Inter-university Upper atmosphere Global Observation NETwork (IUGONET) Metadata Database

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International Workshop on Sharing, Citation and Publication of Scientific Data across Disciplines
Consists of multiple layers between the Sun and the Earth’s surface.
Meridional coupling and horizontal circulation play an important role in the formation of the Earth’s atmosphere.
Phenomena in the upper atmosphere are affected by the energy inputs from both space and lower atmosphere.
Current issues:

- There are a variety of data set (and a variety of file formats for each data).
- Database has been maintained individually by each university / institute.

→ It is time consuming to find, collect, know and analyze the data.

Solutions:

- Development of Metadata Database to cross-search data distributed across many universities and institutes.
  → IUGONET Type-A

- Development of Analysis Software that can handle various types of data in an integrated fashion.
  → SPEDAS/UDAS
• IUGONET handles data obtained by various kinds of instruments.
• So, it is often difficult to understand what data are important and how the data should be analyzed for users’ purpose.

It is important for users to share not only data, but also the information of data!
Data Analysis Software: SPEDAS

- SPEDAS (Space Physics Environment Data Analysis Software) is a grassroots software that can handle data from multiple satellite and ground-based missions.
- Data supported by SPEDAS are basically open and can be easily downloaded via internet with a few commands.
- It is suitable for interdisciplinary study such as space weather.

Data supported by SPEDAS

**Satellite data**
- Stereo
- SOHO
- Wind
- ACE
- IMP-8
- RBSP
- THEMIS
- GOES
- LANL
- NASA
- OMNI
- ERG
- MMS
- POES
- MAVEN

**Ground-based observational data**
- CARISMA Mag.
- GIMA Mag.
- Greenland Mag.
- MACCS Mag.

**IUGONET**
Solar Telescope, Solar and planetary radio telescope, Ionosphere radar (SuperDARN, EISCAT, etc.), Atmosphere radar (MU, EAR, etc.), Meteorological observation data, Geomag. network (WDC, MAGDAS, 210MM, Antarctica, Iceland, etc.)
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IUGONET Metadata Database (Type-A)

IUGONET Type-A  http://search.iugonet.org

It was released on Nov. 1, 2016

One Stop

Output results

Analyze data in detail

Examine data

Know data

Find data

Search data

UDAS web

Contact to PI (Collaboration)

New findings

Extensive Knowledge, Multiple knowledge

UDAS web available

SPEDAS

Cross Disciplines
Search data

http://search.iugonet.org

Search from the lists of some categories such as Instrument/Project and Observed Region

Search by setting keywords, data and time. eg., 2012/03/05~2012/03/11.

The Arase (ERG) satellite was launched at 20:00 (JST) on December 20, 2016 from Uchinoura Space Center, JAXA with an ellipse.
Find data and interesting events

Quick-look display of search results

**Imager data**

Plot/Movie Data: All-sky auroral image taken by the Color Digital SLR Camera at Longyearbyen, Svalbard, Norway

Plot/Movie Data: All-sky auroral image taken by the white-light all-sky camera at Husafell, Iceland

Plot/Movie Data: All-sky auroral image taken by the white-light all-sky camera at Syowa Station, Antarctica

Plot/Movie Data: All-sky auroral image taken by the white-light all-sky camera at Tjörnes, Iceland

Numerical Data: Basic parameters obtained by the 32m ESR

Numerical Data: Basic parameters obtained by the 42m ESR

Plot/Movie Data: Observation data taken by the visible all-sky camera at Shigaraki MU Observatory
Find data and interesting events

