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<th>Title</th>
<th>Metadata database and data analysis software for the ground-based upper atmospheric data developed by the IUGONET project</th>
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Kyoto University
The Inter-university Upper Atmosphere Global Observation Network (IUGONET) is a Japanese inter-university project by the National Institute of Polar Research (NIPR), Tohoku University, Nagoya University, Kyoto University, and Kyushu University to build a database of metadata for ground-based observations of the upper atmosphere. The IUGONET institutes/universities have been collecting various types of data by radars, magnetometers, photometers, radio telescopes, helicopters, etc., to make available to locations all over the world and at various altitude layers from the Earth’s surface to the Sun. The metadata database will be of great help to researchers in efficiently finding and obtaining these observational data spread over the institutes/universities. This should also facilitate synthesis analysis of multidisciplinary data, which will lead to new types of research in the upper atmosphere.

The project has also been developing a software to help researchers download, visualize, and analyze the data provided from the IUGONET institutes/universities.

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**IUGONET project**

- The IUGONET universities/institutes have been leading ground-based observations of the upper atmosphere for decades.
- We have various kinds of observational data acquired or cooperative observational networks (radars, magnetometers, photometers, radio telescopes, helicopters, etc.).
- Our observations cover all over the world and wide altitude range from the Earth’s surface up to the Sun’s surface.

**Metadata format**

- **IUGONET common metadata format = SPADE + modifications**

  - The IUGONET development team investigated widely used metadata formats in Earth and planetary sciences in the context of the IUGONET common metadata format, among which we selected SPADE data model/metadata format as the base of our metadata format because it matches the upper atmospheric data and holds expandability in any kinds of observational data.
  - A few modifications according to our observations of our ground-based observational data, have been done to:
    - Add a number of important digital ground-based observatories all over the world.
    - Add a number of relevant observational data.
  - The current version of the IUGONET Common-Metadata Format is 1.3.3 (in XMI scheme) which is available at [http://www.iugonet.org](http://www.iugonet.org)

**Datasets to be registered**

- Currently 732 metadata files of “Numerical Data” and “Display Data” are registered in the IUGONET metadata database. We are now talking with more researchers and research institutes who are interested in registering metadata of their ground-based observations of the upper atmosphere into the IUGONET metadata database. The number of registered metadata will be continuously increasing.

**Analysis software (UDAS)**

- The beta version of the IUGONET data analysis software, named UDAS (currently version 1.0.0), can be downloaded from the project website at [http://www.iugonet.org/ensoftware.html](http://www.iugonet.org/ensoftware.html).

- The UDAs is written in IDL (Interactive Data Language) which is widely used in the field of solar and terrestrial physics. We are developing the software on the basis of TDAS (Thomson Data Analysis Software). The UDAs is distributed as a plug-in of TDAS to handle data provided from the IUGONET universities/institutes.

- The TDAS already contains a lot of useful functions to enable users to download, visualize, and analyze various kinds of data. It is easy to make quick plots of time series in order to compose various kind of data at one time.

- The UDAs accesses 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 knowing data file locations.

- Users don’t have to take care of data formats when analyzing the data. The data downloaded and plots created can be exported to a variety of data formats (ASCII, PNG, JPG, EPS, etc.).

- **GUI (Graphical User Interface**) as well as **CUI (Character User Interface)** is available so that even users who are not familiar with the data can visualize and analyze them.

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- We acknowledge the cooperation and practical contribution of the TDAS Science Support Team in allowing us to use TDAS for our data analysis software (UDAS).

- The UDAs has been developed in collaboration with the ERI (Energetics and Radiation in Geospace) Science Center.

- SuperSANS/KSM radar data was provided by the National Institute of Information and Communications Technology (NICT) through ERI/SC. The IDL procedures for the data in UDAs was developed in collaboration with NICT.