Japan Geoscience Union Meeting 2013
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Session Scope: Global Data Sciences in the Big Data Era—Global Data Management and System

Session Scope: Global Data Sciences in the Big Data Era—Global Data Management and System

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In earth, planetary and space sciences, scientific findings and understanding of irreproducible phenomena like earth's climate change etc. cannot be validated with double-check of results by independent scientists which is essential elements of the modern science. Then, "data" is the only proof which scientists can show to the society to secure the scientific truth. The ICSU-WDS (World Data System) progarmme has started its international programme office (IPO) hosted in Japan targets world-scale data-sharing community and framework. New initiatives such as persistent digital identifiers of datasets and authors, as well as data citation are important as a new science infrastructure in this new era. Nowadays when decision-makers requires access to usable information on natural phenomena which impacts the society, joint efforts and possible collaboration, and furthermore fusion are required of advanced information science and technology together with earth and planetary science datasets, so targeted activities like DIAS are proceeding now. In this session, a wide range of data activities of not only earth and planetary sciences but also of social and economic fields are welcome to exchange and interact for the future global coordination of scientific data and information.
Keywords: ICSU, World Data System, GEO, GEOSS, DIAS, WDS

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U02-02 会場:201B 時間:5 月 20 日 09:10-09:25

Science Council of Japan and International Programmes (TBD)
Science Council of Japan and International Programmes (TBD)

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Activities of Science Coucil of Japan will be introduced in connection with related international programmes.

キーワード: 日本学術会議, 全球地球観測システム, データ統合・解析システム, 国際科学会議, 世界データシステム
Keywords: Japan Council of Japan, GEOSS, DIAS, ICSU, World Data System

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U02-03 会場:201B 時間:5 月 20 日 09:25-09:45

GEO の戦略目標と主要な機能
GEO Strategic Objectives and Core Functions

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In order to understand the Earth System and the impact changes in the Earth System have on society we need reliable, sustained and comprehensive observations. The Group on Earth Observations (GEO) was created to bring together diverse community of providers and users of Earth observations in order to create the Global Earth Observation System of Systems (GEOSS) that links together planned and current observing systems, improving the integration of, and access to, data and information.

GEO: a) is a unique global initiative mandated to coordinate and facilitate the integration of, and access to, land, water, sea, air- and space-based observing networks and their associated information systems; b) occupies an upstream position in the international community with respect to the major initiatives requiring observations, data and information about the Earth system; and c) brings together Governments and all relevant intergovernmental, international and regional organizations with an interest in Earth observations under a flexible, voluntary framework for coordinating strategies and investments, as well as developing new initiatives, through the on-going implementation of the Global Earth Observation System of Systems (GEOSS).

GEO has set itself ambitious strategic targets, and is making significant progress towards delivering them. Global and regional initiatives, such as AfriGEOSS, the Asian Water Cycle Initiative (AWCI), Blue Planet, the GEO Biodiversity Observing Network (GEO BON), the Global Agricultural Monitoring (GEOGLAM) initiative, the Global Carbon Observing System (GeoCarbon), the Global Forest Observing Initiative (GFOI), and the Global Mercury Observation System (GMOS), have been created to address gaps in our capability as identified by users. To improve access to data a GEO Portal has been developed, providing an entry point to access Earth Observation information and services held by GEO Members and Participating Organizations and GEONETCast, a near real time, global network of satellite-based data dissemination systems designed to distribute space-based, airborne and in situ data, metadata and products has also been set-up. In the 2010 Beijing Declaration, GEO Members committed to implement the GEOSS Data Sharing Principles by developing flexible policy frameworks that enable a more open data environment, and these Principles have influenced national and regional data policies, including INSPIRE and Copernicus (GMES) in Europe and Landsat in the US, facilitating the uptake of Earth Observation data by a wide range of user communities.

キーワード: 地球観測, 地球観測に関する政府間会合, 複数システムからなる全球地球観測システム
Keywords: Earth Observation, Group on Earth Observations (GEO), Global Earth Observation System of Systems (GEOSS)

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U02-04 会場:201B 時間:5 月 20 日 09:45-10:05

ICSU World Data System
ICSU World Data System

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The ICSU World Data System (ICSU-WDS) primary goals are to ensure the long-term stewardship of quality-assessed data for research and education, and the provision of such data and related data services to the international science community and other stakeholders. New technological options opened by todays management, curation and on-line distribution of multi-disciplinary digital data sets make these goals achievable. The WDS is built as an international federated system of long-term data archives and data related services covering a wide spectrum of sciences. It includes 45 Regular an 7 Network Members dealing directly with data curation and data analysis service. It encourages and enables interdisciplinary data activities, but different disciplines (e.g. seismology, oceanography, astronomy, space sciences, biodiversity, health and social sciences) have developed domain-specific efficient answers to their data challenges. Consequently, WDS will have to evolve as a system of data systems and integration of interdisciplinary data will be dependent on implementation of interoperability arrangements. Although the focus of WDS is on the long-term stewardship of scientific data?so that the value of data holdings might actually increase with time?WDS members must share some overarching principles to achieve the system of data systems. This is realized through promotion of close collaboration between members and more importantly through an accreditation process and certification criteria. For example by the development and adoption of, standards and quality control practices, analysis and metadata services, and data publication services that can be recognized across domain boundaries. The latter will require a strong relationship with science publishers and libraries. Another focus point will be to establish a framework to help scientists in developing a data management plan from the very beginning of science projects and programmes, especially in an interdisciplinary and international context.

