observation System of Systems) was decided. It will be promoted by cooperation of various countries in the world including Japan. "A promotion strategy for earth observation" was decided in the general Council for Science and Technology Policy in Japan in the end of 2004 and is promoted under the cooperation of the Cabinet Office, ministries and organizations (secretariat: the Ministry of Education, Culture, Sports, Science and Technology). GEO Grid is perceived as a medium of cooperation between the concerned domestic and international organizations and strong initiative of AIST is anticipated.

Steady progress of GEO Grid advancing system

To promote GEO Grid, AIST set up “Executive Committee” to decide the enforcement policy within AIST and “Steering Committee” to supervise the details of enforcement. AIST also set up “Cooperation Committee” for coordination with other organizations. In addition, subcommittees at the researcher level according to their


topics were established aiming at active research exchange.

It is spreading its user network globally, focusing around Asia based on cooperation of the Coordinating Committee for Geoscience Programmes in East and Southeast Asia (CCOP) that contributed for many years in the field of geology. To promote activities, we have commissioned an in-charge for long term stay in the Bangkok secretariat from April, 2007.

Towards the realization of “Geospatial information for higher practical use in society”

The contents and services which we offer are considered to be greatly useful for improvement of daily life of the people. As the characteristic of contents, it offers information related to underground geological features, resources, etc. and information about the use / maintenance / preservation of the land. It aims to contribute in providing not only two-dimensional data of the outer layer but also three and four-dimensional information introducing time axis, and offer important information for helping decision makers to judge the infrastructure for mitigation of natural disaster, environmental preservation, usage of underground structure, etc.

Expected development of geotechnology

This pamphlet introduces the complete picture of GEO Grid at present. Contents are limited to information mainly focusing on system summary, inquiry system for resources utilizing satellite information and geological features. It also mentions the applicable examples for reduction of volcano disaster and its conditions of spreading in Asia. We are convinced that its use will spread further through cooperation with various organizations from now on. According to the U.S.Department of Labor, information technology of the earth (Geotechnology) will be one of the three major fields alongside nanotechnology and biotechnology that will develop and create new employment and industry. In Japan, it is ranked as one of the main fields of information technology to be promoted toward “Science and technology creation nation”. There is high expectation from it as a new field of information contents service.

United Nations declared 2008 as international year and activities for “international planet earth year” (http://www.gsj.jp/iype/) will be carried out for 3 years from 2007 to 2009. For sustainable future of the earth and the human, this activity is going to contribute to society by providing knowledge and technology of earth sciences. GEO Grid will become the precise system to contribute for this purpose greatly. By all means we would like to establish a clear milestone during this period

Research Coordinator (Geological Survey and Applied Geoscience).
Eikichi Tsukuda

Connecting the earth to know it better

Contribution of IT in solving global-scale problems

Social problems concerning the earth such as the global warming must be solved in a global scale. Therefore, accumulation of knowledge about the earth in various forms and precise understanding of the earth are necessary. Geological maps based on minute geological reseach and enormous earth observation data of remote sensing from satellites are archived in AIST. In addition, data federated on earth observation network on a daily minute to minute basis is accessible through the Internet from all over the world. However, aren't we getting flooded with such enormous data? On the other hand, isn't it true that there is a shortage of necessary data when it is needed? GEO Grid on earth observation offers various data in an IT environment for safe and secure use by enterprises and research communities.

Points to be pursued in the IT environment of earth observation

The following technical requirements must be fulfilled to realize such an IT environment.

Providing large-scale data:Remote sensing data from a satellite need a capacity of more than 200 terabytes during its operative period (in case of sensor ASTER built-in satellite TERRA) . Quantity of data surpasses 10 times the capacity of ASTER in PALSAR of satellite ALOS.

Handling of various data:Data about earth observation are diverse.The modeling of the carbon cycle needs various input parameters, such as land-use map, climate data and vegetation indices. Research communities wish to integrate some of these data according to their interests. In addition to this data diversity, metadata and derivatives associated with the original data should be taken into account. These data sets have been accumulated in different spatial and time resolution, with individual data schema. Hence the IT infrastructure must support the creation of user groups which represent various types of virtual research/business communities, and the federation of distributed and heterogeneous data resources which is shared in such communities.

Respect of the data owner's publication policy:In our example, some of the input data sets, such as ASTER imagery, in-situ data from PEN and AsiaFlux, and ECMWF climate data, cannot be freely accessible. Due to restrictions concerning the protection of national security, intellectual property, privacy, confidentiality, and relevant ethical issues, the data owner is generally willing to permit only a range of data access, certain choices of data format. They wish to require the users to accept certain limits on the transfer of the rights, etc., and wish to reserve the authority to set and modify licensing rights and conditions. Therefore, the IT infrastructure must provide a security infrastructure which supports flexible publication policies for both data and computing services providers.

