Japan Geoscience Union Meeting 2015
(May 24th - 28th at Makuhari, Chiba, Japan)

MGI37-01 Room:203 Time:May 27 15:15-15:30

Study on the upper atmosphere by the IUGONET project

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Upper atmosphere is characterized by the following properties: (1) It is necessary to consider both vertical couplings between the multiple spheres such as the magnetosphere, ionosphere, and neutral atmosphere, and global horizontal circulation. (2) There are many kinds of physical quantities to be measured. (3) The long-term data analysis is required. The IUGONET (Inter-university Upper atmosphere Global Observation NETwork) project was established in FY2009 as a six-year research project to investigate the mechanism of the long-term variation in the upper atmosphere. We have developed metadata database for cross-searching various kinds of ground-based observational data of the upper atmosphere obtained by the IUGONET members (i.e., National Institute of Polar Research, Tohoku University, Nagoya University, Kyoto University, and Kyushu University) and analysis software for visualizing and analyzing these data. More than 10 million metadata have been registered to our metadata database and can be used for the cross-search. We adopted SPASE (Space Physics Archive Search and Extract) metadata model as a basis of the IUGONET metadata format, which is used for describing the elements of the space and solar physics, so it is easy to add the satellite data to our database in the future. The IUGONET data analysis software is based on SPEDAS (Space Environment Data Analysis Software). The SPEDAS is a set of routines written in IDL (Interactive Data Language) to visualize and analyze data obtained by many satellites, e.g., ACE, WIND, GOES, THEMIS, and Van Allen Probes, and various ground-based observational data. A plug-in software for SPEDAS developed by the IUGONET enables users to deal with the upper atmosphere data provided by the IUGONET members on the SPEDAS. In the presentation, we will introduce some research results from the IUGONET project and discuss the issues in data analysis of the upper atmosphere.

Keywords: IUGONET, upper atmosphere, metadata database, data analysis software, long-term data, interdisciplinary study

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MGI37-02 Room:203 Time:May 27 15:30-15:45

Overview of ionospheric total electron content (TEC) derivation system using dense GNSS receiver networks

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We are developing a database of ionospheric total electron content (TEC) using dense GNSS receiver networks on the NICT Science Cloud system. We have automatically collected more than 7000 ground-based GNSS receivers' data in the world, and converted into two-dimensional TEC maps. High-resolution TEC maps are available in Japan, North America, and Europe, where GNSS receivers are densely deployed. These TEC maps and global TEC maps are available through the web site, http://seg-web.nict.go.jp/GPS/DRAWING-TEC. These high-resolution TEC maps make it possible to get a full view of 100-1000 kmscale ionospheric disturbances.

TEC maps over Japan are made using more than 1200 GNSS receivers' data. The database consists of two versions, that is, quasi real-time and final versions. The quasi real-time and final versions provide TEC maps with a time lag of less than four hours and four days, respectively. Now we are developing a real-time version, which can provide TEC data with a time lag of less than one minute. Moreover, we also develop TEC models to forecast TEC in Japan using Artificial Neural Network (ANN). The input parameters of ANN are proxies of the season, the solar activity, the solar wind activity, and the geomagnetic activity. For the learning process, we used absolute TEC data for about 20 years. Using the constructed ANN model, we achieved one-day TEC prediction over Japan.

Keywords: GNSS observation, the ionosphere, prediction model, total electron content, realtime monitoring

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MGI37-03 Room:203 Time:May 27 15:45-16:00

MAGDAS project and its new policy for data sharing

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International Center for Space Weather Science and Education (ICSWSE), Kyushu University was established in 2012 mainly for the purpose of conducting research and education in space weather and related fields. Our major data collection effort is well known as the ”MAGDAS (MAGnetic Data Acquisition System)/CPMN (Circum-pan Pacific Magnetometer Network) Project” (Principal Investigator: Dr. A. Yoshikawa). Currently, 74 MAGDAS magnetometers and 3 FM-CW (Frequency Modulated Continuous Wave) radars have been installed all over the world. Each MAGDAS instrument sends observational data to ICSWSE in near real-time via the Internet.

We at ICSWSE use MAGDAS data for space weather research and for other applications, for example space weather nowcasting and forecasting. In addition, we also use MAGDAS data for capacity building of host institutes. We organize some conferences called ”MAGDAS School” in many parts of the world. In this school, we teach how to use the instrument, data, and scientific applications based on geomagnetism.

It is also important that any user can easily get detailed information and data related to MAGDAS. For the information of MAGDAS, we provide various MAGDAS information via our website. In addition, we provide the MAGDAS information via optimized metadata database system and also via analysis software developed by IUGONET (Inter-university Upper Atmosphere Observation NETwork). However, until recently, we placed strong restrictions for data sharing, for example, requiring general users to fill the ”data usage agreement form” before they can receive the data they requested.

We think that our old rules are suitable for the MAGDAS/CPMN project, but on the other hand, we know that there are some points desirable to be modified from the perspective of users. So, we are updating our policy for data release and citation to accelerate data usage of MAGDAS/CPMN, and to provide benefits to both data providers and users. At the beginning, we opened MAGDAS data (since 2005) to public via Internet. In this paper, we will introduce the MAGDAS project and its new policy for data sharing.

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MGI37-04 Room:203 Time:May 27 16:15-16:30

Development and operation of real-time earth observation data archiving and processing system on DIAS

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Data Integration and Analysis System (DIAS) was launched in 2006 as part of the Earth Observation and Ocean Exploration System, which is one of five National Key Technologies defined by the 3rd Basic Program for Science and Technology of Japan. DIAS is operated as a system to coordinate the cutting-edge information science and technology and the various research fields addressing the earth environment, to construct data infrastructure that can integrate earth observation data, numerical model outputs, and socio-economic data effectively, to create knowledge enabling us to solve the earth environment problems, and to generate socio-economic benefits.

On DIAS, we are developing and operating real-time or quasi-real-time data archiving processing system using variety of characteristic technical approach, which is different from usual earth observation data archiving system because of the characteristic feature of data.

