

# A view of International Landscape of Open Science and Research Data Sharing

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Since the G8 Science Ministers' Meeting in UK 2013, Open Science policy and practice have been intensively discussed in related countries. Many bodies have been committing this activity like academic committees ICSU-World Data System (WDS) and Committee of Science and Technology Data (CODATA), RDA (Research Data Alliance), a data consortium in connection to G8 Group of Senior Officials (GSO)'s data infrastructure working group, and recently OECD (Organization of Economic Cooperation and Development) Global Science Forum, etc. In Japan, Cabinet Office of Japan played a leading role in Japan to publish the first national guiding principle of Open Science for Japan (March 2015). In 2016 G7 Science and Technology Ministers' Meeting was held in Japan, including the Open Science session as one of its six main themes.

Open Science is rapidly becoming an important focus of international discussions for its possible big impacts on scientific research, and also citizen, the Society and its economy. Recognising our scientific knowledge basis accumulated on "print technology" basis (books, articles) for more than 300 years, advantage of digital technology and electronic information and communication (ICT) infrastructure is emphasized in terms of high-speed and huge-volume data processing although it has only a 70-year history. Accessibility, sharing, interoperability of data and infrastructure, citability, and reuse are important prerequisites. Regardless of the open or closed policy, the capacity to assess trustworthiness of datasets, to preserve and manage them in an organized way, and to enable professional and non-professional reuse to create new knowledge are important in the context of Open Science.

Long-term preservation of digital data raises questions such as the size of data we should preserve, the preservation period (50-100 years similar to academic articles?), the increasing costs of bigger size of data (at present), and so on. In the scientific research data area, an international enterprise, the World Data Centres, was established by the International Council for Science (ICSU) in 1957-58 to exchange and store important scientific data as data books and microfilms. With the unprecedented technical infrastructure available today over the world and the need for multidisciplinary data integration to solve the most pressing challenges facing humanity, ICSU decided to form the new ICSU-World Data System (WDS) in 2008 based on the strong legacy of its two data organizations in past. The International Programme Office of WDS is now hosted by NICT in Japan, Tokyo. WDS works with its member organizations—holders and providers of data—to secure trustworthy, sustainable and findable data archives.

Libraries in past have been based on the print technology mostly. They selected books, improved preservation, and built the international network of exchange and copy of books. We are now on the starting line to construct a similar infrastructure for electronic data resources in academic fields. These efforts to support and promote best practices, will lead to building a new layer on top of the current ICT technology layers. This change has potential to lead to wide reuse of datasets with greater interoperability. Experiences and best practices in past academia are indispensable important legacy for us to help designing a new academic information infrastructure in this new era.

Keywords: Open Science, Data Sharing, Open Science Data

# Challenges and Motivations for International Coordination of Open Science Data Infrastructures

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## 1. ICSU World Data System

Modern scientific research is an increasingly global endeavour and sharing common resources and instruments is becoming the norm. Scientific progress is built on the exchange of knowledge and practice—literature, data, and other research artefacts—amongst researchers in the scientific community. Data are widely recognized as a foundational and essential element of research and their availability, sharing and reuse are at the core of the Open Science paradigm.

Scientific communities have long come together to coordinate their research activities internationally including the management and stewardship of data. Taking advantage of the new information and communication technologies, they also enabled the physical networking of research data infrastructures which led to the emergence of large-scale regional and global research data infrastructures supporting science. These global data infrastructures became a reality in pioneering research domains such as astronomy, genomics, and Earth sciences resulting in more efficient research and revolutionizing the conduct of research.

However, these international networks face many challenges because they cut across national boundaries, (scientific) cultures, and sometimes disciplines. Their success is heavily dependent on the convergence and synergies between diverse national (data) policies and funding schemes. Furthermore, these international networks are largely focussing and serving specific domains, thus re-creating silos of data infrastructures when the challenges facing society require multi- and transdisciplinary data infrastructures.

This presentation will review several exemplars in the Earth and Space sciences, analyze common practices and approaches to derive lessons learnt and identify key issues that require policy actions, and the types of actions that might be appropriate.