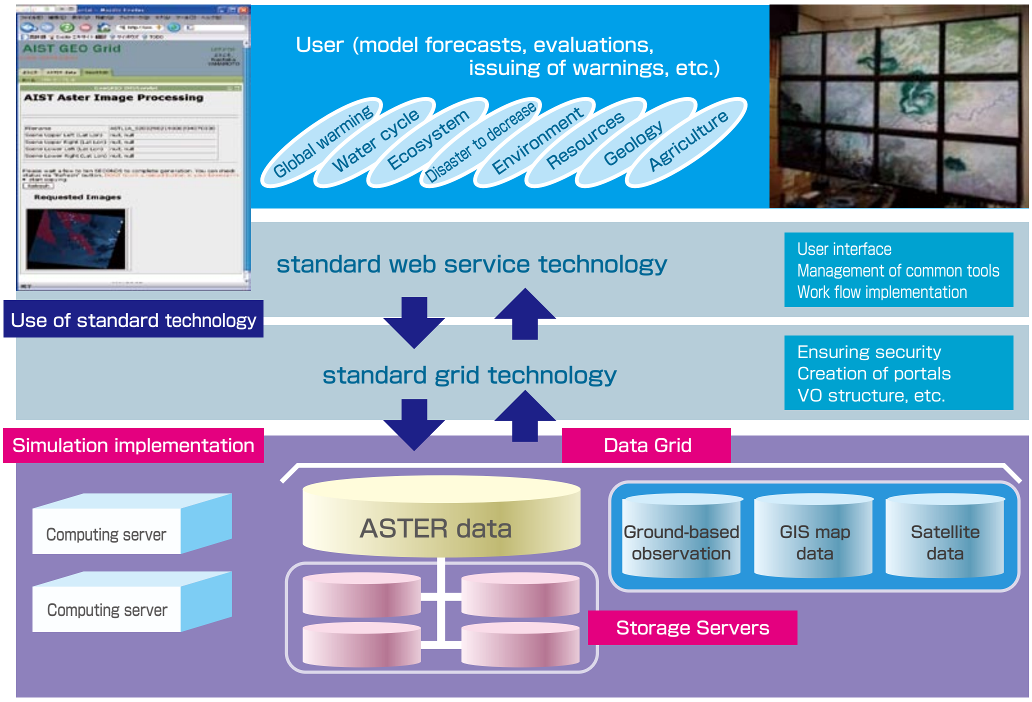
Unification with large-scale simulation:Stored data itself is not of much value. An environment must be provided for simple and easy calculations such as a change of form or predisposal of data, calculation of pyroclastic flow coverage based on data, calculation of quantity of carbon dioxide input and output, and artificial earthquake large-scale simulation. Modeling of the city basement geological feature structure would also be possible.

Various forms of community support:Flexible structural change is anticipated beginning with disaster monitor and resource inquiry in earth observation and in various communities and also on projects related to earth science. Mutual use of processing flow tools and templates within the same group is important.

Why does Grid Technology draw attention?

Grid Technology Research Center of AIST started in 2002 and has been pursuing research concerning the construction of next-generation IT environment to support business and technology. Grid technology is a highly network oriented technology that surmounts obstacles of an organization silo, distance, handling of a variety of data, etc. It is believed that the basic functions of grid technology could be extremely helpful in the construction of IT environment to aid earth observation. Realization of a user-driven IT environment can be easily provided by the observation data of earth that was dispersed corresponding to user demand (community), or by carrying out simulation by adequately assembling computers together.

Let's see a design of GEO Grid in detail (figure). At first we will use a data grid for managing large-scale data. By connecting PC servers with a lot of cheap built-in disk drives in a network, we can virtually store data as a large-scale storage tool. Next we use data grid for handling various other data. Providing unified searches and results would be possible by arranging data according to their types. Basically even in this case the side offering data does not have to change. A schema (a format and an access method) of data called “meta data” is determined by the data owner, but its dispersion to the next place needs to be managed by the user. In addition, it distinguishes a user by complying with the strict and secure mechanism by grid security infrastructure. To be able to grasp who is really accessing it, grid performs the distinctive authorization for abiding by the policy of data provision. Of course one does not need to login individually by single sign-on function. Grid is providing the best at making ensembles of data and simulation. Particular functions are to secure calculation server by large-scale simulation and transfer data to the server directly. There is a concept of Virtual Organization (VO) in grid. Technically it is about the “multiple management domains communicated through a network (for example, an organization offering a user account) based on computing resources in a grouped virtual management domain”. Privacy is secured between different VOs that would help in promotion of research and business by making a VO for every community. When GEO Grid is used every day in the future, by administering GOC (Grid Operation Center), we can take requests for VO operation of management from community and offer indispensable support services effectively. We establish a



Complete structure of GEO Grid

web site and portal site within this VO and promote sharing of information.

Promotion of GEO Grid was mentioned in WEB2.0 of CGM (Consumer Generated Media) for application in the field of earth science. If anyone can send imminent data, for example, with implementation of land level carbon input and output model, we can hope that the information of dynamic carbon (GPP, NPP) of the developing Asian countries participating in the Kyoto Protocol can be mutually shared by the administration and citizen.