キーワード: Data Stewardship, Long-term preservation, scientific data and information, open access, Data Publication, Knowledge Network
Keywords: Data Stewardship, Long-term preservation, scientific data and information, open access, Data Publication, Knowledge Network

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データ統合解析システム上に開発するワークベンチ
Workbenches developed on the Data Integration and Analysis System (DIAS)

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「世界で共有できる知の創造」、「分野を超えて共有できる知の創造」、「体感できるデータと情 報の 提供」を目標に、地球規模課題、特に気候、水循環、生物多様性・農業・水産業に関する科学知の深化と公共的利益創出のための情報基盤であるデータ統合・解析システム（DIAS) をパイロット的に構築し、その有用性が実証された。これを踏まえ、「地球環境情報統融合プログラム」では、DIAS を高度化・拡張し、様々な分野の利用者（ステークホルダー）が地球規模課題解決に向けて、科学的先端性を持続的に発揮し、超大容量で多様なデータ・情報を協働して統融合することによって、新たな価値を創出し、実利用によって公共的利益を実現できる情報基盤（ワークベンチ）のプロトタイプを構築している。

キーワード: 地球観測, 地球環境, データ統合, ビッグデータ
Keywords: Earth Observation, Earthe Environment, Data Integration, Big Data

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Cross-domain interoperability in geosciences for data integration and decision support via Semantic Web technologies

Cross-domain interoperability in geosciences for data integration and decision support via Semantic Web technologies

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The research and understanding of complex geoscience phenomena, such as e.g. climate change, space weather or earth plate dynamics require an integrated approach for the combination of data covering different earth and space science domains. The results must be comprehensible for the scientific community, for the interested public as well as high-level decision-making purposes and therefore prepared and presented in very different ways. At present most of the geoscience data which are generated within one domain, e.g. earth gravity data in the geodetic domain are not usable or at least are only difficult to use within other domains, e.g. in seismology, geophysical domain. The problem is even bigger. Sometimes, within one domain, the ”same” data just measured by different instruments are not capable of being integrated. Just think, how difficult it is to combine in-situ earth gravity data measured by e.g. superconducting gravimeters with global gravity field data derived from specific satellite missions such as GRACE or GOCE.

Obstacles for the integration of data are the usage of different data and file formats provided by proprietary data management and information systems using different services. Therefore a lot of effort for the search of data, the understanding of data management systems and services as well as the transformation of data and file formats often done by scientist is necessary. Another challenge for the integration of data often is the lack of information about data provenance and governance. This context of the data and information are absolutely necessary in order to judge whether the specific data can be used in a specific application within a specific field of research. What else prevents data from being used in the same or different scientific domains? Cultural and linguistic differences of scientific work in geoscience and neighboring disciplines often lead to the use of different vocabularies, different understanding of terms for data description and data retrieval purposes.

The Semantic Web, an extension of the World Wide Web possesses the capability for the solution of many questions touched on in the first part of this abstract. First, the Semantic Web is based on standards for domain models and data as well as for vocabularies used for the terminological interoperability. Domain models formed as ontologies related to earth and space sciences conceptualize a specific field, e.g. virtual observatories in space physics (VSTO ontology), the measuring process itself (SSN ontology) or the lifecycle of geoscience data (ISDC ontology). Upper ontologies (SWEET) for the geoscience domain are often the umbrella of the appropriate domain ontologies. Classification, taxonomy or thesaurus vocabularies consist of domain specific keywords and relations between keywords. Within the Semantic Web these vocabularies are modeled as terminological ontologies. Examples for terminological ontologies in the earth and space science domain are GCMD scientific keywords and SPASE ”allowed values”. The GEMET thesaurus ontology also relates to environmental and social sciences. The merging of domain and terminological ontologies enables both to bridge the gap between different scientific fields and different linguistic comprehension. In the Semantic Web realm, the integration of geoscience data, modeled as individuals and/or at least described by all required context information in the domain ontologies is realized ”just” by networking the specific and appropriate ontologies. An example for such an approach is the ISDC ontology network linking domain ontologies, such as FOAF, GeoNames, Bibo, DBpedia and terminological ontologies, such as GCMD science keywords, SPASE ”allowed values” and GEMET thesaurus. Within the near-earth space domain, it is planned to connect Japanese IUGONET, EU-ESPAS and German ISDC data and appropriate data management systems using the same terminological ontology based on an extended SPASE thesaurus.

キーワード: earth and space sciences, data governance, data integration, Semantic Web, domain ontology, thesaurus vocabulary
Keywords: earth and space sciences, data governance, data integration, Semantic Web, domain ontology, thesaurus vocabulary

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多様な地球観測データの利活用支援手法
Handling Heterogenous Data to Link Earth Observation with Socio-Benefit Applications

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With the improvement of observation technologies and earth science studies, a large amount of and various kind of earth observation data including remote sensing data, satellite images as well as model simulation data is now globally being produced by many experts and researchers. The size of earth observation data is quite huge even if it is compared with other data in the current big data era.

In these days, such earth observation data is an indispensable resource in order to enhance science researches in the fields of agriculture, hydrology, meteorology, biodiversity, or oceanography. Besides, it is required to deal with real issues such as climate change, typhoon, flood, drought, tsunami, poor harvest, pest damage, and ecosystem destruction. Accordingly, the earth observation data has the characteristics not only as big data but also as diverse data from the viewpoint of data uses.

When we consider the suitable usages for earth observation data with the premise to applying for such wide varieties, it is important to manage vocabularies related earth observation community. The vocabularies are useful for basic functions such as data definition, description, classification and retrieval as well as for extent functions such as recommending or interest matching application with data and users across the interdisciplinary domains. In this sense, we are currently developing dictionaries, arranged vocabularies and ontologies by gathering the existing glossaries or information given through discussions with earth scientists and experts in GEO (Group on Earth Observation) and DIAS (Data Integration and Analysis System).

Currently, our developed ontology and vocabulary related systems are used in GEOSS which is an international system for earth observation data and DIAS which is a Japanese data integration and analysis system handling big data including not only earth observation data but also social and economic data. Then in our presentation, we introduce our trials and developing systems through such activities.