Keywords: Global Data Infrastructure, Open Science, International Coordination

## Recent activity of DOI-minting to solar-terrestrial physics data

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Data-DOI, data publication, and data citation will promote "Open Science". Recognizing their importance, solar-terrestrial physics (STP) data centers in Japan have been working to mint DOI to their database. We participated from October 2014 in a 1-year pilot program for DOI-minting to science data launched by Japan Link Center, which is one of the DOI registration agencies. In the pilot program, a procedure of the DOI-minting for STP data was established. As a result of close collaboration with Japan Link Center, the first case of data-DOI in Japan (doi:10.17591/55838dbd6c0ad) was created in June 2015. The first case of data citation in Japan was also made. As of February 2017, there are 16 data-DOIs for the STP data in Japan. In the International Association of Geomagnetism and Aeronomy (IAGA), STP domain scientists who are working for data centers or observatories started discussion about DOI-minting to their data and a task force was formed in August 2013. The next IAGA (joint) assembly that will be held at Cape Town in August 2017 provides a special session entitled "The referencing of geophysical data products: The role of DOIs". The international effort will be continued for DOI-minting to scientific data in STP.

## Toward Open and Beyond! Sharing Data in the Earth Sciences

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The paradigm of Open Science is recognized as a powerful and essential catalyst for the advancement of science in the 21st century, and as a necessary and guiding principle for the integrity and validity of research to ensure trust in the scientific process and its results. One of the primary requirements of Open Science is the open sharing of data, code, and other research materials on a global scale. This is especially relevant in the Earth Sciences, where urgent societal problems such as climate variability, effective prediction of natural hazards, and sustainable management of the natural resources cannot be answered with locally constrained datasets and where society must have confidence in the basis for impacts and decisions that can have large economic and societal effects. Over the past few years, publishers, repositories, and funders have developed a number of best practices around presenting, linking, and curating these related research products. Our presentation will focus on these best practices for sharing data, code, and samples and on developing the broader infrastructure that can support such data sharing in a sustainable manner. We will report on progress made in the Earth Sciences over recent years towards the open sharing of data in the Earth Sciences, reporting on US-based and international initiatives such as EarthCube and COPDESS. We argue that the concept of 'open' is not a sufficient and adequate goal; instead open data must be FAIR –findable, accessible, interoperable, and re-usable. This requires additional support by the community so that data can be explored and interpreted with confidence and in new multi-disciplinary perspectives.

Keywords: Open science, Data sharing, Research infrastructure

## Development status of the metadata server and data archives at Tohoku University for collaborative studies using planetary radio and spectroscopic data

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Data archive of Jovian radio emissions in decametric wavelength range (DAM, 20-40 MHz) measured at ground stations of Tohoku University was started in 2004. Metadata services for IUGONET (Inter-university Upper atmosphere Global Observation NETwork, supported by the Special Educational Research Budget, and the Special Budget Project from MEXT (the Ministry of Education, Culture, Sports, Science and Technology), Japan in 2009-2014) and EuroPlanet/VESPA (Virtual European Solar and Planetary access) were also started in 2009 and 2015 in collaboration with IUGONET-member organizations, and Paris Observatory team. In 2016, we developed data archives of solar radio waves in VHF/UHF range obtained by IPRT (litate planetary radio telescope), and planetary spectroscopic data obtained by Hisaki spacecraft, and started providing their metadata for VESPA with support of JSPS France-Japan Bilateral Joint Research Program "Coordinated observational and theoretical researches for Jovian and Kronian auroral radio emissions". We are planning to add metadata of Jovian radio wave data from observatories of Kochi National College of Technology, and Fukui University of Technology, planetary spectroscopic data from Tohoku University observatories in Hawaii, and solar wind parameters from Tao's model.

Ground-based observations with multi-longitudinal stations enable us 24-hour continuous track of the activity variation of the Jovian auroral radio emissions. By using Spectrograms of Jovian decametric radiation obtained at Nancay and litate observatories, and spectroscopic data from Hisaki spacecraft, we are performing analyses of the effects of the Io's volcanic activity in 2015 on the occurrence timing of the arc structures in the spectrogram of Jovian decametric radiations. Source identification method of the Jovian decametric radiation was developed based on Nancay data [Marques et al., 2016]. We are going to apply the method to dataset including litate data, and utilize for statistical analyses. Another merit of the ground-based observations is that we can use facilities such as large antenna array, high time/frequency resolution receivers, high-speed networks, and large amount storages, which are difficult to use in the spacecraft observations. We participate Juno ground support team and exchange the information on support observation schedules.

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Keywords: Jovian DAM, IUGONET, Europlanet/VESPA

## Science Services: Examples of Opening Research Data to the Scientific Ocean Drilling Community and General Public

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The IODP is a wildly successful example of a long-term, international, collaborative science research program. Once solely managed by a US consortium, operating one ship, it now includes three international agencies/science operators working together, each operating/contracting their own vessels. The data and samples resulting from these collaborative efforts now reside in three regional core repositories, with each region also operating its own database. While standards and policies regarding the treatment of data and samples are extremely mature, each region has approached data management differently.

