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<thead>
<tr>
<th>Title</th>
<th>Inter-university Upper atmosphere Global Observation NETwork (IUGONET)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Author(s)</td>
<td>HAYASHI, Hiroo; KOYAMA, Yukinobu; HORI, Tomoaki; TANAKA, Yoshimasa; KAGITANI, Masato; SHINBORI, Atsuki; ABE, Shuji; KOUNO, Takahisa; YOSHIDA, Daiki; UENO, Satoru; KANEDA, Naoki; YONEDA, Mizuki; IUGONET project team</td>
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<td><a href="http://hdl.handle.net/2433/141788">http://hdl.handle.net/2433/141788</a></td>
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<td>Textversion</td>
<td>author</td>
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Kyoto University
Inter-university Upper atmosphere Global Observation NETwork (IUGONET)

H. Hayashi, Y. Koyama, T. Hori, Y. Tanaka, M. Kagitani, A. Shinbori, S. Abe, T. Kouno, D. Yoshida, S. UeNo, N. Kaneda, M. Yoneda, and IUGONET project team
The IUGONET project aims at building “e-infrastructure” for researchers to effectively find, get, and analyze various kinds of upper atmospheric data spread over universities and institutes.

- To distribute ground-based observational data accumulated over 50 years since IGY (both digital and analogue data)
- To promote analyses of multi-disciplinary data, which will lead to comprehensive studies of mechanisms of long-term variations in the upper atmosphere

Participating universities and research institutes

- Planetary Plasma and Atmospheric Research Center, Tohoku University
- National Institute of Polar Research
- Solar Terrestrial Environment Laboratory, Nagoya University
- Research Institute for Sustainable Humanosphere, Kyoto University
- World Data Center for Geomagnetism, Kyoto University
- Kwasan and Hida Observatories, Kyoto University
- Space Environment Research Center, Kyushu University
Observations by IUGONET institutions

What's the problem?
PROBLEM: Various kind, huge amount of data spread over institutes and universities

SOLUTION: Create a metadata database for cross-search of these distributed data

Promote new types of upper atmospheric research by analysis of multi-disciplinary data

Virtual Information Center for upper atmospheric sci.

Create a metadata database of upper atmospheric data for cross-search

Develop an integrated data analysis tool to handle data from the IUGONET institutes

Finally to other Earth and planetary science fields ...
Design of metadata format

- Many metadata formats available in Earth and planetary sciences!
  - Dublin Core
  - ISO 19115 / 19139
  - GCMD DIF
  - FGDC CSDGM
  - IPY Metadata Profile
  - ISTP Standards
  - SPASE
  - ...

- IUGONET adopted **SPASE**
  - Originally developed to describe research resources regarding heliospheric and magnetospheric satellite observations
  - Closely related to STP and upper atmospheric researches (easy to use as a base format)
  - New metadata elements & words appendable (customizable according to our data)
  - Widely-used in existing Virtual Observatories (possible to exchange metadata)

(http://www.spase-group.org)
Creation of metadata

- The **IUGONET common metadata format** used

  available at http://www.iugonet.org/mdformat.html

```xml
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  xmlns="http://www.iugonet.org/data/schema"
  xsi:schemaLocation="http://www.iugonet.org/data/schema
    http://www.iugonet.org/data/schema/iugonet.xsd">
  <Version>1.0.0</Version>
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    <ResourceHeader>
      <ResourceName>SuperDARN Hokkaido HF radar, common mode data distributed by ERG-SC</ResourceName>
      <ReleaseDate>2009-04-01T00:00:00</ReleaseDate>
      <ExpirationDate>2199-12-31T23:59:59</ExpirationDate>
      <Description>Common mode data generated by SuperDARN Hokkaido HF radar. Data files are distributed in the CDF format through ERG-SC</Description>
    </ResourceHeader>
    ...
    ...
  </NumericalData>
</space>
```

- Metadata file written in XML format ➢ **metadata exchange in future**
- Metadata of each data file, instrument, observatory, and person also created
Development of metadata DB system

- IUGONET adopted DSpace as our metadata DB platform

✓ Free software, widely used by digital repositories in many universities over the world.
✓ Including fundamental functions to register, search, provide, and harvest metadata written in the IUGONET metadata format.
Metadata DB system – search form

- **Keyword search**
- **Time range search**
- **Spatial coverage search**
### Metadata Description

The 10-minute average observation data in the NetCDF (Network Common Data Form) format taken by the equatorial atmosphere radar (EAR) at Kototabang, Indonesia (0.203°S, 100.320°E, 865m MSL), which has been operated in the standard observation mode of the troposphere and stratosphere. The observation data are stored in the NetCDF files of each day. The file name is \((\text{year})(\text{month})(\text{day}).nc\) The NetCDF data include range, height, time, three components of wind velocity, radial Doppler velocity, echo power, spectral width and noise level for each beam number and so on. The azimuth and zenith angles of beam 1, 2, 3, 4 and 5 are \((0, 0), (0, 10), (90, 10), (180, 10)\) and \((270, 10)\), respectively, in unit of degree. The value of \(1.0e+10\) means missing data.

### Acknowledgement

If you acquire EAR data, we ask that you acknowledge us in your use of the data. This may be done by including text such as EAR data provided by Research Institute for Sustainable Humanosphere of Kyoto University.