キーワード: 地球観測データ, データ検索, オントロジー, データ融合
Keywords: Earth Observation Data, data discovery, ontology, data fusion

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衛星と直接観測データを用いたメガシティーからの CO2 発生量のインバース解析
Inverse analysis of CO2 emissions from a mega-sized city using satellite and in situ observation data

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The greenhouse gas observing satellite (GOSAT) has functioned normally for more than four years since its launch on 23 January 2009. Although its main purpose is the meas-urement of greenhouse gases globally to reduce the estimation error of source/sink strength in a sub-continental size region, it can measure gas concentrations at multiple targets on a regional scale during one orbital over-flight. We have initiated and con-ducted special observations to monitor CO2 concentrations at sufficiently numerous ob-servation sites and thereby cover all regions of a mega-sized city. The main sensor of the satellite, the ”thermal and near infrared sensor for carbon observation Fourier transform spectrometer (TANSO-FTS)”, has been operated in a ”specific operation mode” to measure CO2 concentrations at 4 x 4 (totally 16) mesh points over the Kanto Plain, the center of which is Tokyo. This specific observation covers about 100 km x 100 km of the plain. These satellite data are used as inputs as well as ground-based and aircraft observation (CONTRAIL) data for the inverse analysis of emission/sink strength of CO2. The AIST meso-scale transport model (AIST-MM), whose highest spatial resolution is 1 km is used for the inverse analysis. Boundary conditions in a large area outside the re-gional target are provided by the NICAM based transport model (NICAM-TM). The system detected a signal of reduction of CO2 emission from some industrial districts just after the Tohoku-Pacific Ocean Earthquake.

キーワード: 二酸化炭素, インバース解析, いぶき, メガシティー
Keywords: carbon dioxide, inverse analysis, GOSAT, mega-sized city

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An integrated approach to evaluate biodiversity and ecosystems conducted by GRENE (Green Network of Excellence) Environm

An integrated approach to evaluate biodiversity and ecosystems conducted by GRENE (Green Network of Excellence) Environm

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The global degradation of biodiversity and ecosystem has became a big concern since the last decade of 20th century. To tackle this problem, several activities including Convention on Biological Diversity (CBD) are now on-going. To carry out these activities, it needs to assess present status of biodiversity and ecosystem.

Biodiversity, ecological, climatological, and environmental data are required for developing indicators that are effective in assessing the states of biodiversity and ecosystems. However, most existing data are inaccessible or unavailable because they are either scattered among many databases or are unpublished. Therefore, our project aimed to collect metadata about biodiversity and ecosystems information at the first. We achieved progressive steps in sharing metadata through cooperation with Japan Long Term Ecological Research Network (JaLTER). JaLTER Metacat (http://db.cger.nies.go.jp/JaLTER/) provides information such as location, availability and format of ecological observation data in Japan. The next step was accumulation of biodiversity and ecosystems data based on the above metadata. We collected observational data from separate layers such as species distribution, community structure, ecosystem and flux. One of the main data sources at the species and community levels is the vegetation survey data conducted by The Ministry of the Environment in Japan. Using the output of this survey, the plant distribution database including 344,718 records for 4,160 species was developed. The data format of this species occurrence database was compliant with the Darwin Core standard (http://rs.tdwg.org/dwc/) in order to maximize reusability. The third step was a spatial interpolation of species and community distribution. Together with environmental data (such as climate, geography, soil type and land cover), we predicted potential species geographic distributions in a broad area using the ecological niche modeling method. These interpolated data for species and community distribution would be an indispensable infrastructure for mapping CO_2 flux, ecosystems function and so on. These mappings are the on going process in cooperation with JapanFlux (http://www.japanflux.org/) and AsiaFlux. (http://asiaflux.net/). We are planning to evaluate the state of biodiversity and ecosystems through integration of these predictions and environmental data stored in Data Integration and Analysis System (DIAS: http://www.editoria.u-tokyo.ac.jp/projects/dias/) for further steps.

キーワード: 生物多様性, 生態系, GRENE, DIAS
Keywords: biodiversity, ecosystem, GRENE, DIAS

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U02-10 会場:201B 時間:5 月 20 日 11:45-12:00

アジアモンスーン地域における気候変動とその農業への影響評価のための地球観測データ利用
Global Data Utilization for Climatic Changes and Evaluation of Their Effects on Agriculture in Asian Monsoon Region

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1. Introduction

It is important to predict climate change correctly in regional scale and to build adaptation measures and mitigation measures in the Asian monsoon region where more than 60 % of the world's population are living. The reliability of climate change prediction model is evaluated by the reproducibility of past climate in general. However, because there are many developing countries in the Asian monsoon region, adequate documentations of past climate which are needed to evaluate the climate reproducibility have not been prepared. In addition, at present it is difficult to get information on wide-area agricultural meteorological data which affect the growth of agricultural crops when considering the impact on agriculture of climate. This study has been proposed to increase the confidence in future climate prediction of Asian monsoon and to build an information infrastructure in order to develop mitigation measures and adaptation of agriculture to expected climate change.

2. Configuration and goal of the study

In this study, five research institutions which are responsible for climate change and agricultural impact researches, work closely for four sub-themes. (Figure 1)

FIGURE 1: An overview of this study (2011-2015)

2.1. Development of Agro-climatological Data-base in the Developing Countries

In developing countries of the Asian monsoon region, the publication of meteorological data is not sufficient. In addition, it is difficult to use wide-area data with the exception of some low-precision global data because the data is managed separately in each country. In this sub-theme, we will make a database of the paper-based data which were observed from the northeastern part of China to Southeast Asian countries in the Asian monsoon region.

2.2. Impact of Land-Use/Land-Cover (LULC) Changes on the Asian Monsoon Climate

In the Asian monsoon region, there is the Asia-specific surface state such as paddy. The land surface state is affected by climate change and controlled artificially at the same time. By comparing the output of multiple climate models that are generated on the DIAS and using the data of more ground surface, we will make clear the importance of land surface atmosphere interaction including the effects of anthropogenic Asian monsoon.

2.3. Climatic Changes and Evaluation of Their Effects on Agriculture Based on a Field Survey

We will build a simulation system that can grow in various conditions different cultivar, weather, and cultivation management. The system will have the flexibility that can replace the crops and crop model depending on the type and observation interval of observation data available. By giving the effects of climate change in this system, we will assess the impact of climate change to target crops. The researchers and agricultural extension will be able to browse the simulation results from anywhere using the Web application.

2.4. Development of Information Platform to Design Adaptation and Mitigation Strategies of Major Crops against the Predicted Climatic Changes

Rice is a main crop in the Asian monsoon region where is a zone of greenhouse gases such as methane in the agricultural sector. In order to construct future sustainable food production systems in the Asian monsoon region, it is necessary to consider the trade-off initiatives of mitigation and adaptation technology to global warming. In this sub-theme, we will implement the development of information infrastructure and integration related to agriculture meteorology, soil, land use, land management.