Participation in GEO Grid and plan

We receive questions like “What are the requirements to participate in GEO Grid?” Introduction of the necessary software packages differs depending on the form of participation of data provider, a VO manager (a leader of project or community), and a general user. As long as general users do not perform any specialized task, they use only a normal web browser, but need to decide the VO they belong to and have to ask the administrator for making an account. Other than this anyone might have a limited accessibility to the data participating in the GEO Grid. We offer participation based on the provision of application and computing resources, but it is considered to have lesser specialty in GEO Grid.

At present, online usage of ASTER data is of top priority and complete tape archive of the past has been uploaded since March, 2007, and we make global level DEM (Digital Elevation Model), a highly advanced product generated on-demand, by March, 2008. Again from an advantage of having the details of the design data of ASTER, we plan to offer global mosaic DEM with 15m resolving power after performing enough precision inspection in the future. At the same time we offer a prototype equipped with a necessary function by software packaging of GEO Grid.

Spreading E- science of earth science in the world

Quantity of data which a person can read, look and feel alone during a lifetime has a natural limit. By selecting the truly necessary parts from exploding information of earth observation data,there must be opportunities for everyone to establish innovations.Cutting edge IT is indispensable for its realization. The new infrastructure technology such as that of GEO Grid is called the 4th mode of science : E-science.

The computational science that was the 3rd mode of science covers the theory that was impossible to experiment even with supercomputers. E-science in addition to this is a new scientific mode for sharing of dispersion data along with carrying out high quality data processing.

GEO Grid as E-science in earth sciences is building a system for possible use by fusion of earth observation information and data handling programs. By promoting fusion of information related to geosciences and the satellite, AIST has plans of fusion with larger communities of earth observation information. In addition, by promoting international cooperation positively, higher use in Asia in particular is of main concern. Considering the general trend of internationalization in this case, we aim at securing mutual use of the information system and data at an international level.

Director,
Grid Technology Research Center
Satoshi Sekiguchi

Observing the present to secure the future of the earth

From "presumption" to "possibility"

This is the slogan for careful driving in Japan. However, we are unable to ignore the impact of human activities towards the earth at present, and this slogan may be considered the correct preventive method towards the global environment problem. But more precisely the car called the earth which is steered by nature, is being driven by humans who do not have a driver's license.

Global warming is the topic of the day, but, on the other hand, doubt is posed on the scientific grounds, too. The reason behind this is uncertainty in prediction by a model and earth observation as well. However, there is a fact to be considered even in its uncertainty, in addition to sensing the danger of our future with some accuracy.

To understand and reduce uncertainty

Presently, we are handling earth observatory satellite data in the GEO Grid. Concerning the aforementioned global warming research, we are advancing research and development of carbon dioxide flux calculations from satellite data, and some scientific results have been achieved already. At first glance these results might seem to be a fact, however, they have uncertainty. In order to grasp the precise results, it is essential to know the extent of uncertainty of these results. In addition, it also means that we need to make efforts to decrease the uncertainty.

For that, calibration and validation of the satellite-derived data and its algorithm/model by ground observation data have become necessary (figure below).

As for the calibration and validation of GEO Grid, geometric calibration using Lidar and DCP (Degree Confluence Project) data and radiometric calibration, such as vicarious and cross calibrations, are firstly carried out for the standardized satellite data. Next, we verify various surface data derived from the standardized satellite data (reflectance ratio, the amount of insolation, vegetation index, land coating, leaf area index, photosynthetically active radiation absorbance, etc.) by DCP and PEN (Phenological Eyes Network) of earth's surface observation. Furthermore, these satellite-derived surface data and the climatic data are input into the ecosystem model, and the net primary production of the vegetation is calculated. The result is verified by comparing with AsiaFlux (ground observation network of carbon dioxide flux, etc.) and improvement of the precision is assured. Furthermore, in order to do these activities smoothly, web portal with the quick look function for observation data (http://kushi.geogrid.org) is also under development.

But, most of these data and its algorithm/model are placed under different managing organizations, and have different format and handling.

Furthermore, in order to deduce precise results, the integration and fusion of various kinds of observation data is going on, and the necessity of processing/analysis system which integrates and fuses the observation data, algorithm and model which disperses in the world is anticipated.

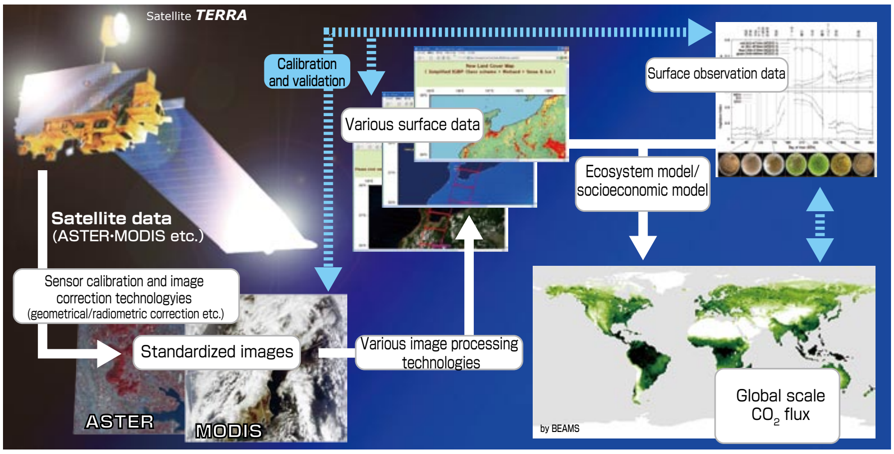
As for GEO Grid, the various types of earth observation data, operated by different organizations, can be applied to the VO (Virtual Organization) introduced in the last page, and it exceeds the obstacle of geographical/owner/access method, and makes the process and analyzing of the earth observation data possible. By this, we aim to decrease the uncertainty of earth observation by understanding its uncertainty.