Quick-look display of search results

**Satellite data**
- MF radar, Meteor Wind Radar data

**Solar Telescope data**
- Imager data
- MF radar, Meteor Wind Radar data

**Ground data**
- Smart data

**Quick-look display of search results**
- Imager data
- MF radar, Meteor Wind Radar data

**Numerical Data**
- Wind data in the equatorial mesosphere and lower thermosphere estimated from the MF radar observations at Pameungpeuk (NetCDF format)
- Wind data in the mesosphere and lower thermosphere estimated from the observation data of the MF radar at Pontianak (NetCDF format)
- Horizontal wind data in the equatorial mesosphere and lower thermosphere estimated from the meteor radar observations at Blak (NetCDF format)
- Horizontal wind data in the equatorial mesosphere and lower thermosphere estimated from the meteor radar observations at Kototabang (NetCDF format)
Find data and interesting events

Quick-look display of search results

Geomagnetic data

The QL-plot display with the same horizontal axis (time interval) helps users to find scientifically interesting events!
The IUGONET metadata format was created based on SPASE (Space Physics Archive Search and Extract), which is the metadata format developed by international consortium to comprehensively describe research resources regarding heliospheric and magnetospheric satellite observations.
Know how to analyze data

Metadata display page

How to Plot (SPEDAS-CUI #Basic):
IDL> thm_init
THEMIS> timespan, ['2012-03-04 00:00:00', '2012-03-11 00:00:00']
THEMIS> lug_load_gmag_wdc, site='dst', level='provisional'
THEMIS> tplot, 'wdc_mag_dst_prov'

GUI How to plot the data with SPEDAS-GUI.

“How to plot” section shows how to plot the data by the dedicated software “SPEDAS”.

→ Guide users to advanced analysis

CUI #Basic : SPEDAS commands minimally required to plot the data

CUI #Advanced : SPEDAS commands used to create QL plot in the metadata display page.
Select data that you want to plot, then click “Plot”.
The other institutes and universities in the Japanese STP community.

Japanese Geoscience Group

STP community in the Asia/Oceania/ Africa countries

NASA/Virtual Observatory (VMO, VHO, VWO, …)

Metadata Format

Analysis Software

Cross-Searching

Metadata Registration

Support for continuous activity of IUGONET from the international scientific activities and council.

IUGONET welcomes any type of support and feedback from users!
We had data analysis workshop during the 2nd International School on Equatorial and low-latitude ionosphere (ISELLI-2) at Covenant University in Nigeria.

Participants: 38 graduate students.
In order to diffuse the use of our tools and data and also promote research collaboration, we hold data analysis workshops several times a year.

IUGONET tools are often useful for capacity building.

Such data analysis workshops enhance the motivation of the maintenance of the instruments.

We will have the data analysis workshop in Indonesia on March 9, 2018.

Participants: 38 graduate students.
Usage of database

Number of unique users

Number of Page Views (by main foreign countries)

Percentage of website visits accounted for by each country without Japan (2016.10-2017-9, based on PV)

- Japan: 83.62%
- Others: 16.38%

Changes associated with the change into IUGONET Type-A
1. Increase of the number of visitors on the database (about 300→1,500 /month).
2. Mainly, the access from Japan increased. United States became the foreign country that shows the largest number of visitors.
3. The access from foreign countries also increases gradually. → Outreach (i.e., workshop) is important!
Effect on Outcomes

These tools allowed users to

- quickly produce research results. (For example, it is often possible to write papers about the campaign observation within one year after the observation).
- analyze long-term observational data more than 30 years [e.g., Shinbori et al., 2017]
- comprehensively analyze data obtained by many types of instruments at globally distributed observatories [e.g., Takahashi et al., 2017].
- enhance activities of both young scientists and senior scientists. (Even senior scientists can conduct their researches and write the papers using these tools [e.g., Sato et al., 2015; 2017; Noersomadi et al., 2017].)
Conclusions

• The IUGONET project has developed the infrastructure for upper atmospheric research, such as the metadata database (IUGONET Type-A) and data analysis software (SPEDAS).

• IUGONET Type-A provides a one-stop web service to search data, find data (and interesting events), know data, examine data, and guide to advanced analysis. We believe that it should be useful to share data and develop the upper atmospheric science.

• These tools are making an effect on outcome, for examples, they help to quickly produce research results, carry out comprehensive analysis, and enhance activities of young scientists and senior scientists.