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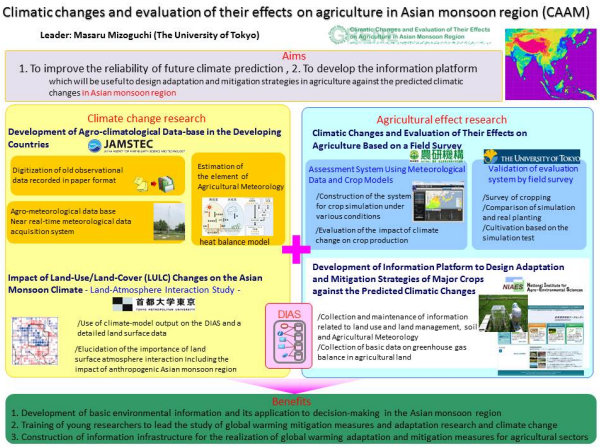
Green Network of Excellence - environmental information 2011, http://grene.jp/

キーワード: 気候変動, 農業, アジアモンスーン, 適応策, 地球観測データ
Keywords: Climatic changes, Agriculture, Asian monsoon, adaptation measures, Global data



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U02-11 会場:201B 時間:5 月 20 日 12:00-12:15

環境情報技術を用いたレジリエントな国土のデザイン
Designing Resilient Cities and National Land - An Application of Environment Information Technology -

林 良嗣 [1*], 加藤孝明 [2], 溝口常俊 [1], 鈴木康弘 [1], 谷川寛樹 [1], 佐藤愼司 [3], 柴崎亮介 [4], 加藤博和 [1], 川添善行 [2], 柴原尚希 [1], 福本雅之 [5]
Yoshitsugu Hayashi[1*], KATO, Takaaki[2], MIZOGUCHI, Tsunetoshi[1], SUZUKI, Yasuhiro[1], TANIKAWA, Hiroki[1], SATO, Shinji[3], SHIBASAKI, Ryosuke[4], KATO, Hirokazu[1], KAWAZOE, Yoshiyuki[2], SHIBAHARA, Naoki[1], FUKUMOTO, Masayuki[5]

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Objective:

This research project aims to construct a methodology to realize ”Resilient cities and national land” with mitigation and adaptation measures for vulnerability of national land and society. This ”resilient” concept is derived from an understanding of ”natural providence” as much as possible. Proposed system takes advantage of broad range information with disaster risk caused by meteorological phenomena and others from DIAS (Data Integration and Analysis System) by the Earth Observation Data Integration & Fusion Research Initiative (EDITORIA), the University of Tokyo. Therefore the system will be developed to ”Progressive Integrated Database” based on various environmental information infrastructure provided by DIAS. In addition, this project aims to cultivate experts who can construct and utilize this database in actual policy making fields.

To achieve this goal, re-design of national land and society for reduplicative system both normal and emergency situations are necessary. Both ”Safety and security” concept which takes account of damage reduction and ”Sustainability” concept which tackles low carbon, energy saving and prevention of climate change are restriction to keep pace threat of predicted huge earthquake and climate change.

Contents:

Natural violence caused by climate change, earthquake and other disasters may be increasing and strikes our vulnerable society with declining birth rate and a growing proportion of elderly people, population decline, urban sprawl and etc. in near future. Based on the common recognition on these problems, this research project sets out to construct a methodology to lead more safe, peace of mind and sustainable national land and society by using DIAS.

At this time, the system needs to use the data on natural and social situations. The data on natural situations include earthquake, climate and disasters. The data on social situation include population structure, economic condition, infrastructure and land use. Additionally, not only present data but also historical data, for example land use and infrastructure change, record of disasters, population structures and other information are collected. Therefore ”Four-dimension GIS” will be constructed to utilize quantitative prediction and to evaluate policies with considering historical facts, past place name and other qualitative information.

In consequence, analysis system will analyze vulnerability of national land and society caused by social, geographical and other conditions and natural variations and disaster risks. This system supports to examine various policies, especially, effectiveness of ”Smart shrink” which stop urban sprawl.

Results and future works:

1) Information archives

This project collected historical data on earthquake, tsunami and other natural disasters from old document and other resources. Especially, records of tsunami damages of the Great East Japan Earthquake are stored. Prototype WebGIS is developed to show these photos and tsunami height with map information.

2) Analyze and design

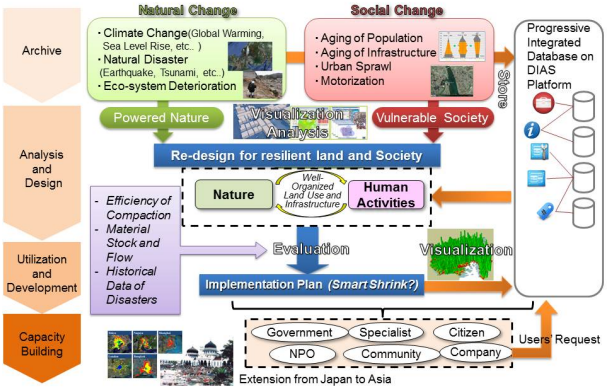
This project makes the evaluation system about vision of national land and city with a view of safety, security and sustainability. The system introduces ”QOL (Quality of Life)” indicators required data about accessibility, amenity and disaster vulnerability to calculate QOL indicators are collected and stocked to the system. This will be utilized to illustrate a condition of residential amenity and disaster vulnerability in each areas of national land.

3) Utilization and deployment

This evaluation system will be applied to case study cities for verifying its effectiveness. Therefore, the problems and demands

of system will be clarified. As a result, the system and database will be developed to accommodate a request from policy planning with city and natural land.