A second's notice would prevent a lifelong disability

Perhaps in case of prolonged "careful driving with possibility" the continuous development of the mankind is difficult. But, by knowing the uncertainty in earth observation and decreasing that, correctly grasping the information of these earth observations, believing those which can protect the future of the earth, we would like to advance the research and development and spread of GEO Grid.

"A second's notice would prevent a lifelong disability", which is the slogan for careful driving in Japan, by always observing the earth carefully, overcoming the problems of the earth with the intelligence of the mankind, and without causing major accident of the earth due to reckless driving, we desire to build a rich society.

Grid Technology Research Center
Satoshi Tsuchida



Calibration and validation of carbon dioxide flux calculation

Internet promotes usage of geological information

From papers to Internet

Geological information, which has been accumulated as basic information on resources/ environment/ prevention of disasters since 100 years or more, could be obtained only from the published papers just about twenty years ago.

In the 1980s computer processing of geological maps started, and in the 90s, the geological maps were released on CD-ROMs. And these days, it is designed in such a way that geological information can be retrieved directly from the Internet database. Presently, AIST has released 22 databases on the comprehensive features of geological information (http://www.gsj.jp/Gtop/geodb/geodb.html).

The style of database was changed by the advancement of geographical information display technology on the Internet such as WebGIS. In the past, display was carried out by changing the range of graphics data prepared beforehand. Now, the user can select the area and display items freely and furthermore display system of color, transparency, etc., can be indicated finely. In AIST, geological map database (GeoMapDB), which was introduced as WebGIS database in our journal (February, 2007), and the geological information index retrieval system (G-INDEX), which aims toward the thorough retrieval system of the geological information including the geological map (see figure), are released.

Top page of the Geological Information Index retrieval system
http://www.aist.go.jp/RIODB/GINDEX/GSJ_E1

Dispersive Database

As for the geological and geographical information database which utilizes WebGIS technology, beginning with "the national land information web mapping system" of the Ministry of Land, Infrastructure and Transport, "the landslide map database" of the National Research Institute for Earth Science and Disaster Prevention, such database became released even by the local governments and the private companies. Now one can view various information related to geological features on the Internet and further requests for simultaneous viewing by superposing those data have been received.

In order to enable the user to simultaneously display information of the WebGIS database on the Internet freely, standard regulations have been decided recently. Several WebGIS databases have begun to support this service and superposing information has become possible to peruse. AIST is advancing its preparation in order to display in the aforementioned two systems, superposing the information of other databases. In addition, if the satellite graphics data transmission with GEO Grid is included, environment utilizing features of geological information combined with other databases can be spread further.

Integration of geological information

As people say "Looking underground is more difficult than looking at outer space," there is a limit in elucidating underground structure from a single type of information. Integrating and utilizing various information such as geological map, boring data, geophysical data and satellite information is necessary. The database maintained by each agency is connected by a network, a system has been constructed where mutual utilization and releasing of the data is possible, and research in order to promote the application of the data is being pursued. Also utilization of the open-source software is one of the major features. In addition, research for constructing 3 dimensional geological model by integrating a lot of geological information is also going on. By GEO Grid, we can fuse geological information and grid technology and the 3 dimensional geological structure model will be released on the Internet in the near future.

Institute of Geology and Geoinformation.
Yasuaki Murata
Geoinformation Center
Shinji Takarada

Utilizing the experiences of natural disasters to reduce damages in the future

As one of the applications using GEO Grid, for the purpose of reducing volcanic disaster, we made a pyroclastic flow computer simulation which used the high accuracy data of the earth observatory satellite ASTER sensor (15 m precision) above sea-level. In this way GEO Grid is also tackling the simulation tecnology development for such reduction of natural disasters.

1991 - 1995 Unzen pyroclastic flow

Pyroclastic flow occurred 9500 times or more in 5 years, from 1991 - 1995 in the Unzen volcano of Nagasaki Prefecture. There were 43 victims in the pyroclastic flow of June 3rd, 1991. Pyroclastic flow of the Unzen volcano is considered one of the most dangerous as the unstable part of the growing lava dome collapsed and flowed down at high temperature (above the 600 °C) and high speed (above 100 km/h).

Next-generation hazard map

For reducing the damages caused by volcanic disasters, “map (paper)” was drawn in the form of disaster maps (hazard maps) for volcanic prevention, from the past activities of the principal active volcanoes in the entire country. In the future, this information of “the geographical information system (GIS)” will be used in superposing function of various data and drawing “real time hazard map” corresponding to the circumstances of the local area is demanded.