With the recent momentum behind open data and open access to science data and samples resulting from public investment increasing, it's important to ensure that these important scientific ocean drilling resources are readily available to the science community and the general public.

I examine the current status of each drilling database, and discuss the efforts to improve data services among the three science operators.

Keywords: scientific ocean drilling, international ocean discovery program, open data

# Digital Typhoon and open science - a trans-disciplinary platform for typhoon-related data

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Digital Typhoon is a transdisciplinary platform for typhoon-related data. It is the database of not only research data, but also society and citizen derived data such as news text and social media. It covers not only current data, but also past data to make comprehensive data archives, such as 40 years of satellite and ground observation data and 100 years of weather chart data. A variety of typhoon-related data is not only stored in silos, but also linked with other data across domains, and indexed using data-driven algorithms to make them findable. In short, Digital Typhoon offers the collection of best practices about how data can be integrated and indexed to make them findable, accessible, interoperable and reusable (FAIR). As a result, Digital Typhoon has been used not only by scientists but also by citizens for a variety of purposes such as for research, work, and hobby, with annual page views of 10 to 20 million for more than 10 years since 2003. In the context of Open Science, we share our experience on more than 10 years of operating this platform, and our challenges to make this platform sustainable against internal and external problems.

Keywords: typhoon, Digital Typhoon, open science, transdisciplinary platform, communication, meteorology



## VESPA: a community-driven Virtual Observatory in Planetary Science

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The VESPA data access system is intended to apply Virtual Observatory standards and tools to Planetary Science. Building on a previous EU-funded Europlanet program, it has reached maturity during the first year of a new Europlanet 2020 program (started in 2015 for 4 years). The infrastructure has been upgraded to handle many fields of Solar System studies, with a focus both on users and data providers. This paper describes the broad lines of the current VESPA infrastructure as seen by a potential user, and provides examples of real use cases in several thematic areas, together with hints for future developments.

Keywords: Virtual Observatory, Solar System, GIS

## System architecture enabling runs on request for a Transplanet model of magnetosphere-ionosphere coupling at Earth, Mars, and Jupiter

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Under Horizon 2020, the Europlanet 2020 Research Infrastructure (EPN2020-RI, <http://www.europlanet-2020-ri.eu>) includes an entirely new Virtual Access Service, “Planetary Space Weather Services” (PSWS) that will extend the concepts of space weather and space situational awareness to other planets in our Solar System and in particular to spacecraft that voyage through it. PSWS will provide at the end of 2017 12 services distributed over 4 different service domains –1) Prediction, 2) Detection, 3) Modelling, 4) Alerts. These services include in particular a Transplanet model of magnetosphere-ionosphere coupling at Earth, Mars, and Jupiter that enable the users to made runs on request of the model, archive and/or connect the results of their simulation runs to various tools developed in the Virtual Observatory. The present paper will first describe the Transplanet model, and then present the system architecture developed by the Space Plasma Physics Data Center (<http://www.cdpp.eu>) in France in order to make the service operational (<http://transplanet.irap.omp.eu>). Europlanet 2020 RI has received funding from the European Union’ s Horizon 2020 research and innovation programme under grant agreement No 654208.

Keywords: Planets, magnetosphere, ionosphere, runs on request, Virtual Observatory, Data archive

## Recent science developments of the French Plasma Physics Data Centre (CDPP)

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The French Plasma Physics Data Centre (CDPP, <http://www.cdpp.eu/>) addresses for nearly 20 years all issues pertaining to natural plasma data distribution and valorization. Initially established by CNES and CNRS on the ground of a solid data archive, CDPP activities diversified with the advent of broader networks and interoperability standards, and through fruitful collaborations (e.g. with NASA/PDS): providing access to remote data, designing and building science driven analysis tools then became at the forefront of CDPP development. Today the CDPP tool AMDA helps scientists all over the world accessing and analyzing data from ancient to very recent missions (from Voyager, Galileo, Giotto, ... to Maven, Rosetta, MMS, ...) as well as results from models and numerical simulations. Other tools like the Propagation Tool or 3DView allow users to put their data in context and interconnect with other databases (CDAWeb, MEDOC) and tools (Topcat). This presentation will briefly review this evolution and demonstrate technical and science use cases. The presentation will ultimately show how CDPP activities will serve future missions (BepiColombo, Solar Orbiter, THOR, ...).