キーワード: レジリエンス, 国土・都市計画, 環境, 安心安全性, 持続可能性
Keywords: resilience, land and city plannning, environment, safety and security, sustainability



Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)

U02-12 会場:201B 時間:5 月 20 日 12:15-12:30

GRENE Ecohealth ー気候変動・社会変動と人の健康
Grene Ecohealth - climate change, social change and human health

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Chiho Watanabe[1*]

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Among various impacts of climate change, impacts on human health are felt directly by ourselves. While the description in the IPCC chapter emphasizes global aspect of the impact, actual human impacts will vary with the ecological and social settings of the locality/population of concern and show complicated nature. Thus, human population health will be dependent on physical/chemical environment, ecosystem health, and social environment. In addition, the ability of human population to build and/or choose such complex combination of environment exerts substantial effects on the health consequences of given change in physico-chemical environment.

In this presentation, several problems in connecting environmental information and health-related events, which should be affected by many factors as described above, will be discussed, and outline and achievement of the GRENEcoH project, a GRENE-Ecohealth project that is running under the GRENE-environmental information program, will be presented. In the GRENEcoH project, three sub-topics including (1) Health impact of heat and air pollution in urban area taking the daily commuting behavior of the inhabitants into consideration; (2) urban flood and the risk of infectious diseases in relation to the behavioral patterns of affected people; (3) climate change and infectious diseases associated with the land use (forest cover). Thus, each of the subtopics has some component of behavior (commuting, flood-behavior, or land use) that should modify/affect the final consequences of environmental events. All the subtopics focus on Asian developing areas, considering their importance in shaping global environment, their vulnerability to climate change, and their rapid change in the subsistence/life style. Each of these subtopics was chosen as global issues that are not global scale issues (like Climate Change) but rather local scale issues observed in many areas over the world. So far, the interim results suggest the importance of local factors in each of the sub-topics.

キーワード: 温度, 大気汚染, 都市洪水, 土地利用, ヒトの健康, 感染症
Keywords: temperature, air pollution, urban flood, land use, human health, infectious disease

Japan Geoscience Union Meeting 2013
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U02-13 会場:201B 時間:5 月 20 日 12:30-12:45

A high-resolution surface water electrical conductance monitoring network built on the citizen science model
A high-resolution surface water electrical conductance monitoring network built on the citizen science model

Mark Green[1*], Errin Volitis[1], Ashley Hyde[1]
Mark Green[1*], Errin Volitis[1], Ashley Hyde[1]

[1]Plymouth State University
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Flowing water is fundamental to human societies, providing water for consumption, transportation, ecological habitat, and many other ecosystem services. Thus, understanding water sources and dynamics of water quality in flowing water is vital to efficient management of the flowing water as a resource. Water electrical conductance can be an excellent tracer of water sources and surface water pollution. We are implementing a new flowing water sensing network in New Hampshire, U.S.A., focused on high temporal resolution water stage, temperature, and electrical conductance measurements at 100 sites. A novel aspect of this network is that it is built on the citizen science model: we are collaborating with a broad group of agencies, high school teachers, and ordinary citizens who collect data for this network. The collaborators are maintaining relatively inexpensive water sensors that log water dynamics at three to ten minute intervals; the collaborators then download and send us the data on a monthly basis. This approach allows us to collect a very large data set with a modest financial investment. The network is one-year-old and beginning to produce novel patterns of electrical conductance variability, demonstrating hydrologic differences between watersheds across New Hampshire. For example, water sensing during the remnants of Hurricane Sandy demonstrated that the level of watershed urbanization influences groundwater contributions to streamflow during large storm events. The growing data set from this sensing network is novel, the method of implementation is novel, and ultimately, we think the network represents the densest spatial and temporal resolution sensing of surface water electrical conductance built. We will discuss the data collection methods, the data structure, and how the data are being used to advance hydrologic science.

キーワード: water tracing, citizen science, electrical conductance, water temperature
Keywords: water tracing, citizen science, electrical conductance, water temperature

Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)

U02-14 会場:201B 時間:5 月 20 日 14:15-14:45

10 ペタバイト地球環境データベースとその系譜
10 Peta-byte Earth Environment Data Base and its History

喜連川 優 [1*]
Masaru Kitsuregawa[1*]

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ビッグデータなる言葉がＵＳホワイトハウスからの重点研究投資のアナウンス以降ホットな話題となりつつある。東大では、地球環境に関する統合的データベースを長年構築してきており、その容量は１０ペタバイトのシステムとなりつつある。ビッグデータにおける所謂４Ｖ (volume, velocity, variety, veracity) について、概説する。

キーワード: ビッグデータ, データベース, 地球環境
Keywords: Big Data, Data Base, Earth Environment

Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)

U02-15 会場:201B 時間:5 月 20 日 14:45-15:03

DIAS システムにおける多様なメタデータの登録，検索機能について
On registration and retrieval of heterogeneous metadata in DIAS system

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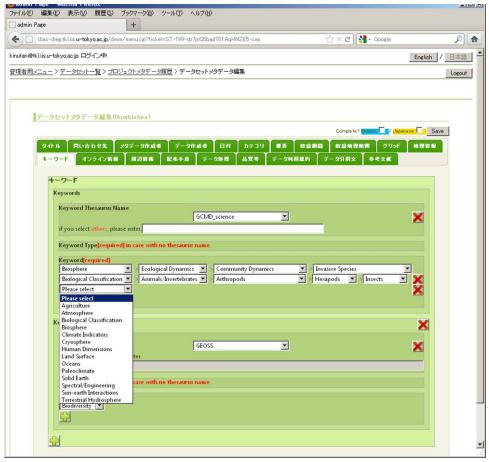
In DIAS system, a wide variety of metadata is collected, and some of them are registered semi-automatically. In this presentation, we will discuss how large number of heterogeneous metadata is registered and retrieved in DIAS system.

キーワード: メタデータ, データ統合, データ検索
Keywords: metadata, data registration, data retrieval



Japan Geoscience Union Meeting 2013
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U02-16 会場:201B 時間:5 月 20 日 15:03-15:21

Implementation of 4th Paradigm and Beyond
Implementation of 4th Paradigm and Beyond

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[1]The Graduate School of Project Design, [2]Tokyo University of Science, [3]Toyo Unuversity, [4]National Institute of Genetics

Total quality control(TQC) of data has been one of most challenging subjects for the data era. TQC of such engineering products as automobiles, trains and aircrafts have been established by big industries after requirements of serious customers. TQC of most original papers have been managed systematically by big publishers and/or voluntary peer reviewers. For the latter two cases, there are stakeholders who elaborate the complicated systems with economical incentives. However the key issue of the 4th Paradigm:

Data Intensive Science, namely TQC of data, has not been established yet, so that a strategic plan for the 4th Paradigm concerns this issue. How to overcome this issue and how to go beyond will be discussed in the presentation.