Pyroclastic flow simulation

With the pyroclastic flow simulation of GEO Grid, it is possible to do simulation by the energy cone model on the Web browser (Fig. 1). This simulation fixes the point of column collapse height (Hc) with equivalent coefficient of friction of the pyroclastic flow (H/L) by inputting the two parameters, appraising the range of the energetic arrival of pyroclastic flow is possible. Presently, simulation can be executed with nine volcanoes:the Merapi volcano (Indonesia), the Fuji volcano, the Unzen volcano, the Kirishima volcano, the Sakurajima volcano, the Yotei volcano, the Usu volcano, the Tarumae volcano and the Bandai volcano (Fig. 2). By adding the observation information of earth observatory satellite such as 3 dimensional elevation model, even in midst of eruption, it can always use the up-to-date topographical data according to the circumstances of volcanic activities. It is possible to execute high speed processing with grid technology. Processing of data in a brief time of 10 seconds - 3 minutes is also possible. Application of this simulation is not just restricted to the pyroclastic flow, but also to various volcanic and geological disasters such as avalanche and landslides. Opening to general public is planned from 2007.

It is aiming towards enabling the use of this simulation with any volcano in the world by researchers and prevention disaster in-charges anytime and anywhere in the world.

Executing numerical simulation by granular flow model of lava flow is planned in the future. By this granular flow model of lava flow, quick correspondence in case of volcanic eruption becomes possible and it is expected to be useful as a deciding material for evacuation of inhabitants.

Geoinformation Center
Shinji Takarada

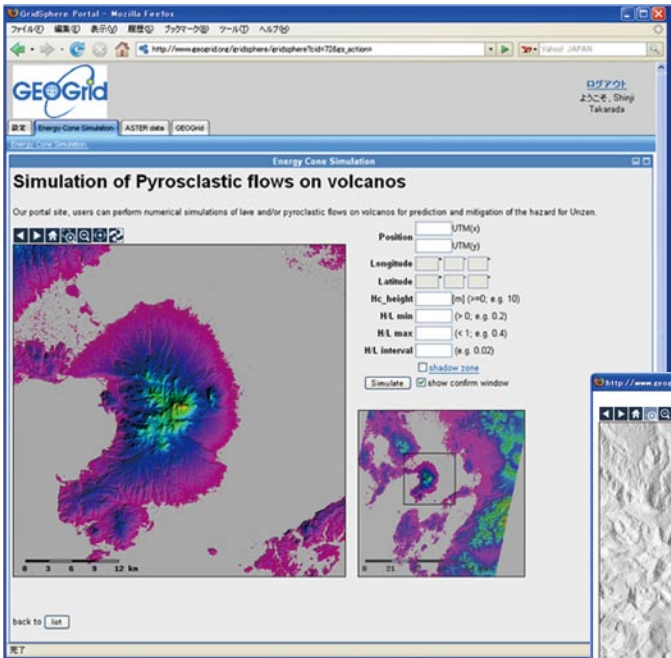


Fig. 1 The initial screen of the pyroclastic flow simulation by the GEO Grid system (Nagasaki Unzen volcanic area)

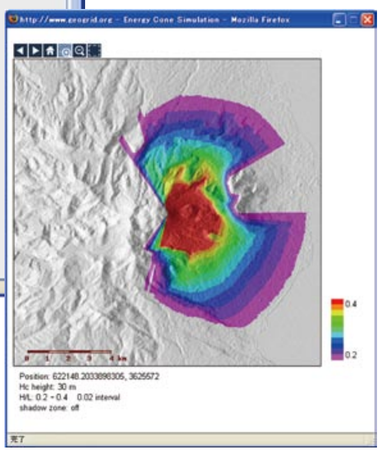


Fig. 2 Example of Unzen pyroclastic flow simulation result
(Red area indicates expected danger zone for 10,000 m^3 scale pyroclastic flows. Purple area for 1,000,000 m^3 scale pyroclastic flows)

Connecting smooth resource supply to the future

Underground resources supporting citizen's life

If we look around us, it can be easily understood that our lives depend on the mercy of underground resources. Especially, petroleum is an irreplaceable raw material for fuel and petrochemicals. Because of that, it is one of the important national policies to maintain stability of the supply of petroleum resource, until alternative source of energy and substance to substitute will be developed. It is said that there is a proportional relationship between the petroleum consumption and the income per person. Compared to the worldwide mean value of petroleum consumption, our country is on the higher side. Petroleum, which is non-renewable resource, is unevenly distributed only in specific areas. Actually the consumption of petroleum has increased, but the discovery of the new oilfields is not progressive. Effort on discovery of petroleum is continuing worldwide, but it has become difficult to continue with the discovery of new oilfields so as to compensate the increase in consumption.