Keywords: data centre, analysis tool, archive, plasma data

## Arctic Data archive System(ADS)

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A new project of the Arctic research (ArCS :Arctic Challenge for Sustainability) has been started in 2015. ArCS is a national flagship project funded by the Ministry of Education, Culture, Sports, Science and Technology. The National Institute of Polar Research (NIPR), Japan Agency for Marine-Earth Science and Technology (JAMSTEC) and Hokkaido University are playing the key roles in this project, and will continue to carry it out for approximately four-and-a-half years from September 2015 to March 2020. Arctic Data archive System (ADS) is responsible for the data management of this project.

Arctic Data archive System (ADS), to promote the mutual use of the data across a multi-disciplinary to collect and share data sets, such as observational data, satellite data, and numerical experiment data. Through these data sets, clarify of actual conditions and processes of climate change on the Arctic region, and further contribute to assessment of the impact of global warming in the Arctic environmental change, to improve the future prediction accuracy.

Keywords: Arctic, Global Warming, ArCS

## DIAS metadata input camp as an Open Science activity

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The Data Integration and Analysis System (DIAS) started from 2006. The goals of DIAS are to collect and store earth observation data; to analyze such data in combination with socio-economic data, and convert data into information useful for crisis management with respect to global-scale environmental disasters, and other threats; and to make this information available within Japan and overseas. The current project of phase III has started since 2016 with the aim of its practical operation.

From October 2010, we have released data of DIAS with Document-metadata, describing about dataset in English and Japanese. DIAS has a mission to accelerate the accessibility of data created and maintained by institutions implementing Earth observation projects through creating Document-metadata in the DIAS metadata creation support tool. Anyone can use the DIAS data discovery system by accessing <http://search.diasjp.net>, and can download data files of 270 DIAS released datasets, can access 80 datasets outside DIAS through the system. We are also collecting metadata from related data centers and which is searchable and accessible through the system.

Until now, we have had workshop concerning about metadata input 6 times as “DIAS metadata input camp”. The initial workshop participants were the data owners or providers who should create Document-metadata. The recent workshop increased librarians who are interested in research data management of open science. In order to share how to cataloging research data using Document-metadata, in the workshop, participants had experienced the difference between the metadata of the research data and the metadata of the literature. We report issues about how to manage metadata to data providers and librarian and issues about how to introduce research data to wide users in an easy-to-understand manner using metadata.

Keywords: DIAS, Earth Observation data, Metadata, Open Science

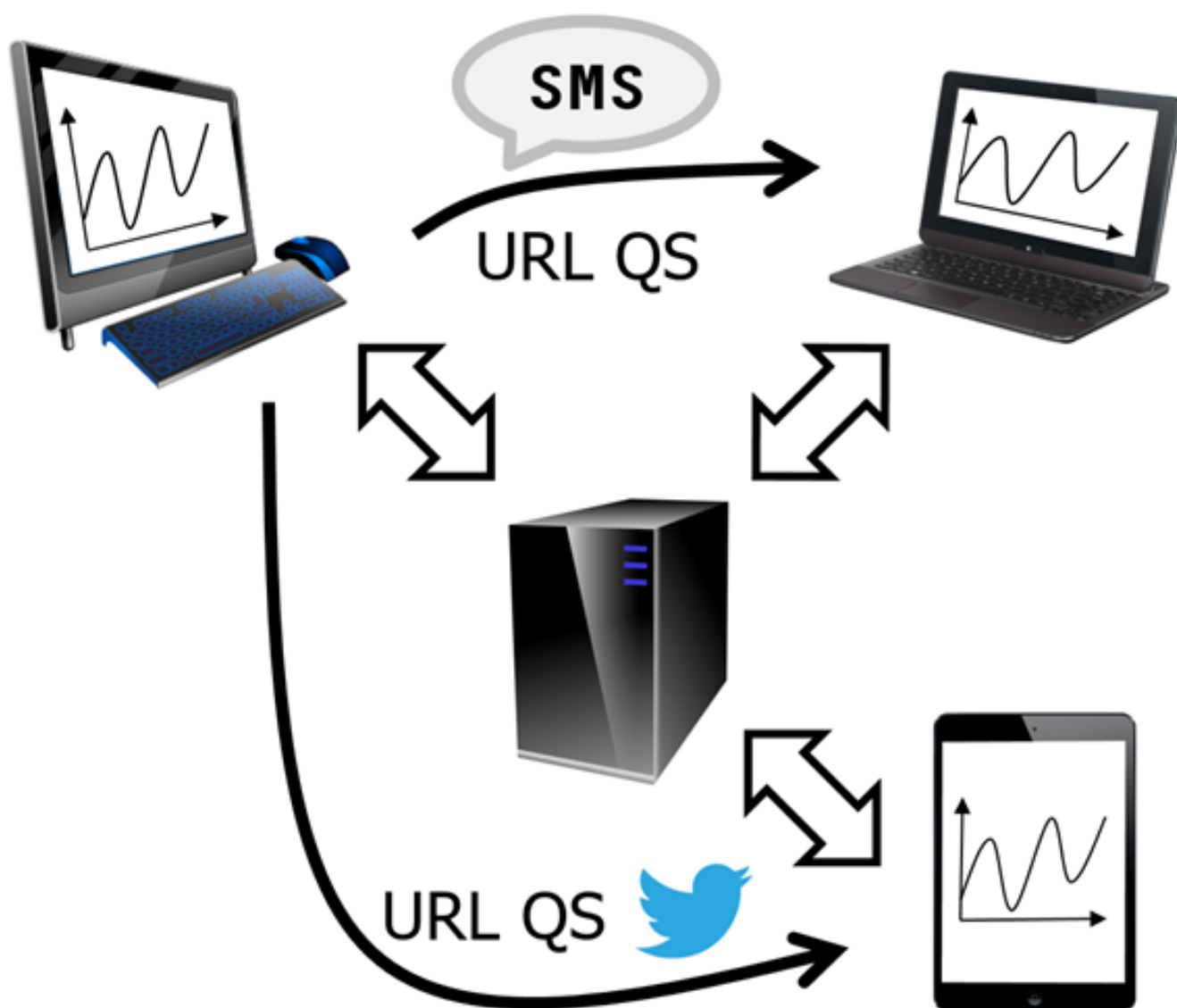
## Web service for reproducible multidisciplinary data visualization