First, as a feature of real-time earth observation data, it is quite difficult to re-acquire those data in case we fail to acquire at the appropriate timing.For example, GPV(Grid Point Value) data which is generated by Meteorological Agency in Japan and provided by Japan Meteorological Business Support Center is stored only the latest one week data because of the amount of data volume. After a period of time the data is holded, the acquisition of those data become no longer very difficult to acquire.Further, in the case of a system which can provide real-time live camera images, we cannot acquire any historical data after the next data is obtained because the image data archived at provider is overwritten every acquisition time.As the reason of failure factors of such acquisition, trouble of acquisition system program, stopping associated with routine maintenance, trouble of the system of data provider, network factor and etc. are considered, sufficient countermeasures are required to acquire data certainly within a predetermined period of time.

Secondly, because many of real-time data are periodically observed or generated, and continuously provided new data, our system must terminate all kind of processes within the delivery interval.This is not considered so much about the system of archiving general earth observation data, it is necessary to develop a processing system which is considered deeply about the limitation of delivery interval, when we start to archive and start a service for providing a data acquired regularly.In addition, it is assumed that it is possible to get late acquisition fails for some reason as described above, consider the mechanism to recover the delay is also required.

The third point is to manage the information of consistency of data, missing of data.In the archive of earth observation data, data is considered to be lacking in the various factors of creating side, providing side, middle path of transfer, and acquisition side, which is not limited in the case of real-time data.

In a fourth aspect, when performing the cooperation with an application that processes real-time data in real time, there is a point that must be considered, including the treatment protocol for data to be delivered, especially delayed.Generally, because applications with real-time data in real-time require the immediate results in most cases, including the variations of acquisition time of each area and synchronization of the data and application describes above, development of processing policy is very important.

In this paper, we introduce our real-time earth observation data archiving and processing system on DIAS with some specific examples, considering these points describes above.

Keywords: Earth observation data, Real-time data, Data archive, Big data, User interface

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MGI37-05 Room:203 Time:May 27 16:30-16:45

Recent activity of DOI-minting to database by WDCs in Japan

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Recent electronic journals are published with DOI (digital object identifier) such as doi:10.1029/2012SW000785. DOI is a persistent name that is resolved into URL, where readers can obtain digital objects of the journal articles; for example, abstract, figures, and pdf files. The DOI system was launched around 2000 and becomes popular these days so that DOI is ordinarily indicated in references and citations.

The next development of the DOI system is to extend it to database. It makes possible for researchers to cite the data used in a scientific publication, which is called ”data citation”. Data citation provides the following benefits:

• Readers can more easily locate the data used in the paper, obtain necessary information of the data (i.e., metadata), and validate the findings of the paper.

• Readers can also easily discover datasets which are relevant to their interests but has not been noticed.

• Data contributors can gain professional recognition and rewards for their published data in the same way as for traditional publications.

• Data centers can measure the impact of individual datasets and receive proper credit of their work.

Recognizing the importance of data citation, World Data Centers (WDCs) in Japan including WDC for Aurora (National Institute of Polar Research), WDC for Geomagnetism (Kyoto University), WDC for Ionosphere and Space Weather (National Institute of Information and Communications Technology), and WDC for Space Science Satellites (Japan Aerospace Exploration Agency) started discussion to mint DOI to their own database in August 2013. The discussion finds that Japan Link Center (JaLC) is a proper agency to register DOI-URL mapping, because JaLC aims at public information services to promote science and technology in Japan and it handles scientific and academic metadata and content from holders nationwide, including national institutes, universities. Two representatives of the above 4 WDCs work closely with JaLC to define a registration scheme to implement the DOI-URL mapping. We also develop a web-based system to register metadata with JaLC and to create landing pages of database. JaLC starts a pilot program to mint DOI to the database from January 2015, in which we participate. In this talk we will show results of the pilot program and future perspective for DOI-minting to the WDC database in Japan.

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MGI37-06 Room:203 Time:May 27 16:45-17:00

Data Activities of ICSU-WDS for Earth and Planetary Sciences

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ICSU World Data System (ICSU-WDS) was established in 2008 mainly on the legacy of World Data Center (WDC) which was established by ICSU in the IGY era (1957-58). WDS has about 90 members (data centers, data networks, etc.) in this stage, and more than 30 members are contributing to the scientific community of Earth and planetary sciences. Since this community is essentially interdisciplinary one, its contribution to the WDS will be very important. The SCOSTEP-WDS joint workshop on ”Global Data Activities for the Study of Solar-Terrestrial Variability”, to be held in Japan (28-30 Sep. 2015), will be a remarkable opportunity to demonstrate data-oriented activities in Japan to WDS and SCOSTEP communities. Details will be posted on http://isds.nict.go.jp/scostep-wds.2015.org/.

Keywords: ICSU-WDS, SCOSTEP, Data management

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MGI37-07 Room:203 Time:May 27 17:00-17:15

Database construction and application to spatial modeling of metal contents using the resource survey materials in Japan

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Much metal mines had been operated in Japan, and investigations to estimate metal resources abundance and their concentrations were performed in the metal deposits areas. However, most these results are not utilized at present because they have been paper-based non-digital data without unified data formats. It is important to utilize such information and knowledge accumulated in the past, because these data-set becomes available for analyses of traditional statistics and spatial modeling by arranging and being digitized. From the results of analyses of the data-set, acquisition of novel knowledge about the origin and the generation mechanism of a metal mine is expected. This knowledge can be used for the exploration of metal deposits of other countries. In addition, they are also useful for the inspection and validation of other studies.

Investigation reports by JOGMEC, the regional investigations of 54 districts from Kyushu to Hokkaido, the detailed investigations in 34 districts, the potential assessment investigations of the rare metal resources of 9 districts, and the fundamental geological investigations of gold mine of 3 districts, were used for constructing a database. These investigations had been carried out from 1966 through 2002. The coordinate of each borehole, geologic column, and main metal contents were selected from these reports. The errors of the coordinates of the data described in the reports were corrected by comparing the original data with landmarks and topography using digitalized images.