### Information of Data Access

- **AccessInformation RepositoryID:**
  - spase://IUGONET/Repository/RISH/RISHDB

- **AccessInformation AccessURL URL:**
  - [http://www.rish.kyoto-u.ac.jp/ear/data/index.html](http://www.rish.kyoto-u.ac.jp/ear/data/index.html)

- **AccessInformation Availability:**
  - Online

- **AccessInformation AccessRights:**
  - Open

- **AccessInformation Format:**
  - NetCDF
IUGONET data analysis software (UDAS) = IDL + TDAS

- enable users to easily download, visualize, and analyze various kind of data

THEMIS Data Analysis Software suite - a set of IDL libraries

Able to make stacked plots of time series to compare various kind of data

Easy to handle data even for those who are not familiar with the data by using GUI
Use of metadata DB by analysis software

Planning to use metadata DB from analysis software to get some info (e.g. URL)

1. **Query**
   - User
   - (Data Analysis Software)
   - Observational DB

2. **Metadata**
   - User
   - (Data Analysis Software)

3a. **Load procedure**
   - OpenSearch / SRU / SRW

3b. **Wget**
   - (internal call)

4. **Obs. data**
   - User
   - (Data Analysis Software)

5. **Plot**
   - User
   - (Data Analysis Software)

**IUGONET metadata DB**

**OpenSearch / SRU / SRW**
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<tbody>
<tr>
<td>Virtual Information Center</td>
<td>Installation &amp; stable operation</td>
<td>Install system</td>
<td>Update system</td>
<td></td>
<td></td>
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<td>Construct the integrated research environment (video and/or web conference system, etc.)</td>
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<td></td>
<td>Wrap up the project and discuss further extension of the system to other discipline</td>
</tr>
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<td></td>
<td>Extension to other disciplines</td>
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<td></td>
<td>Design and build the IUGONET metadata DB system on the basis of DSpace</td>
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<tr>
<td></td>
<td>Development</td>
<td>Make prototype</td>
<td>Develop regular system</td>
<td>Release product to public</td>
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<td>Conduct regular operation of the metadata DB and customize it as needed</td>
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<tr>
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<td>Metadata DB system</td>
<td></td>
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<td>Formulate the IUGONET common metadata format and keep updating it if necessary</td>
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<tr>
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<td>Stable operation</td>
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<td>Create metadata in the designated format and register them in the metadata DB system</td>
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<tr>
<td></td>
<td>Design of metadata format</td>
<td>Release ver.1 format</td>
<td>Prepare documents</td>
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<tr>
<td></td>
<td>Creation of metadata</td>
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<tr>
<td></td>
<td>Analysis Software</td>
<td>Specification</td>
<td>Prepare documents</td>
<td></td>
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<td>Design an integrated analysis software to download, visualize, and analyze data provided from the IUGONET institutions</td>
</tr>
<tr>
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<td>Programming</td>
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<td>Develop the IUGONET analysis software by using TDAS (a set of IDL subroutines)</td>
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<td>Rearrangement of observational DBs</td>
<td>Rearrange DBs corresponding to metadata &amp; software development</td>
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<td>Rearrange existing observational DBs and newly compile DBs of undatabased items</td>
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<td>Scientific researches</td>
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<td></td>
<td>Conduct scientific researches with the IUGONET products</td>
<td>Do interdisciplinary researches using various data from the IUGONET institutions</td>
</tr>
<tr>
<td></td>
<td>Management of project website</td>
<td>Build project homepage</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Provide project information to the public through the website</td>
</tr>
</tbody>
</table>
The IUGONET metadata database and analysis software have just been **beta-released**!

http://search.iugonet.org/iugonet


**UDAS (IUGONET Data Analysis Software)**

**Topics**
- UDAS v1.00.01 was released on May 13, 2011. → Download UDAS

**What is UDAS?**
We provide users with IUGONET Data Analysis Software (UDAS) to read and analyze ground-based observational data opened individually by each institution in the IUGONET project.

- UDAS is a plug-in software of THEMIS Data Analysis Software suite (TDAS), which has many useful routines to visualize and analyze time series data.
- It accesses the IUGONET data through the internet, and then the data are automatically downloaded onto the user’s computer. Users can get and analyze the data without any concerns about data locations.
- The loaded data and/or plots can be exported to a variety of data format (ASCII, PNG, JPEG, PS, EPS, etc.).
- CUI (Graphical User Interface) as well as the CUI (Character User Interface) is supplied for beginners.
- Even users who do not have the IDL commercial license will be able to use the CUI-based UDAS on the IDL Virtual Machine* (Under development)

* The IDL Virtual Machine is a freely distributed, cross-platform utility for running compiled IDL codes. The IUGONET project will distribute compiled IDL codes of the data analysis software.

**Getting started**
- View screenshots
- List of load procedures and corresponding IUGONET observations

**Data Policy**
When you use the IUGONET data, please check the data policy for each data set. The data policy will be displayed in the console, when you run the load procedures on IDL. It is also possible to search the data policy at the IUGONET Metadata Database.

**Collaborations**

➢ We welcome your feedback
The IUGONET project builds e-infrastructure (metadata database and analysis software) to promote effective use of upper atmospheric data taken by various ground-based observations.

The IUGONET products have just been beta-released!

Metadata database: http://search.iugonet.org/iugonet/

The IUGONET project plans to expand this system to other types of data (satellite & simulation) and to other countries. We also would like to collaborate with other disciplines to build more comprehensive system.
The Inter-university Upper atmosphere Global Observation NETwork (IUGONET) is a six-year research project of the National Institute of Polar Research (NIPR), Tohoku University, Nagoya University, Kobe University, and Kyushu University to build a metadata database (MDB) of ground-based observations of the upper atmosphere. We have various kinds of observational data acquired so far by a global network of radars, magnetometers, optical sensors, heliographs, etc., but these data are archived in individual databases at each site. By developing the MDB, which will give the location and other information about the observational data, we intend to provide researchers with a seamless data environment linking databases spread across the member institutions. This MDB will be of great help in conducting comprehensive analyses with various observational data to clarify the mechanisms of the long-term variations in the upper atmosphere.