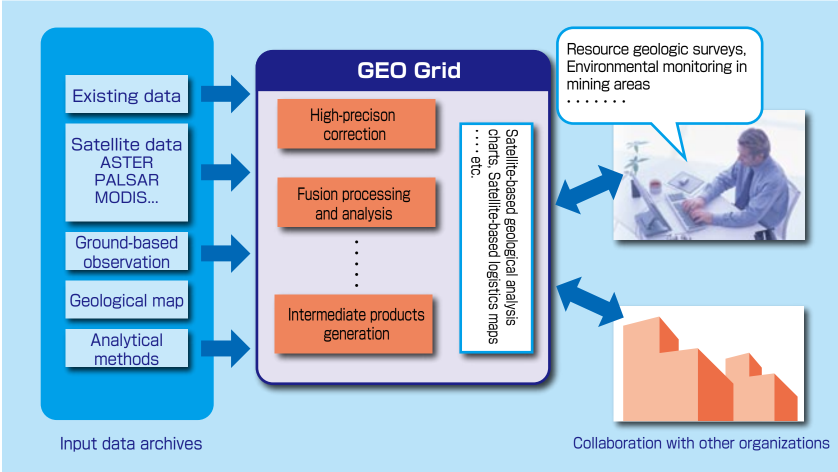
At least in this decade, so called giant oilfields have not been discovered. The securing of petroleum resource is becoming difficult at the any stages of exploration, exploitation and production.

Satellite data which contributes to smooth resource supply

When we think about the present condition in which we are dependent on more than 70% of energy from the fossil fuel (petroleum, coal, natural gas and others), it is necessary to continue with the discovery of the resources for a while. Suppose the enormous oilfields, which have produced approximately 90% of the gross petroleum production, has already been discovered, thus prospecting and developing the middle /small-scale oilfields are major target in the future, so it is necessary to prospect many such places. In development of an oilfield, a series of long-time process of reconnaissance geological survey, securing a mine-field, precise geological survey and geophysical exploration, trial drilling, development drilling and production is necessary. Preparatory geological survey is extremely important, at the same time should be done in a short period.

For efficient preparatory investigation, satellite images are often utilized as one of the tools to support prospecting. As for utilization of satellite images to investigate prospects of petroleum resource, it has been utilized in decipherment of geological structures and lithologic units with the satellite images since the early 1970s. Compared to that time, high-quality satellite data can be available now. Spatial resolution, stereoscopic viewing function and spectral resolution of optical sensors have rapidly improved. The Synthetic Aperture Radar can observe earth's surface during day and night, even over cloud-covered areas.

In addition, information mining technology from the satellite data is progressing steadily. There is no doubt in using satellite data for logistics purpose instead of the topographic map, but state-of-art analytical technology in order to obtain more detailed geological features is in strong demand.



Overview of GEO Grid-based resource exploration subsystem

Fusion technology is indispensable

Recently, information integration is greatly required for prospecting and exploration of resources. Thus information mining and fusion from large amount of data are focused today. In AIST, we aim towards the development of a novel multidisciplinary platform called GEO Grid. With GEO Grid based on grid technology, we aim to provide the data archives (such as ASTER and PALSAR) and their search tool, along with highly accurate image correction system, including the geological information such as geological map, also with the ground observation data. Thus, we can possibly provide the highly-reliable information, which will be contributing to preparatory geological survey, exploration, etc. (figure adove).

The GEO Grid has productive functions for various information. The most important aspect of it will be a flexible testbed system, which allows try-and-error approach to accomplish a variety of product production. For this purpose, cooperative framework and interoperability with various data archives and similar distributed systems are extremely required. AIST, while cooperating with intra and inter-systems closely, promotes a future innovative framework based on GEO Grid, then will contribute in the field of securing underground resources for our lives.

Institute of Geology and Geoinformation
Isao Sato

Dispatching global geological information "from Asia to the world"

Present conditions of Asian geological information service

So far Geological Survey of Japan (GSJ) of AIST has been cooperating with various Asian countries to construct different earth science information maps and databases. As main ones, it can provide 1/2000000 east & southeast Asian geological map, tectonic map, sedimentary basin map and 1/5000000 East & Southeast Asian heat flow map, 1/4000000 east Asian magnetic anomaly map, 1/7700000 East Asian geological hazard map and the East & Southeast Asian city geological information database etc. GSJ directed most of them, and it is the results of the projects of the Coordinating Committee for Geoscience Programmes in East and Southeast Asia (CCOP) through which it cooperates with the geological surveys of various Asian countries.

Standardization and integration of Asian geological information

But, there are various problems related to these results depending on the fact that the time when it was made differs from each result. The data is paper based, and assuming that it was digitalized, there are various forms of reduced scale precision and data format etc. Thus, as the standard topographical data differs, there is a big problem in order to use it as an integrated data. Integrating and re-constructing it as a database and updating the old geological information is necessary. Standard topography and the data format, reduced scale (precision), the database for standardized projection and geodetic survey system etc. should be constructed, and it is our urgent task to offer data possible to use with GEO Grid.