Basic statistical analyses, a deposit type and metal content, metal type and the correlation with the depth, were carried out using the constructed database. It was revealed that Cu and Sn, Sn and Zn, Pb and Zn, and Ag and Pb were strongly correlated, because of existence of kuroko-type deposits and hydrothermal deposits. Spatial distribution models of the metal contents were constructed by original kriging, co-kriging, and sequential Gaussian simulation for several areas such as the Bantan area (west Kinki) and the Noya area (middle Kyushu). In addition, to clarify the formation and development process of the deposits, 3D geological models were constructed using category data extracted from the geologic columns by the borehole investigation, geological cross-sections, and digitized images of the fault traces. By integrating these spatial models, it was clarified that highly-concentrated zones of Cu were divided into by two faults in the Bantan area. In the Noya area, an andesite layer was found to divide highly-concentrated zones of the Ag and Au into two parts at different depths. Our next step is to construct a more advanced database and combine it with various software for comprehensive GIS and 3D modeling.

Keywords: Borehole investigation data, Geostatistics, Metal deposit, Mineralogy, Statistical analysis, 3D spatial modeling

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MGI37-08 Room:203 Time:May 27 17:15-17:30

Constructing applied Database System of Early Earthquake Warning information

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To make Earthquake Early Warning (EEW) more valuable, evaluation and verification of information are essential, as we all know. However, there is not any easy-to-use EEW dataset of alerted information up to now. We studied data structure of EEW information and constructed a new dataset suitable for evaluation, to accelerate EEW improvement process.

The EEW information has features such as:
○ one earthquake makes multiple (and variable) EEW informations
○ each data size of information is variable
○ data itself has a layer structure
Such features indicate that the table structure (or ”conventional” Relational Database System) is not suitable to contain EEW information.

Emphasizing on simplicity, we chose to use JSON to write down our data format, and to utilize MongoDB to contain them. Our compilation resulted in 14.8MB data from EEW information of 7124 earthquakes from Oct. 2009 to Feb. 2014.

Keywords: Earthquake Early Warning, database, JSON, NoSQL, MongoDB

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MGI37-09 Room:203 Time:May 27 17:30-17:45

Database development for understanding the wet deposition processes after the Fukushima nuclear power plant accident

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This presentation reports datasets of precipitation and other meteorological information being developed for understanding the dispersion and deposition process of radionuclides associated with the Fukushima accident in March 2011. Original data includes X-band radar data from Fukushima University and the three-dimensional data of the Japan Meteorological Agency C-band radar network. Quantitative estimates of precipitation and rain/snow judgment based on the method of APHRODITE are also included.

A metadata-database on the meteorological observations associated with the Fukushima issue is under construction by this Fukushima-IRIS project (http://firis.stelab.nagoya-u.ac.jp), in which metadata connected with various atmospheric in-situ observations and radars over Japan are being archived.

Among the various meteorological data, meteorological radar (C-band and X-band) data is useful to understand the three dimensional structure of precipitation, although handling process is not always easy for non-meteorological researchers. Hence, we put graphic files of three dimensional radar pattern to the NICT STARStouch system (http://sc-web.nict.go.jp/jma-radar/)

Keywords: Fukushima, Precipitation, Radar, Database, Graphics

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MGI37-10 Room:203 Time:May 28 09:00-09:15

Quasi real-time analysis of Solar radiation using 3rd generation HIMAWARI satellite with monitoring of Renewable Energy

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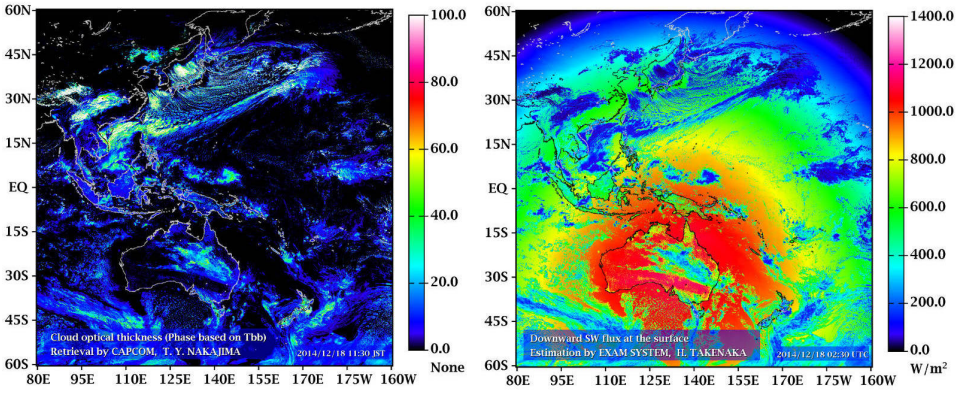
Clouds has strongly influence on the Earth's radiation budget and the climate. Clouds can cool the Earth by reflecting solar radiation but also maintain warmth by absorbing and emitting terrestrial radiation. Cloud activity is complex because its connect to water cycle, aerosols, and other climatic components with feedbacks. Therefor it is important to estimate the radiation budget and influence of cloud based on observations for better understanding of climate. Geostationary satellite is useful for estimate the radiation budget at the TOA and surface. It is suitable for observations of time dependent change of clouds and aerosols with high temporal resolution. Japanese geostationary satellite HIMAWARI-8 is launched on 2014 October 07. Advanced Himawari Imager (AHI) has sixteen channels that four visible channels, two near-infrared channels and ten thermal infrared channels. AHI will provides the detailed information of clouds and aerosols as the geostationary satellite observation of a new generation (10min wide area observation and 2.5min regional rapid scan).We develop high-speed algorithm for estimate the Solar radiation using HIMAWARI-8/AHI data. EXAM SYSTEM [Takenaka et. al.,2011] has been extended for HIMARARI-8/AHI. It will apply the detailed cloud optical properties by CAPCOM [Nakajima and Nakajima,1995; Kawamoto et. al.,2001]. High-speed algorithm allows a Quasi-real-time analysis of Solar radiation. Solar radiation is the only energy source on the earth's climate. As one of the basic parameters, it is widely used in many fields. Especially, the field of Renewable energy has a possibility of progress. We try to semi-real-time monitoring of Solar thermal and Photovoltaic power generation by Solar radiation analysis. It is new-innovative collaboration of Renewable energy and Climate study.