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We propose a new method for reproducible data visualization on a web browser. A web service, Cross-Cutting Comparisons (C3) has a query string (QS)-controllable system to make various interactive charts of earth, planetary and space sciences. By including information of data handling procedures in the QS in an orderly manner, the chart is easy to understand, remake and share via text-based communication tools.

Keywords: open data, open science, citation



## Start-up of earth observation by a small laboratory

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In Japan, there is an institution of higher education which is different from university system.

There are National Institute of Technology (NIT) in Japan in total of 51 colleges. The head quarter is located in Tokyo, but the each college is established in most in 47 prefectures in Japan. Because it's scattered about a various part of Japan, those are a strong potential earth observation base.

The NIT, Oita College is located in Oita Prefecture, Kyushu, Japan.

Because the vocational researcher is little again, too, because they're higher educational facilities, but he makes the young generation the subject, there is a problem with the continuity of the study.

However, it's potential because I split regionally.

Keywords: Meteor, Radio observation, Multi-point observation, Data sharing, Metadata, Identifier

# Terminological Ontologies and Vocabulary Broker for Open Science

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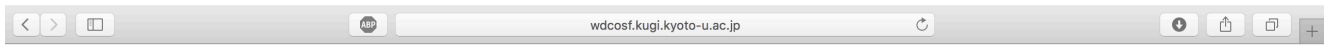
Keyword vocabularies as part of metadata standards, such as NASA GCMD DIF, SPASE data model, ESPAS keyword ontology or UAT thesaurus are used to tag and qualify specific metadata elements in a standardised way. The different concepts behind the used keywords transport specific semantic knowledge about features of the tagged elements. The scope and the validity of the concepts and keywords normally is limited to a specific domain, such as earth and space physics or astronomy. Natural language is used to express the semantic of the concepts and appropriate keywords. Therefore diverse keywords are used in different metadata standards to express same or very similar concepts. Even in the same domain different keywords are used to describe the same concept. Out of that there is the problem using keywords for the search of data within different repositories. In order to overcome this challenge, we have developed a semantic Web based Vocabulary Broker framework which is connecting appropriate keywords mainly using "skos:closeMatch" relationships for the expression of concordances.

Terminological ontologies derived from the above mentioned metadata standards are processed, and semantic based keyword matches are generated. The original ontology and the mapped parts are managed by the Open Semantic Framework (OSF). The Vocabulary Broker application provides both, schema based browsing and keyword search features. The main idea of the Vocabulary Broker, the semantic (Web) based mashup of keywords, prepares the way for a seamless and overlapping data search within different data repositories, which are managed by different metadata standards. This idea works within a domain or even cross-domain. Therefore our approach is a valuable contribution to mashup data and knowledge within an Open Science environment.