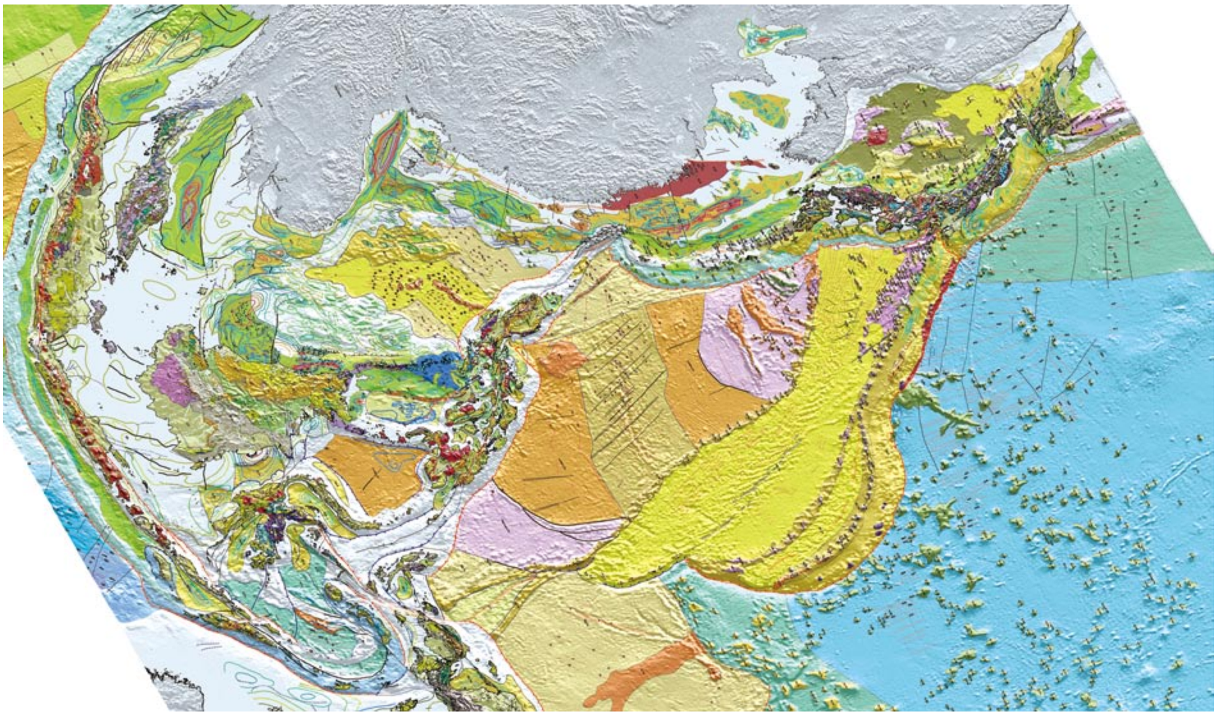
Servicing the up-to-date geological map of Asia

As a start-off we have begun the renewal of the geological map from 2005. Geological information is integrated with the satellite data and other geological information and geological map is the standard in order to utilize them. The latest edition of the geological map in regard to the drawing of the Asian region was carried out in "The international digital geological map of Asia (IGMA5000: 1:5M International Geological Map of Asia) project". With this project, 1.5M Asia-wide geological map was drawn up under the committee of geological surveys of countries from the whole Asia from west Asia such as Iran to Japan. It was facilitated with a digital geological map database which confirms to worldwide standard of 1/2.5M.

GSJ is in-charge of 1/5 of the entire area (the islands section and the sea area) of the East Asian region, and drew the digital geological map accordingly. As it prepared the common guide of Asian region in order to carry out a leading role, it was requested to compile a standardized guide of the ocean area.

GSJ, along with this geological survey map as the base, integrates and maintains various geological information of Asia (especially East & Southeast Asia). Actualizing and dispatching information of high interoperability with GEO Grid is also being planned.

Institute of Geology and Geoinformation
Koji Wakita



GEO Grid Promotion on International Stage

Strategy of the GEO Grid Promotion

In this pamphlet, GEO Grid is introduced as a tool to utilise various kinds of information on the earth like satellite images. In this chapter are indicated measures and framework construction for the overseas promotion.

What strategy is needed to make GEO Grid to be recognised and harnessed widely abroad? Let us refer to a part of the management policy established by the AIST, prime mover of this programme. It reads “AIST will work toward a sustainable society by taking a leadership role in industrial technology innovations in Japan. ” In addition, AIST decided to encourage international deployment, especially by relating entities in Asia (AIST Management Policy and Research Strategy 2006) . It is on this basis that we have initiated our actions in Asia.

Science and Technology Diplomacy through CCOP

When something should be appealed on international stage, the task becomes easier if it has impact such as implication to international policy or construction of mechanism which is useful to every country. And in order to realize intended easiness the issue should be brought to a level as high as possible. Fortunately GEO Grid finds a strong advocate. It is a Bangkok-stationed international organisation CCOP (Coordinating Committee for Geoscience Programmes in East and Southeast Asia) .

Japan is a Member Country of CCOP. The Ministry of Foreign Affairs serves as permanent representative and AIST as deputy permanent representative of the nation. It is of paramount importance that CCOP is placed as an institution for science and technology diplomacy. It is reminded that all of the international cooperation cannot be regarded diplomatic but cooperation with CCOP is approved to be of the diplomacy. According to this position, our research products can be brought to higher levels if channels through CCOP are used appropriately. It is envisaged that cooperation with CCOP can be a nucleus to disseminate GEO Grid in Asia.