Keywords: HIMAWARI-8, Radiation budget, Quasi real-time analysis, Solar radiation, Photovoltaic power, Solar thermal



Sample products based on first light of HIMAWARI-8 (December,18)
Left: Cloud optical thickness, Right: Downward solar radiation at the surface

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MGI37-11 Room:203 Time:May 28 09:15-09:30

On the data handling for the international ground-based network (SKYNET) observing aerosols, clouds, and radiations

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SKYNET is an observation network dedicated for aerosol-cloud-radiation interaction researches. It was initiated under the WCRP/GAME project and expanded focusing on East Asia as the ADEOS/GLI validation activity. The primary objectives of SKYNET are 1) to quantitatively evaluate long-term variations of aerosols, clouds, and atmospheric radiation and 2) to understand their effects on climate through aerosol-cloud-radiation interaction. In addition, the validation for satellite observations (e.g., GOSAT, GOSAT-2, GCOM-C, EarthCARE, and Himawari-8) as well as climate model simulations and data assimilations are also within the scope of the SKYNET activity. To accomplish these objectives, SKYNET observes optical and microphysical properties of aerosols and clouds and atmospheric radiation in worldwide under close collaboration among national agencies, institutes, and universities. All sites of SKYNET are equipped with one or more sky radiometers as the main instrument. To strengthen the ability of the SKYNET, simultaneous measurements with other instruments such as pyranometer, pyrgeometer, microwave radiometer, absorption meter, cloud camera, lidar, and MAX-DOAS are also conducted for some selected sites. These various data measured at each site are collected by a local computer and then transferred via the Internet to Center for Environmental Remote Sensing (CEReS) of Chiba University and National Institute for Environmental Studies (NIES) in real time and processed automatically. In addition, since the data are stored in the local computer first, this system works as the open system that data can be processed and analyzed by the observer as well. As a result, a solid collaborative framework has been formed to improve analysis softwares and enhance data analysis by the community. Considering the potential expansion of SKYNET, for instance, for upcoming satellite validation activities, we desire improved instrument and data handling systems to better use limited human and pecuniary resources. Such discussions are made in this talk, along with some new findings obtained from recent SKYNET activities.

Keywords: SKYNET, ground-based observation, network, aerosol, cloud, radiation

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MGI37-12 Room:203 Time:May 28 09:30-09:45

Estimation of Photovoltaic Power Prediction Technology Using Unit Commitment Model

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Japanese Strategic Energy Plan, established in 2010 and renewed in 2014, shows the basic energy plan of Japan. According to the plan, about 120 GW of renewable energy would be installed, mainly consisting of 53 GW of photovoltaic (PV), 10 GW of wind energy, and 55.6 GW of hydropower generation (including 27.7 GW pumped storage hydro).

Renewable energy can contribute to reducing carbon dioxide emissions and advancing sustainable development. Since they are domestic energy resource, the installation of renewable energy can also improve our energy security. With the importance of the installation, the feed-in tariff scheme for renewable energy was introduced on 1 July 2012. Due to the high premier price (JPY 42/kWh for 10 years for small systems less than 10 kW and JPY 40/kWh for 20 years for larger systems in FY 2012), PV and wind energy systems has installed increasingly. Recently, the installation of 13GW of PV and 0.27 GW of wind energy were achieved by January 2014.

On the other hand, we must focus on the demerit of the installation of renewable energy, especially PV and wind energy whose generation depends on and varies with the condition of weather. Thereby, to introduce a large amount of renewable energy may make it difficult to have stable power system operation (e.g. the variability of PV and wind energy destabilize the frequency of power systems). We have to be careful to make sure that we anticipate what the future power system might be.

The development of PV and wind power prediction technology is very important issue to utilize variable renewable energy sources (v-RES), achieving the large scales penetration of the v-RES into power grid and providing high stable power system.

Under the situation where there is need for many researchers to try to develop the technology, various approaches (e.g. day-ahead forecasting using numerical weather prediction model, intraday forecasting based on statistics, and short-term forecasting using satellite data) have been done. Forecast improvement is generally evaluated by comparing to measured data and calculating the variability (e.g. the mean error (ME) and the root mean squared error (RMSE)). These statistics cannot accurately evaluate the effect of using prediction data on power system operation. The effect should be evaluated from the point of view of financial indicator (e.g. fuel cost, start-up cost, and operation and maintenance cost) and keeping the stability of power system operation (e.g. supply and demand balance, operating reserve which is referred to as load frequency control capacity, unserved energy, and, surplus and curtailment of v-RES). A unit commitment (dispatch simulation), which determine the least cost solution i.e. schedule of what generators need to be online i.e. start (generate power) to meet the expected (actual) demand, is performed by system operators on actual system operation. These model and simulation are appropriate tool to evaluate the impact of the prediction on power system operation. Our developed model optimize the schedules of the thermal power plants and the pumping systems to minimize the operational cost of power system. We estimated the relationship between forecast error, forecast accuracy, and operational cost using the model.

Keywords: Renewable Energy, Photovoltaics, Prediction Accuracy, Prediction Error, Power system, Supply-Demand Balance

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CEReS archived satellites related datasets and these applications

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Center for Environmental Remote Sensing (CEReS) was established in 1995 as a research institute for nationwide collaboration of the academic community of remote sensing. Since 2005, we have been re-constructed archiving and publishing environmental datasets system. In this presentation, we will introduce our archived and published satellites related datasets and products. In particular CEReS has most of geostationary meteorological satellites data, such as MTSAT, GOES-E, -W series and Meteosat series (Meteosat-IDOC, -MSG series) to cover globe with fine time resolution. We briefly introduce geostationary satellites gridded product and higher processed products and utilized applications (research results). 1). Shortwave radiation product EXAM, of which based on neural network system for faster-calculation, has been performed from MTSAT and other geostationary satellite dataset, we will explain brief explanation of EXAM output and future plan. 2). To improve the global precipitation product (GSMaP), now we are developing the potential precipitation map (PPM) based on the combination of several channels of geostationary satellites. PPM estimated by look-up-table (LUT) learned by true-observation of TRMM precipitation radar (PR), then PPM has a potential to improving the accuracy of precipitation areas without overpassing microwave imagers in GSMaP product (hourly 0.1 grid-box). Finally 3) Utilizing EXAM radiation product and satellites oriented precipitation products such as GSMaP, we re-analysis land surface meteo-hydrological status (hydro-reanalysis). As one of demonstration, we will introduce the Japan 1km resolution land process reanalysis project forced by EXAM and Radar-AMEDAS (perfect reanalysis) and impact of satellites forcing datasets.