Vocabulary Broker URL: <http://wdcosf.kugi.kyoto-u.ac.jp>

Keywords: Metadata Standard, Keyword Vocabulary, Terminological Ontology, Matching Ontologies, Vocabulary Broker, Open Science





**World Data System Vocabulary Broker - Proof of Concept** - A +  
*Linking Research Data*

Home | [GCMD Keywords](#) | [SPASE Keywords](#) | [ESPAS Keywords](#) | [UAT Keywords](#)

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**Update of Search Results page**

Submitted by wdcosf on Fri, 08/26/2016 - 19:55

To improve user experience we modified the presentation of search results when performing a "Concept Search". Instead of just displaying the Concept keyword, we now show additional context information like the keyword scheme to which the term belongs (GCMD, SPASE, ESPAS or UAT respectively), a short definition of the term if available from the vocabulary maintainers, and direct links to <skos:relatedMatch> or <skos:closeMatch> keywords from other vocabularies, if they exist.

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**Integration of UAT vocabulary**

Submitted by wdcosf on Thu, 08/11/2016 - 22:20

The domain-oriented [Unified Astronomy Thesaurus](#) vocabulary is based on concepts which are also used in neighboring domains, such as geophysics, especially magnetic field research, near earth-space exploration and solar-terrestrial physics. The space weather and space climate domains are covered by UAT concepts too. Therefore we think, the integration of the UAT vocabulary into the Vocabulary Broker is a benefit for astronomers but also geo and space scientists.

**Concept Search**

Enter your keyword

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  - [Integration of UAT vocabulary](#)
  - [Update of GCMD Keywords](#)
  - [Feasibility test: Integration of context-sensitive SPARQL query to DBPedia](#)
  - [Vocabulary Mapping Algorithm updated](#)
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## IUGONET Type-A: web service for solar-terrestrial science

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IUGONET is a community to promote solar-terrestrial physics studies, which NIPR, Nagoya Univ., Kyoto Univ., Tohoku Univ., Kyusyu Univ., NICT, NAOJ, JMA and Kanazawa Univ participate in. Our team has mainly developed two products, i.e., UDAS and IUGONET Type-A. UDAS is an analysis software based on SPEDAS (Space Physics Environment Data Analysis Software) and IDL (Interactive Data Language), and IUGONET Type-A is a web service to provide data information and web-based analysis platform 'UDAS web'.

IUGONET Type-A was opened to public on 1 Nov, 2016. This service has functions to show metadata of observational data (e.g., description, acknowledgement [data policy], start and stop date, contact person, data publisher URL, observatory and instrument information), quick-look images (QLs), and how to create these QLs. In particular, thumbnail display of QL plots of retrieved data is very useful to view various data and find correlated data. In addition, UDAS web enables to plot data easily on web browser (PC, smartphone, tablet device and more) without any installation/setup of dedicated software and license. Therefore, IUGONET Type-A is an one-stop web service that enables to search, understand, visualize and test data, and promotes new interdisciplinary studies regarding the solar-terrestrial physics even for researchers in emerging countries.

Furthermore, IUGONET Type-A was built by 'IUGONET Web Application Framework for Science'. This framework can also handle various metadata formats and work on other system. For example, this framework is now being used for Fukushima radiation database, RADARC, and in future we will divert it to some database for various data, such as meteorological data, sequential (ensemble-based) data, and the other scientific data. We believe that this framework is useful to share scientific knowledge between wider communities and can contribute to open science.

Keywords: solar-terrestrial environmental science, open science, open data, database system

## Activity for promoting interdisciplinary studies of solar-terrestrial physics

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Inter-university Upper atmosphere Global Observation NETwork (IUGONET) is a Japanese inter-university project whose goal is to effectively utilize upper atmospheric data, including solar and planetary data, which have been separately archived by Japanese universities and institutes for more than 60 years. This project was established in FY2009 originally by Tohoku University, Nagoya University, Kyoto University, Kyushu University, and National Institute of Polar Research, that have been conducting global ground-based network observations of the upper atmosphere, and several other universities and institutes joined in the project later. We present our activities for sharing the data, facilitating interdisciplinary studies of solar-terrestrial physics, and promoting open science.

