

## The IUGONET project and its international cooperation on development of metadata database for upper atmospheric study

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The upper atmospheric observational study is the area which institutional and international collaborations are crucially important. In order to investigate the mechanism of long-term variations in the upper atmosphere, we need to combine various types of in-situ observations and to accelerate data exchange. The Japanese Inter-university Upper atmosphere Global Observation Network project (2009?2015), IUGONET, is an inter-university program 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 institutions have been archiving observed data by radars, magnetometers, photometers, radio telescopes, helioscopes, etc. in various altitude layers from the Earth's surface to the Sun. The IUGONET has been developing systems for searching metadata of these observational data, and the metadata database (MDB) has already been operating since 2011. It adopts DSPACE system for registering metadata, and it uses an extension of the SPASE data model of describing metadata, which is widely used format in the upper atmospheric society including that in USA. Hence, these systems can be extended to incorporate other formatted data which are used in the STP community, and we are incorporating the metadata of the data obtained by the cooperative institutions such as NAOJ, NICT and Kakioka Magnetic Observatory of JMA.

The European Union project ESPAS (2011?2015) has the same scientific objects with IUGONET, namely it aims to provide an e-science infrastructure for the retrieval and access to space weather relevant data, information and value added services. It integrates 22 partners in European countries. The ESPAS also plans to adopt SPASE model for defining their metadata, but search system is different. Namely, in spite of the similarity of the data model, basic system ideas and techniques of the system and web portal are different between IUGONET and ESPAS. In order to connect the two systems/databases, we are planning to take an ontological method. The SPASE keyword vocabulary, derived from the SPASE data model shall be used as standard for the description of near-earth and space data content and context. The SPASE keyword vocabulary is modeled as Simple Knowledge Organizing System (SKOS) ontology. The SPASE keyword vocabulary also can be reused in domain-related but also cross-domain projects. The implementation of the vocabulary as ontology enables the direct integration into semantic web based structures and applications, such as linked data and the new Information System and Data Center (ISDC) data management system.

Keywords: database, metadata, atmosphere, earth science, international collaboration