Keywords: Geostationary Meteorological Satellites, data archive, data applications

Japan Geoscience Union Meeting 2015
(May 24th - 28th at Makuhari, Chiba, Japan)

MGI37-14 Room:203 Time:May 28 10:00-10:15

Implementation of the vessel navigation support system for sea ice area

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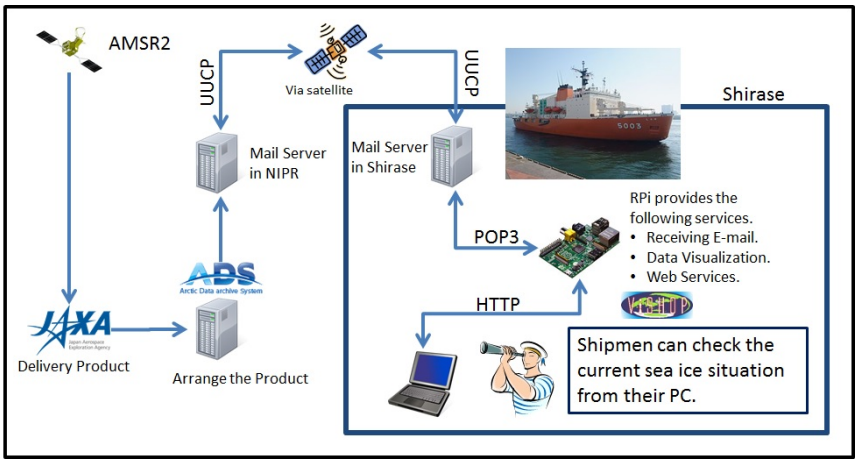
Understanding of sea ice situation is the most important issue for vesseles in the sea ice area. In particular, overviewed inforamtion of 1000 km scale is a good indication to determine a safe route. The remote sencing data of sea ice concentration by Earth observation satellites is required. However, limitted satelite telecommunication line on the vessel makes on-demand data delivery difficult. And more, if the compressed data would be sent via this line, a professional staff for decoding and visualizing the data must always be needed on the ship. In order to reduce these anxiety and burden, automatical system integrating these processes (delively, decoding, and visualizing data) is needed. ADS (Arctic Data archive System) is providing a quasi-real-time visualization service for satellite data at Polar region, and this service is called VISHOP (Visualization Service of Horizontal scale Observations at Polar region). In this research, we develop new automatical visualization system for the vessel by reconstructing VISHOP to a small board server. We want to introduce practicality and advantages of this new system.

Keywords: sea ice area, satellite data, automation, visualization, web server



Japan Geoscience Union Meeting 2015
(May 24th - 28th at Makuhari, Chiba, Japan)

MGI37-15 Room:203 Time:May 28 10:15-10:30

Application possibility of the JMA observations and forecasts data for an electric energy management system

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Many photovoltaic (PV) systems have been installed in Japan after an introduction of a feed-in-tariff in summer of 2012. For an electric energy management system (EMS) including many PV systems, a PV power generation forecast based on an engineering model with a grid point value of a mesoscale model (MSM-GPV) from the Japan Meteorological Agency (JMA) and/or a solar irradiance forecast based on a numerical prediction model (NWP) has been useful technologies. For forecast data users in the EMS, the PV power generation forecasts and/or solar irradiance for a relative large area (i.e., electric power area by an electric power company) also are expected, because the PV power generation produced by PV systems are transferred to transmission lines.

Recently, the NWP have been used to forecast solar irradiance, because NWPs can directly calculate and produce solar irradiance (or downward shortwave radiation) at each grid point. However, the solar irradiance forecasts also have invariably errors. Therefore, we must use the forecast data considering its error. Before using the forecast datasets, validation of solar irradiance forecasts are desired for a stable system operation in the EMS.

In this study, we investigated seasonal and/or regional errors of global horizontal irradiance (GHI) from the MSM of the JMA. From the results, underestimation of solar irradiance forecasts in summer and overestimation of ones in winter are found. In the southwestern part of Japan islands (around Okinawa prefecture), relatively large forecast errors of GHI values were found compared with the Japan main islands.

We also attempted to estimate a confidence interval for hourly forecasts of GHI values obtained from the MSM. In the recent study, we found that the GHI forecasts from the MSM have a systematical forecast errors; the GHI forecasts are depended on the clearness indices, which are defined as normalized GHI values divided by hourly extraterrestrial solar irradiance theoretically calculated.

Information of the errors of hourly GHI forecasts, that is, the confidence interval of GHI forecasts, is of great significance for planning the EMS included a lot of PV systems. For the relatively large area, a spatial-smoothing method of GHI values is performed by an integration of GHI values for both the observations and forecasts. The spatial-smoothing method caused the decline of range of confidence intervals of the hourly GHI forecasts.

In addition, MSM-GPV data is powerful datasets for research institutes and business persons. They can calculate cloud fields and surface solar irradiance based on NWPs for the EMS. The MSM-GPV is used for a boundary data and an initialization data. However, GPV data do not include solar irradiance forecasts. The data of solar irradiance forecasts would become also powerful datasets for the EMS field including PV systems. In future, an ensemble forecast for one-day forecast would be useful tool for the estimation of confidence intervals of hourly GHI values.

Furthermore, monitoring PV power generation, maintenance processes and fault diagnosis of PV systems are more and more important for stable production of electric power. For the maintenance and the fault diagnosis of PV power system, solar irradiance observation data will be necessary. However, installation cost of pyranometers for each residence would be high. In addition, the maintenance of PV systems installed on a roof of a residence is not safety because a worker have to go up the roof. Therefore, spatial monitoring of solar irradiance based on satellite observations would be also useful for monitoring surface solar irradiance.

Both the GHI forecasts and the monitoring data from the JMA would be useful for both the EMS and the maintenance of PV systems.