We have mainly developed two tools, i.e., an analysis software and a metadata database for the upper atmospheric data. The analysis software is based on Space Physics Environment Data Analysis Software (SPEDAS) that is a grass-roots software written by Interactive Data Language (IDL) for space physics community and supports multiple missions. We have provided a plug-in software for SPEDAS, which allows users to load, visualize, and analyze the IUGONET data with SPEDAS. The metadata database enables users to cross-search various kinds of the upper atmosphere data distributed across the IUGONET members. We have registered the metadata of more than 1,000 dataset made in the Space Physics Archive Search and Extract (SPASE) format to our metadata database. Recently, we newly released IUGONET Type-A, which is a one-stop web service based on the metadata database. The IUGONET Type-A provides services to search data, show information of data (i.e., metadata), display quick-look (QL) plot of data, and plot data interactively with SPEDAS. It is useful for users to find interesting solar-terrestrial phenomena and proceed to more detailed analysis of them by using SPEDAS. In order to explain how to use these IUGONET data and tools, we hold tutorial seminars several times a year in Japan and sometimes foreign countries. In addition, we introduce our various activities for data sharing and open science.

Keywords: upper atmosphere, metadata database, data analysis software, solar terrestrial physics, IUGONET project

## Juno-Ground-Radio Observation Support Tools

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In the frame of the NASA/Juno mission, an international support activity with observations in the low frequency radio range has been set up. We are proposing a new set of tools directed to data providers as well as users, in order to ease data sharing and discovery. The data service we will be using is EPN-TAP, a planetary science data access protocol developed by Europlanet-VESPA (Virtual European Solar and Planetary Access). This protocol is derived from IVOA (International Virtual Observatory Alliance) standards. Data from all major decametric radio instruments will contribute: Nançay Decameter Array (France), LOFAR (France, Sweden, Poland), URAN (Ukraine), LWA (USA), Iitate Radio Observatory (Japan), etc. Amateur radio data from the RadioJOVE project is also available. We will first introduce the VO tools and concepts of interest for the planetary radioastronomy community. We will then present the various data formats now used for such data services, as well as their associated metadata. We will finally show various tools that make use of this shared datasets. This activity also supports the development of the ESA/JUICE (Jupiter Icy Moon Explorer) mission, and that of the planetary sciences virtual observatory.

Keywords: Jupiter, Decametric Radio Emissions, Juno, Virtual Observatory

## WDS Asia-Oceania Conference 2017

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The World Data System (WDS) is an Interdisciplinary Body of the International Council for Science (ICSU) with a mission to promote international collaboration on long-term preservation and provision of quality-assessed research data and data services. ICSU-WDS is a membership organization that federates trustworthy scientific data services—and networks thereof—across a range of disciplines in the Natural and Social Sciences, as well as the Humanities. ICSU-WDS has 76 Regular and Network Members and 25 Partner and Associate Members as of December 2016. The Asia–Oceania region comprises 14 WDS Regular Members. The WDS Asia–Oceania Conference 2017 will reinforce the WDS community in this region, and help establish a collaborative system for access to and dissemination of research data. The principal objectives of the conference are: (1) Strengthen collaboration among China, Japan, and countries in the Asia–Oceania region for WDS activities, (2) Build and expand the WDS community in the Asia–Oceania region, (3) Exchange experience on successful applications for WDS membership, (4) Encourage former World Data Centres to join ICSU-WDS, (5) Introduce advanced technologies connected with WDS-oriented activities, and (6) Promote WDS activities in support of Future Earth in the Asia–Oceania region. Details will be seen at <http://wdc2.kugi.kyoto-u.ac.jp/wds2017/>.

Keywords: Science Data, ICSU, WDS, Asia-Oceania

## Minna de Honkoku: online transcription project of earthquake-related historical documents

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We have launched Web-based transcription project “Minna de Honkoku” in January, 2017. The URL is <https://honkoku.org/>. “Minna de Honkoku” is also the name for Web application to realize this online transcription project.

The study of historical earthquake is based on historical documents. In Japan, almost all of the documents are written in Kuzushi-ji. Kuzushi-ji is writing style used before ~1900. Since the style is different from that of modern Japanese, transcription is necessary to use the historical documents as data for earthquake research. Catalogs of historical records such as “New collection of materials for the history of Japanese earthquakes” has been published and used for earthquake research. Although huge number of historical documents survives, the majority of the documents left untranscribed.

We loaded 114 historical documents included in the Ishimoto collection in Earthquake Research Institute Library, the University of Tokyo. We planned to start the transcription project with historical document describing past earthquakes on “Minna de Honkoku”, although the application can be used for any type of historical document.

“Minna de Honkoku” consists of viewer of document image and vertical (Japanese-style) editor for transcription. Users can input transcribed texts viewing its image. The ranking of words transcribed is displayed to keep motivation of users. The edit history and online bulletin board are implemented to enhance communication between users. The application is linked to Kuzushi-ji Learning Application, KuLA developed by Osaka University.