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U02-17 会場:201B 時間:5 月 20 日 15:21-15:39

Identifiers for academic activities: people, publication and data
Identifiers for academic activities: people, publication and data

武田 英明 [1*]
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Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)

U02-18 会場:201B 時間:5 月 20 日 15:39-16:00

ScienceBook: A Knowledge Network
ScienceBook: A Knowledge Network

Hugo Wim[1*]
Wim Hugo[1*]

[1]SAEON Chief Data and Information Officer and WDS-SC Member
[1]SAEON Chief Data and Information Officer and WDS-SC Member

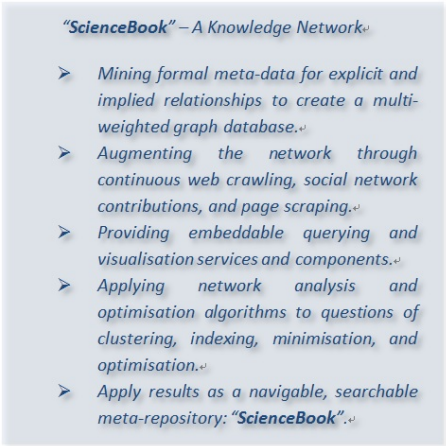
Worldwide standardisation, and interoperability initiatives such as GBIF, Open Access and GEOSS (to name but three of many) have led to the emergence of interlinked and overlapping meta-data repositories containing, potentially, tens of millions of entries collectively. This forms the backbone of an emerging global scientific data infrastructure that is both driven by changes in the way we work, and opens up new possibilities in management, research, and collaboration.

Several initiatives are concentrated on building a generalised, shared, easily available, and indefinitely preserved scientific data infrastructure to aid future scientific work ? with WDS as one of these.

This paper deals with the parallel aspect of the meta-data that will be used to support a global 'Knowledge Network'. There are obvious practical issues (semantic interoperability and speed of discovery amongst others), but we are here more concerned with some of the less obvious conceptual questions and opportunities:

1. Can we use meta-data to assess, identify, and reduce duplication of meta-data?
2. Can we use it to reduce overlaps of mandates in data portals, research collaborations, and networks?
3. What possibilities exist for mining the relationships that exist implicitly in very large meta-data collections?
4. Is it possible to define an explicit 'scientific data infrastructure' as a complex, multi-relational graph database, that can become self-maintaining and self-organising in true Web 2.0 and 'social networking' fashion?

The paper provides a blueprint for an approach to massive meta-data collections, its encoding, and how this can be processed using established analysis techniques to answer the questions posed. It assesses the practical implications of working with standard meta-data in a data mining context, and makes recommendations in respect of extension to support self-organising, semantically oriented 'networks of networks'. It concludes with the efforts underway by the Scientific Committee of the World Data System to implement such a Knowledge Network in support of its membership and stakeholders.



Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)

U02-19 会場:201B 時間:5 月 20 日 16:15-16:30

天文学におけるデータ共有と利活用
Data Sharing and Utilization in Astronomy

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The rapid development of semiconductor technology has lead to large sensitive detectors that enabled astronomers to easily survey large sky areas. Such large-scale observations and surveys cover a wide range of scientific themes in astronomy. Astronomers need to be well-prepared for such a new era of astronomical research utilizing large amounts of data. Since the data production rate will be 100 to 1000 times larger than the past, advanced data analyses combined with statistics and data mining will be essential to derive general “rules” and/or “knowledge” on various phenomena in the Universe, as the data volumes will make human inspection and analysis of the data impossible. The most important and exciting astronomical discoveries of the coming decade will rely on research and development in data science disciplines that enable rapid information extraction, knowledge discovery, and others, combined with sophisticated data management, access, visualization and other technical advancement.

キーワード: データ活用型天文学, データ管理, ヴァーチャル天文台, 統計的データ解析, 知識発見
Keywords: Data Intensive Astronomy, Data Management, Virtual Observatory, Statistical Data Analysis, Knowledge Discovery

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U02-20 会場:201B 時間:5 月 20 日 16:30-16:45

IAG における 2 つの測地事業（ILRS と IVS）の枠組みと日本の関わり
International Cooperation within IAG's Geodetic Services ILRS and IVS and the Japanese Contribution

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Toshimichi Otsubo[1*], Shinobu Kurihara[2], NOLL, Carey E.[3], BEHREND, Dirk[3]

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宇宙測地技術は、グローバルスケールと高い精度の観点で、その可能性が劇的に広がっている。それらの技術にとって、観測データが全地球的に均等に分布していることが必須である。本発表では、国際レーザ測距事業（ILRS）と国際 VLBI 事業（IVS）という 2 つの国際組織に着目する。

SLR/LLR は、地上局と衛星または月との間の絶対距離を測定する。地上局ネットワークは、大型の光学望遠鏡とレーザ測距システムを備えた数十の測地観測点からなる。たくさんのさまざまな衛星と月には地上局から発射されるレーザパルスを地上局へ戻すためのレトロリフレクタが搭載されている。

一方、VLBI は、クウェーサからの微弱な電波を受信する。地上局ネットワークは、大型の電波望遠鏡、原子時計、超高速データ記録装置を備えた数十の測地観測点からなる。複数の地上局で記録された同一の天体からの信号、これは一日で何テラバイトにも及ぶが、これを一か所に持ち寄って後段の相関処理によって電波の到達時刻差を精密に測定する。

日本は、早い時期からその開発と測地技術の運用に関与し、しばしば主要な技術においてリードしている。一部には、その地理学的側面のせいか、日本はその観測局の位置、技術開発、個人的貢献の観点で比類なく国際コミュニティに貢献している。