Keywords: Photovoltaics, power generation forecasts, solar irradiance forecasts, numerical prediction models, forecast errors, energy management system

Japan Geoscience Union Meeting 2015
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MGI37-16 Room:203 Time:May 28 10:30-10:45

Responsibility of comprehensive design: Fukushima atomic power plant issue

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Invited talk: Responsibility of comprehensive design: Fukushima atomic power plant issue

Keywords: Fukushima Atomic Power Plant Issue, Comprehensive Design

Japan Geoscience Union Meeting 2015
(May 24th - 28th at Makuhari, Chiba, Japan)

MGI37-17 Room:203 Time:May 28 11:00-11:15

Experience in Constructing ”Data-Intensive Astronomy”, and Circumstances Surrounding Data Utilization in Sciences

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N/A

Keywords: Data-Intensive Astronomy, Utilization of Archival Data, Science Council of Japan, ICSU, RDA

Japan Geoscience Union Meeting 2015
(May 24th - 28th at Makuhari, Chiba, Japan)

MGI37-18 Room:203 Time:May 28 11:15-11:30

Seamless integration of flow and stock for the utilization of JMA-XML

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Flow and stock are two types of views on earth observation data. Flow refers to the quantity of information for a time slice, while stock refers to the quantity of information as a whole. The values of two viewpoints depend on the purpose of utilization.

Hence we believe that the seamless integration of flow and stock is an important challenge for the utilization of earth observation data. As a case study, we focused on the seamless integration of flow and stock for the utilization of Japan Meteorological Agency (JMA) disaster prevention information XML format (hereafter called JMA-XML). The operation of JMA-XML started on May 12, 2011, and the service was expanded on December 17, 2012 when it started an experimental service accessible by the general public. We started the archiving of JMA-XML since December 2012, to reach more than 730,000 bulletins as of February 2015. This stock of bulletins can be analyzed by the type, for example, such as about 175,000 weather forecast bulletins and 101,000 weather warning bulletins, with 69,000 special weather warning bulletins started on August 22, 2013.

JMA-XML is intended to be used as flow, so it has high familiarity with the automatic posting (bot) into a flow-oriented social networking system (SNS) such as Twitter. We started an account @JMAXMLAlerts which posts weather alerts constantly. However, conversion from flow to flow is an ordinary type of utilization, and we thought that conversion from flow to stock may lead to a more innovative type of utilization.

The first type of utilization is ”weather warning database.” This is the database of special warnings, warnings, and advisories (hereafter called weather warnings) announced from JMA, and it involves conversion from flow to stock because the announcement of activation and deactivation of warnings span across multiple bulletins. The period between activation and deactivation should be determined by maintaining a status of a warning by monitoring the flow of warnings. We released this database that updates in real-time with the implementation of this logic. The database contains about 13.2 million announcements of weather warnings, and about 1.75 million warning periods are extracted from the announcements. Each bulletin in the database also offers links to meteorological data such as satellite images and AMeDAS or disaster data.

This database reveals the number of warnings in history for each area. Hence we released ”weather warning risk map” with a hope that this statistics could be used as proxy for weather risks. For example, Akita prefecture has the largest number of warnings, among which dense fog advisories is the most frequent type. Does it mean that Akita prefecture has the highest risk for dense fog? This question needs careful scrutiny on the standard used for weather warnings. However, it naturally leads to a question if the issuance of weather warnings is fair across the country. These results indicate that flow information in a short time scale could be transformed to risk information in a long time scale through conversion from flow to stock.

We have been interested in the seamless integration of flow and stock. For example, ”Digital Typhoon” is the database of typhoons, but the core concept of the database is the integration of flow and stock, and aims at providing context for a proper interpretation of flow information through reference from flow to stock. We believe that this methodology could be applied widely to the utilization of earth observation data.

Keywords: weather information, database, JMA-XML, weather warning, risk map, flow and stock

Japan Geoscience Union Meeting 2015
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MGI37-19 Room:203 Time:May 28 11:30-11:45

Modeling of typhoon translation velocity based on past typhoon track data

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The motion of a typhoon is mainly controlled by the background large-scale wind velocity field. The pattern of typhoon trajectory can thus vary due to the variations of the background wind velocity field. Since a typhoon may cause a serious disaster in the East Asia region, it is important to evaluate the variations of the motion pattern of typhoons. We have developed a model of the spatial pattern of the typhoon translation velocity field based on the typhoon track data for about sixty years. This model was obtained by using the Gaussian process regression technique, which enable us to represent typical typhoon translation velocity as a function of latitude, longitude, day of year, and year. We will discuss the characteristics and current problems of the proposed modeling technique.

Keywords: typhoon, tropical cyclone, Gaussian process regression, spatial statistics

Japan Geoscience Union Meeting 2015
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MGI37-20 Room:203 Time:May 28 11:45-12:00

Extraction of moving object from spatio-temporal data and modeling of its generation extinction process

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A large amount of spatio-temporal data has been accumulated in the various field of the Earth science such as weather satellite observation and ground radar observation. Moving objects are often included in these spatio-temporal data. For example, the cloud lumps in the weather image, the rainfall area in radar data are equivalent to objects. These objects are generated at some time point, survive with their shape and feature changed for a while, and finally extinct. Objects interact each other, sometimes are fused or decomposed. The basic information of these objects are the position and the shape of these objects, feature based on texture or spatial pattern. We developed the method to extract theses information from spatio-temporal data semi-automatically in order to find higher-order spatio-temporal variation pattern from them. The objects are modeled by the combination of multivariate normal distributions and its model parameters are determined via EM algorithm. The number of components was determined based on BIC.

The developed method is applied to cloud lump extraction from a weather satellite image (IR1 image of MTSAT 6 and 7) and the extraction of the rainfall area from 3 dimensional weather radar data.

Keywords: Spatio-temporal, data mining, objects, modeling, weather images, radar

Japan Geoscience Union Meeting 2015
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MGI37-21 Room:203 Time:May 28 12:00-12:15

Automation of Visualization Processing in the Volume Visualization Software ”VDVGE” for Google Earth

KAWAHARA, Shintaro[1*] ; SUGIYAMA, Tooru[1] ; ARAKI, Fumiaki[1] ; TAKAHASHI, Keiko[1]

[1]JAMSTEC

Software to visualize volume data that is called VDVGE (Volume Data Visualizer for Google Earth) has been developed. VDVGE visualizes a four-dimensional scalar data (a three-dimensional scalar data with time series), and exports it to KML and COLLADA which are suitable format for Google Earth. Visualization parameters of VDVGE are usually set by using GUI (graphical user interfaces). Recently, the command line execution mode is implemented as an additional function and it has become possible output the content files for Google Earth without launch GUI window of VDVGE. The simulation data and the observational data are visualized automatically by using this function. In the presentation, the development status of VDVGE and application examples will be introduced.