Transcription has been completed for 29 documents out of total 114 documents in 3 weeks. Total number of inputted character is about 700,000.

To finish the transcription of 114 earthquake-related historical document is the main goal of the project. In addition, the Web-based project may attract people who are not interested in local earthquake history and natural disaster.

Keywords: Historical earthquake, Digital Humanities, Web application, Crowdsourcing

# みんなで翻刻

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## Future of Open Science foreseen with society: report on a multi-stakeholder workshop in Japan

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It is important that research projects solve social issues, such as global environmental problems, and the falling birthrate, and the aging population. Here, a transdisciplinary approach is needed in which researchers take co-leadership roles to make decisions to solve issues through the process of the co-design of the research agenda, co-production of knowledge, and co-dissemination of the results, based on equal dialogue and deliberation. It is also noted that *pro bonos*, or skilled volunteers providing technical knowledge such as on ICT technologies and social design, have actively been involved in projects driven by social issues. Therefore, it is anticipated that researchers and *pro bonos*—experts in other words—will increasingly strengthen ties with diverse societal stakeholders and that innovative solutions to social issues will be accelerated by promoting open research data to citizen scientists. These actions may contribute towards promoting the movement of open science by paying more attention to collaboration with society. However, few reports focus on practical methods and problems in promoting open science in this direction.

Aware of this situation, a multi-stakeholder workshop was held in Kyoto in January 2017. The workshop aimed at overviewing the current issues of open science from the multifaceted viewpoints of 37 participants, representing natural and social scientists, governmental officials, local municipality officials, industry managers and employees, *pro bonos*, and librarians, through an unconference-style dialogue, during which the topics of group talk were decided by participants *ad hoc*. One of the group talks revealed the necessity to conventionalize open science in each domain of research. Another group talk shed light on two functions of citizen science—the co-development of data infrastructure and the actions for social transformation. Another group pointed out the importance of the capacity building of bridging agents who facilitate the bidirectional interaction of knowledge systems between researcher communities and other societal actors. This paper recommends the actions required to promote open science in the light of social needs, by reorganizing the results of the workshop.

Keywords: Co-design with society, Foresight, Multi-stakeholder workshop, Science and technology policy, Japan



# Research Data Management towards Open Science: An attempt at NIES

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The open science movement is picking up steam worldwide recently. Opening access to journal articles has been a hot topic in open science for about a couple of decades, but opening access to research data (open data) is another critical component of open science. Open data enables a wider group of researchers to build upon existing knowledge by reusing data in novel ways, resulting in increased citations and opportunities for collaboration. However, except some disciplines that already have a culture of sharing research data at least within the communities, appropriate policies and standards for research data management are not consolidated.

National Institute for Environmental Studies (NIES) has recently started to take action on this issue. It started by request from some researchers about minting Digital Object Identifier (DOI) to the research data, which ended up becoming a member of the Japan Link Center, one of the DOI registration Agencies and started minting DOI to research data since 2016. As the beginning was “bottom-up” rather than “top-down”, it has been “reactive approach” rather than “proactive approach”. A working group for promoting open science has been officially formed in 2017, in order to discuss about the institutional repository, data management policies of the institute.

It is not easy to promote open science as an institute though. There are various disciplines in environmental research and in some disciplines, majority of researchers are still reluctant to make their research data publicly available. Resources (both money and human) available for data management is very limited as well. We will present the situation of our attempts to promote open science and discuss about existing issues as a case study of a research institute.

Keywords: Open Science, Open data, Research data management

## On recognition of "primary data" producers through DOI minted to "secondary" data (derived from primary data)

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In specific scientific disciplines (e.g., Earth and Planetary Sciences), some studies are conducted based on data directly retrieved from experiments, observations, and/or simulation, etc. (hereinafter "primary" data or PD), while there are other studies based on data generated from compilation and/or further data processing of PD (hereinafter "secondary" data or SD). SD is sometimes generated from processing multiple PD products (e.g., at different geographical locations, at different time, at different observational techniques/conditions and so on). In a research field where SD is more popularly used, the current data-DOI mechanism may not be sufficient in supporting data producers to keep sustainability of their data creation/curation/management works of PDs, because it is often difficult to ensure they receive proper recognition (and with it, enhanced reputation) even when SD generated from their PD products are used frequently and correctly cited in a number of research papers. In this paper, we attempt to focus on this difficulty for PD producers and we propose a revision in a metadata schema that enables the PD producers' work is appropriately recognized.

Keywords: Open Science, DOI, Secondary data