Appeal to Asia

The idea to promote GEO Grid in Asia was already proposed and approved by the CCOP Steering Committee meeting. During the meeting, it was explained as follows.

– As GEO Grid manufactures virtual infrastructure and does not need expensive facilities such as super-computer, every Asian nation can participate in the programme in spite of the economical gap.

– GEO Grid contributes to bridge digital divide which is a serious issue in Asia.

– It is considered that GEO Grid development is a common challenge among nations to solve issues in Asia, while specific application resides within each nation’s responsibility.

– GEO Grid ranges from resources, environment, hazard mitigation to geo-information. Thus it can be used to thrust sustainable development and human security in Asia (human security is a diplomatic pillar of Japan) .

Way Forward of GEO Grid in Asia

Welcome responses to the presentation were observed at the CCOP Steering Committee meeting, which means the idea of GEO Grid was supported by the Member Countries. And the Member Countries present in the hall agreed to cooperate with this initiative. At the Steering Committee meeting they also approved a plan to send a liaison officer from AIST to the CCOP Technical Secretariat. GEO Grid promotion in Asia will be for the time being conducted by the officer who consults with AIST staff responsible for the initiative.

Specific plans were already proposed by Thailand and Vietnam. GEO Grid is expected to achieve good promotion and to show rapid dissemination in the Asian region.

Geoinformation Center
Satoshi Murao

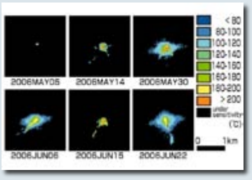
A Japanese delegate who makes a presentation on GEO Grid at the 48th CCOP Steering Committee meeting in November 2006. Rules and procedure of the meeting are in accordance with the UN system and the items agreed in the hall become international engagement.

COVER IMAGES

Image of Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER) temperature data superimposed on a 3D terrain

The image shows the pyroclastic flow (the blue streaks running from the peak) following the eruption of the Merapi Volcano in central Java, Indonesia.

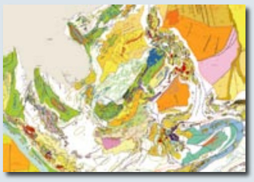
Image by courtesy of Minoru Urai, Institute of Geology and Geoinformation



Long-term monitoring of volcanic activity using ASTER temperature data

Part of the data obtained using satellite data during monitoring of the Merapi Volcano's activity. This image and the above one possess great potential as resources for making judgments aimed at disaster prevention.

Image by courtesy of Minoru Urai, Institute of Geology and Geoinformation



Part of a 1:5,000,000 scale map created by the International Geological Map of Asia (IGMA 5000) project

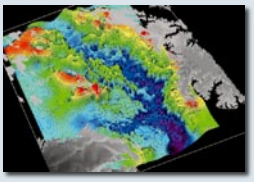
International cooperation plays a major role in the field of geological information, in which various forms of data are increasingly integrated.

Image by courtesy of Koji Wakita, Institute of Geology and Geoinformation

Image of the 2005 eruption of the Sierra Negra Volcano on the Galapagos Islands

Superimposing a daytime visible and near-infrared image on a nighttime thermal infrared image enables the distribution of the lava flow areas to be observed.

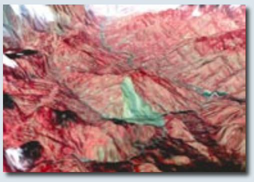
Image by courtesy of Minoru Urai, Institute of Geology and Geoinformation



Shallow subsurface geological structure of Tokyo and its vicinity

It is thought that elucidating the distribution and structure of the soft sedimentary layer directly below the Kanto Plain will help to mitigate the damage caused by earthquakes. The organization of detailed spatial geographical information can be a useful material in disaster prevention.

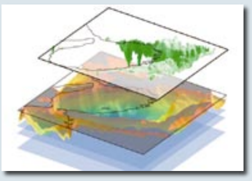
Image by courtesy of Susumu Tanabe and Toshinori Nakanishi, Institute of Geology and Geoinformation



View of a landslide generated with satellite observation data

Using satellite data, a view of an enormous landslide caused by the 2005 Pakistan earthquake was created with remarkable alacrity. It is a powerful tool for providing information about areas that may be difficult to access during times of disaster.

Image by courtesy of Daisaku Kawabata, Institute of Geology and Geoinformation



Subsurface structure model of the Osaka Plain

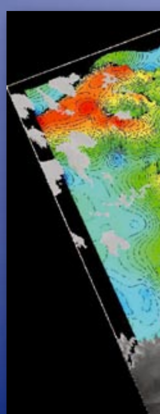
Using various methods including geophysical exploration, information about the subsurface structure is also becoming more accurate. It is demanded that such information can be provided in more easy-to-use formats.

Image by courtesy of Haruko Sekiguchi, Active Fault Research Center

The topography of Tsukuba City and its environs, which spread out at the foot of Mt. Tsukuba

The uses of the ever-increasingly sophisticated satellite observation data are almost infinite in their potential. In tandem with grid technology, the day when earth information leads to a whole new industry may not be far away.

Image by courtesy of Hirokazu Yamamoto, Grid Technology Research Center



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