Keywords: Volume visualization, Google Earth, VDVGE, EXTRAWING

Japan Geoscience Union Meeting 2015
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MGI37-22 Room:203 Time:May 28 12:15-12:30

Development of High-Performance Data Analysis Library Based on Vector Operation and Its Application to ALMA

NAKAZATO, Takeshi[1*] ; SUGIMOTO, Kanako[1] ; KAWASAKI, Wataru[1] ; KAWAKAMI, Shinnosuke[1] ; KUNIYOSHI, Masaya[1] ; NAKAMURA, Kohji[1] ; KOSUGI, George[1] ; MAEKAWA, Jun[1]

[1]National Astronomial Observatory of Japan

Atacama Large Millimeter/submillimeter Array (ALMA) is a radio-astronomical interferometer operated by an international partnership of East Asia including Japan, Europe, and North America. With its state-of-the-art capability, ALMA produces a lot of important scientific results for various fields of astronomy that cover from planetary science to early universe. These results are sustained by large amount of data produced by many telescope elements of ALMA. The data size will become 200TB per year in a full operation phase. To analyze such a large data efficiently, it is extremely important to improve data analysis software to take advantage of full capability of given hardware resources as well as to build up powerful hardware resource. In particular, it is crucial that such data analysis software implements each function based on parallel processing since it is one of the key means to improve performance of the data analysis. Among others, vector operation is a promising for high-performance computing because 1) it is universal that is widely available from personal laptop computer to computer cluster environment, and 2) it is relatively handy to implement using auto-vectorization of compilers if the source code is carefully written so that it suits to vector operation. In this context, we have been working on improving the performance of data analysis software for ALMA called Common Astronomy Software Applications (CASA). Our plan is to develop general purpose high-performance data analysis library and utilize it from CASA to improve its performance. We have been developing this library for three years. The library is named Sakura. Noticeable feature of Sakura is to improve the performance by using vector operation as much as possible. In optimizing the code based on vector operation, it is important to take care of an antinomy between optimization and versatility. In general, it is better to use newer instruction set for more efficient processing. However, the library will not work on older CPU if too new instruction set is used. In Sakura, we provide an easy interface for compiling it with various types of instruction set to overcome this antinomy. For specific purpose computer and software, one can optimize Sakura by compiling it against native instruction set for the computer. For general purpose, we can generate several versions of Sakura library that are optimized to various types of instruction set including conservative but inefficient optimization, and select which library is loaded depending on runtime environment. In CASA, we will take the latter option. Based on Sakura, we have developed a prototype CASA command for reduction of single-dish radio telescope data. Thanks to vector operation in addition to improve workflow and reduce unnecessary data input/output from the disk, the prototype command is 20 times faster than existing counterpart in CASA. With this result, Sakura based development has been approved by CASA team. Sakura based commands will be available in CASA 4.4 that is planned to release in April of 2015. Here, we will summarize an implementation of Sakura, and a performance of Sakura based command compared with existing CASA commands. We will also describe a status of Sakura based development for CASA 4.4. Furthermore, we will mention about our future plan for improving CASA performance by extending Sakura to be able to handle interferometry data, which usually deals with complex visibility data.

Keywords: ALMA, Data Analysis, Vector Operation

Japan Geoscience Union Meeting 2015
(May 24th - 28th at Makuhari, Chiba, Japan)

MGI37-23 Room:203 Time:May 28 12:30-12:45

A Parametric Sensitivity Study for the Global MHD Simulation Model by Using Large-Scale Data Analysis and Visualization

SAITA, Satoko[1*] ; FUJITA, Shigeru[3] ; KADOKURA, Akira[2] ; TANAKA, Takashi[4] ; YUKIMATU, Akira sessai[2] ; TANAKA, Yoshimasa[2] ; OHTANI, Shinichi[5] ; MURATA, Ken T.[6] ; HIGUCHI, Tomoyuki[7]

[1]National Institute of Technology, Kitakyushu College, [2]National Institute of Polar Research, [3]Meteorological College, Japan Meteorological Agency, [4]International Center for Space Weather Science and Education, Kyushu University, [5]The Johns Hopkins University Applied Physics Laboratory, [6]National Institute of Information and Communications Technology, [7]The Institute of Statistical Mathematics

The Magnetosphere-Ionosphere (M-I) boundary condition in the global MHD simulation (Tanaka, 2010) includes insufficient factors for the M-I coupling process, so that we have to calibrate the global MHD simulation model considering parametric uncertainty in the M-I coupling process.

For statistical analysis and visualization, case studies have been done for the global MHD simulation.

We need computational techniques to analyze simulated and observed data simultaneously. However, the amount of simulation data with high spatial and temporal resolution is very large.

Therefore in this study, we compare the ionospheric E x B plasma drift obtained from the global MHD simulation and that obtained from the SuperDARN HF Radar Network.

The simulated plasma drift are not always reproducible under a southward interplanetary magnetic (IMF) condition.

In today's presentation, we show latest results of a parameteric study of the global MHD simulation and demonstrate the evaluation of the reliability and validity of M-I coupling process in the global MHD Simulation.

References:

Tanaka, T., A. Nakamizo, A. Yoshikawa, S. Fujita, H. Shinagawa, H. Shimazu, T. Kikuchi, and K. K. Hashimoto (2010), Substorm convection and current system deduced from the global simulation, J. Geophys. Res., 115, A05220, doi:10.1029/2009JA014676

Keywords: global MHD simulation, sensitivity analysis, ionospheric electric field potential map, aurora, ionospheric conductivity, field-aligned current

Japan Geoscience Union Meeting 2015
(May 24th - 28th at Makuhari, Chiba, Japan)

MGI37-P01 Room:Convention Hall Time:May 27 18:15-19:30

STARS touch: A web-application for time-dependent observation data

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This paper is to present a cloud system for science, which has been developed at NICT. The NICT science cloud is an open cloud system for scientists who are going to carry out their informatics studies for their own science. The NICT 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. In the present study, we discuss a Web application for time-dependent science data, which is named STARS touch. This Web application is based on a technique of asynchronous data transfer of graphic files for several types of data plots. The cloud system create a huge number of data plots with various time scale (e.g., from few minutes to few years) for each data-set. Parallel processing techniques to create such huge number of graphic data files are also discussed. We also make a live demonstration of the STARS touch to show several types of applications not only for research works but also for social data previews.