Japan Geoscience Union Meeting 2013
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U02-21 会場:201B 時間:5 月 20 日 16:45-17:00

超高層大気長期変動の全球地上ネットワーク観測・研究
Inter-university Upper atmosphere Global Observation NETwork (IUGONET)

谷田貝 亜紀代 [1*], 小原 隆博 [2], 中村 卓司 [3], 荻野 竜樹 [4], 津田 敏隆 [1], 家森 俊彦 [5], 柴田 一成 [6], 湯元 清文 [7]
Akiyo Yatagai[1*], Takahiro Obara[2], Takuji Nakamura[3], Tatsuki Ogino[4], Toshitaka Tsuda[1], Toshihiko Iyemori[5], Kazunari Shibata[6], Kiyohumi Yumoto[7]

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[1]Research Institute of Sustainable Humanosphere, Kyoto University, [2]Planetary Plasma and Atmospheric Research Center, Tohoku University, [3]National Institute of Polar Research, [4]Solar-Terrestrial Environment Laboratory, Nagoya University, [5]World Data Center for Geomagnetism, Kyoto University, [6]Kwasan and Hida Observatories, Kyoto University, [7]International Center for Space Weather Science and Education, Kyushu University

IUGONET is a joint project aiming at establishment of a data exchange system for the Earth's upper atmosphere observations including the mesosphere, thermosphere, ionosphere and magnetosphere. It was started in 2009 as a 6-year project by the five Japanese universities and institutes that have been leading ground-based observations of the upper atmosphere for decades.

In order to investigate the mechanism of long-term variations in the upper atmosphere, we need to combine various types of in-situ observations and to accelerate data exchange. To achieve this, we have built a metadata database (MDB), have been archiving data by means of a global network of radars, magnetometers, optical sensors, helioscopes, etc, and have been producing software to help researchers easily download, visualize, and analyze data provided from the member institutions and cooperative organizations/persons.
Keywords: Climate and Weather of the Sun-Earth System (CAWSES), Metadata, Database, Upper atmosphere, Solar-Terrestrial Environment

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U02-22 会場:201B 時間:5 月 20 日 17:00-17:15

NICT サイエンスクラウドによるビッグデータ処理
Toward Big Data Sciences: A challenge of NICT Science Cloud

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Ken T. Murata[1*], Hidenobu Watanabe[1]

[1] 情報通信研究機構
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During these 50 years, along with appearance and development of high-performance computers (and super-computers), numerical simulation is considered to be a third methodology for science, following theoretical (first) and experimental and/or observational (second) approaches. The variety of data yielded by the second approaches has been getting more and more. It is due to the progress of technologies of experiments and observations. The amount of the data generated by the third methodologies has been getting larger and larger. It is because of tremendous development and programming techniques of super computers.

Most of the data files created by both experiments/observations and numerical simulations are saved in digital formats and analyzed on computers. The researchers (domain experts) are interested in not only how to make experiments and/or observations or perform numerical simulations, but what information (new findings) to extract from the data. However, data does not usually tell anything about the science; sciences are implicitly hidden in the data. Researchers have to extract information to find new sciences from the data files. This is a basic concept of data intensive (data oriented) science for Big Data.

As the scales of experiments and/or observations and numerical simulations get larger, new techniques and facilities are required to extract information from a large amount of data files. The technique is called as informatics as a fourth methodology for new sciences.

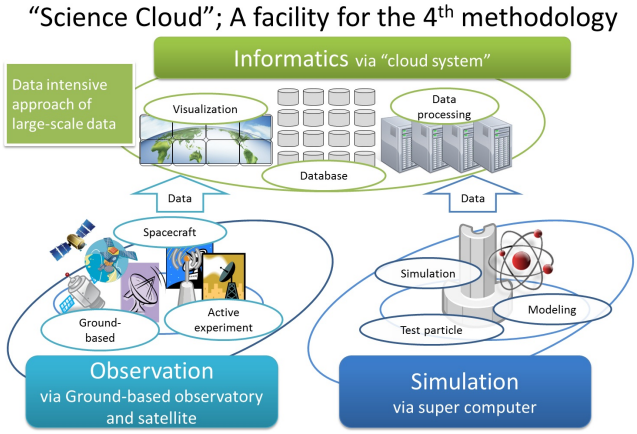
Any methodologies must work on their facilities: for example, space environment are observed via spacecraft and numerical simulations are performed on super-computers, respectively in space science. The facility of the informatics, which deals with large-scale data, is a computational cloud system for science.

This paper is to propose a cloud system for informatics, which has been developed at NICT (National Institute of Information and Communications Technology), Japan. The NICT science cloud, we named as OneSpaceNet (OSN), is the first open cloud system for scientists who are going to carry out their informatics for their own science.

The science cloud is not for simple uses. Many functions are expected to the science cloud; such as data standardization, data collection and crawling, large and distributed data storage system, security and reliability, database and meta-database, data stewardship, long-term data preservation, data rescue and preservation, data mining, parallel processing, data publication and provision, semantic web, 3D and 4D visualization, out-reach and in-reach, and capacity buildings.

Figure is a schematic picture of the NICT science cloud. Both types of data from observation and simulation are stored in the storage system in the science cloud. It should be noted that there are two types of data in observation. One is from archive site out of the cloud: this is a data to be downloaded through the Internet to the cloud. The other one is data from the equipment directly connected to the science cloud. They are often called as sensor clouds.

In the present talk, we first introduce the NICT science cloud. We next demonstrate the efficiency of the science cloud, showing several scientific results which we achieved with this cloud system. Through the discussions and demonstrations, the potential performance of sciences cloud will be revealed for any research fields.



Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)

U02-23 会場:201B 時間:5 月 20 日 17:15-17:30

JAXA 衛星地球観測データアーカイブ
JAXA's space-based earth observation data archives

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Toru Fukuda[1*]

[1] 宇宙航空研究開発機構地球観測研究センター
[1]Earth Observation Research Center, JAXA

JAXA's earth observation satellites play an important roll in providing essential information for water, food and health security. JAXA operates Greenhouse gas Observing SATellite (GOSAT), Tropical Rainfall Measurement Mission/Precipitation Radar (TRMM/PR), and Global Change Observation Mission-Water 1 (GCOM-W1). These satellites are collecting important information regarding carbon and water cycle. In addition to current ongoing missions, worldwide data users can access quantities of archived data of past missions including high-resolution data of Advanced Land Observing Satellite (ALOS) and water-related products of Advanced Microwave Scanning Radiometer-EOS (AMSR-E). JAXA will launch a series of new generation satellites to observe disaster, earth resources, climate change, water cycle, carbon cycle and global warming, such as ALOS-2/3, GCOM-Climate (C), Global Precipitation Measurement (GPM), Earth Cloud, Aerosol, and Radiation Explorer (EarthCARE) and GOSAT-2. All data obtained by the new satellites will also be archived and distributed. However, it is needed to provide useful information for decision makers and stakeholders in order to contribute to solving global and regional issues. To create such information, integration and fusion of satellite data, in situ data, numerical model outputs, and socio-economic data are essential. JAXA has started close collaboration with various players in various sectors.

Keywords: GCOM, ALOS, GPM, TRMM, GOSAT, EarthCARE

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U02-24 会場:201B 時間:5 月 20 日 17:30-17:45

DIAS のデータ分散型システム「CEOS 水ポータル」について
CEOS Water Portal, one of the DIAS distributed data sytems

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CEOS 水ポータルは DIAS のデータ分散型システムの一つであり、自身ではデータを所持せず、ユーザ要求に従いデータセンターからのデータ取得・切り出しを行い、ユーザがデータをダウンロードしたり画像として確認することを可能とするシステムである。
システム本体は東京にあるが、データは東京 (衛星データ)、米国（地上観測データ)、ドイツ（モデルデータ）等のデータセンターに分散している。
本システムは、ユーザを実務者（河川管理者等）にまで広げ、以下の例のように研究者と実務者間のコミュニケーション促進の一助となることを目指している。
(1) 研究者がモデル計算のためのデータを本ポータルから取得
(2) 研究者がモデル計算を実施
(3) 研究者が解析結果をユースケースとしてシステムに登録
(4) 実務者が本システムにアクセスしてユースケースを参照

本システムは http://waterportal.ceos.org/にてアクセス可能である。

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地球環境情報統融合プログラム（DIAS-P）：運用体制の設計・提案
Data Integration and Analysis System Program (DIAS-P): Design and Proposal of an Operational DIAS

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DIAS（データ統合・解析システム、Data Integration and Analysis）は、様々な分野の利用者（ステークホルダー）が協働して地球観測データ、気候変動予測データ、社会・経済データ等、超大容量で多様なデータ・情報を利活用し、資源管理、生物多様性、自然災害など、地球環境に関わる社会的課題に対し、適応策やレジリアントな社会形成に向けた情報を提供し、新たな科学知や公共的利益を創出する。それによって新たなイノベーションや社会の成長を牽引する社会インフラとなることを目指している。

2011 年度より DIAS 第　期計画として「地球環境情報統融合プログラム」(DIAS-P) が開始されており、その課題の一つとして、上記目的の実現に必要な科学的先端性を持続的に発揮し、実利用によって公共的利益を実現できる運用体制（実運用 DIAS）について、海洋研究開発機構が中心となって、東京大学 EDITORIA、宇宙航空研究開発機構および国立環境研究所との協力の下で設計し、文部科学省に提案することとしている。その設計作業のベースとして、実運用 DIAS が果たすべき役割を示す暫定的なレファレンスモデルを設定した。この概要は以下の通りである。このレファレンスモデルに示されたようなインフラや体制は実現すれば世界初のものとなろう。このレファレンスモデルは、関係者のニーズを反映しつつ、設計作業の進捗に伴って毎年度見直される。

DIAS は、さまざまな地球観測データのほか、実利用化ワークベンチ（各分野のステークホルダーの協働のもと、多様なデータ・情報を統融合し、公共的利益を創出するための情報基盤）および機能向上パートナーシップ（DIAS の機能を持続的に向上するとともに新たな科学知を創出するための協働組織）を通じて得られるデータ（分野特有の観測データ、社会・経済データ、農・水産業活動に係るデータ、土地利用・土地被覆データ、道路・港湾などの交通ネットワークデータ、地形データ、災害発生データ、その他）を提供し流通させる統合ポータルとして、これらのメタデータを統合的に管理・公開する。アーカイブ自体が研究成果として認知されるような状況をいかにして創り出すかも今後の検討課題となる。

DIAS のコアインフラは、データをアーカイブするための大容量ストレージおよびデータを解析・統融合するための解析空間や解析ツールからなる。いずれも大規模データを取り扱えるものとする。

DIAS は、防災、資源管理などの政策決定者（国内および途上国）を主たるユーザーとして想定するが、DIAS の統融合データや解析機能を実際に主として使用するのは、施策担当者（decision maker）に判断材料を提供する研究者（科学コミュニティ）や、実利用化ワークベンチにおいて協働する関係者とする。また、DIAS データポータルへのアクセスを通じて、エンドユーザー、市民活動グループ、民間サービスその他もユーザーとして想定する。

実利用化ワークベンチでは、ニーズによって、必要な気候・気象・海洋データの分解能が異なるので、ダウンスケーリングなどによって、求められるデータを作成する。公開が制限されているデータの利用を実利用化ワークベンチのドメイン研究者等が希望する場合は、そのための許認可手続きも実運用 DIAS が支援・代行し、さらには「こんなデータを探してもらいたい」という要望にも対応する。

実利用化ワークベンチは、エンドユーザーのニーズを把握した上で、継続的にプロトタイピングを行うとともに、成功事例の経験・ノウハウを積み重ねつつ段階的に対象範囲を拡大する。実利用化ワークベンチのプロトタイピング段階においては各利用分野の研究者、関係府省、自治体等と協働して有用な政策ツールを開発する。さらに、DIAS は開発済みワークベンチの社会実装を支援し、他分野に展開するための普及・広報も行う。

キーワード: DIAS, 地球環境情報統融合プログラム, 実運用, データセントリック
Keywords: DIAS, Data Integration and Analysis System Program, operational, data-centric