Keywords: Web application, WDS, time-dependent data, Collective intelligence, spacecraft observation, Meteorological observation

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MGI37-P02 Room:Convention Hall Time:May 27 18:15-19:30

Security approaches of a distributed storage system in the NICT Science Cloud

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Open data and global data citation of a scientific data have been discussed in international projects of scientific research field in recent years. Nowadays, internet services of them are gradually being provided. In these circumstances that a scientific researcher can manipulate large amounts of scientific data, the Informatics for Earth and Space Sciences fields is expecting the data-intensive science which provides new scientific knowledge or realizes multidisciplinary research by cloud computing technology.

On the other hand, there are not much success cases of the data-intensive science because there are not many free cloud services which provides a storage with large capacity, high available and high security in addition to high performance computers at the disposal of users. Also, many scientific researchers are much concerned about security of cloud services according to the results of the questionnaire survey by a promotion project of the Ministry of Education, Culture, Sports, Science and Technology.

National Institute of Information and Communications Technology (NICT) established about 500 CPU and 3 petabyte-scale cloud systems (NICT Science Cloud) for the data-intensive science. The NICT Science Cloud has data centers in 5 regions (Tokyo, Nagoya, Kyoto, Osaka and Okinawa) of Japan and provides a distributed computing environment with the Gfarm file system on a 10Gbps Layer 2 network (JGN-X). Scientific researchers can use it anytime without charge.

We introduce security approaches of a distributed storage system with the Gfarm in the NICT Science Cloud. In particular, we explain an application and a system to verify integrity, authenticity and traceability of stored data. Also, we discuss about a contribution of the approaches to the data-intensive science.

Keywords: data-intensive science, cloud service, distributed storage system, security, open data

Japan Geoscience Union Meeting 2015
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MGI37-P03 Room:Convention Hall Time:May 27 18:15-19:30

Migration to BUFR/CREX of meteorological observation reports

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The World Meteorological Organization (WMO) is tring to finalize its decades-long migration plan of the format of conventional observation reports, from telgram-based traditional alphanumeric codes (TAC) to the table-driven code forms (TDCF). For major types of observatios, the deadline of migration was November 2014, and several countries terminated dissemination of reports in TAC.

There are two forms of TDCF: the preferred form is binary called BUFR, while an alternative one called CREX can be used for single-case character-based telecommunication channel. In both forms, the message contains a list of 16-bit numbers called element descriptors defines the structure of following data. Each element descriptor represents either a number (with units), an ASCII character string, an enumeration or a flag field (referring to external table). The descriptor list may include (maybe nested) repetition, and that allows XML-like semi-structured data such as list of a structure associated with other type of data.

With respect to self-descriptivity, the benefit of a TDCF message is that a new data structure can be analyzed without documentation, while the self-description is completed only after referring to external tables. Some features are considered old-fashoned (in comparison to XML), such as being binary, number-based, referring to external tables. Sometimes it is explained that the telecommunication bandwidth was much more expensive at the early stage of TDCF development in 1990s, and the short size had to be pursued at the sacrifice of readability. But the features have benefit of reducing freedom of representation, which is important for stability of operational system.

The migration to TDCF is almost perfect for satellite data, while it takes many yeares for surface-based observation, since all WMO members have to change their own systems. Use of upper-air sounding in TCDF requires great effort and care; firstly the TDCF was planned to have more elements and precision, while many countries circulate reformatted TAC with compromised content.

Keywords: WMO, World Weather Watch Programme, Upper-air obsservation, Table-driven code form, BUFR, TEMP

Japan Geoscience Union Meeting 2015
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MGI37-P04 Room:Convention Hall Time:May 27 18:15-19:30

Development and publishing of the Seamless Geological Map of Japan (Chiriinchizu edition, tentative name)

NISHIOKA, Yoshiharu[1*] ; NAGATSU, Juri[1] ; KITAO, Kaoru[2]

[1]Institute of Geology and Geoinformation, AIST, [2]CubeWorks Inc.

We developed a next viewer of the Seamless Geological Map of Japan 1:200,000 with rewriting a cord completely.
This viewer adopts the Chiriinchizu as a base map.
This viewer, and also, the most high technique everywhere, for example 'Portable map', it's applied.
We are going to publish this viewer in May of this year.

Keywords: Seamless Geological Map, Leaflet.js, Chriin tile, portable map, Web site

Japan Geoscience Union Meeting 2015
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MGI37-P05 Room:Convention Hall Time:May 27 18:15-19:30

Parallel Distributed Processing of Plasma Waveform Using Science Cloud

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Measuring waveform of plasma waves by scientific satellites is one of very important methods for understanding the physical processes in space plasma. It is quite difficult to extract and study characteristic wave phenomena using waveform data manually, because the data amount of waveform is too large. We have tackled for many years on automatic detection algorithm to extract varieties of characteristic waveforms in a systematic way. In order to analyze the waveform data properly, however, many computation time is necessary for the signal processing for noise reduction and filtering and many turnarounds are indispensable to brush up the algorithm.

In the present study, we evaluate a parallel distributed processing technology implemented in the NICT Science Cloud using our original program for the automatic detection of bipolar pulses measured by the waveform capture (WFC) onboard the KAGUYA spacecraft. We introduce a task scheduler named Pwrake (Parallel workflow extension for Rake) for the parallel processing. We demonstrate that Pwrake is a suitable task scheduler for hetero-type tasks.

In the presentation, we report the current results and also new science outputs expected from our trial.

Keywords: Parallel Distributed Processing, Science Cloud, Plasma Wave, Signal processing, Waveform analysis