

# Global Observing Systems Datasets in the Global Change Master Directory

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## ABSTRACT

The Global Observing System Information Center (GOSIC) (<http://gotic.org>) is intended to provide a single point of access to data and information, observational requirements, data flows, and products within the three observing systems: Global Ocean Observing System (GOOS), Global Terrestrial Observing System (GTOS) and the Global Climate Observing System (GCOS). NASA's Global Change Master Directory (GCMD), an information system for locating and discovering Earth science datasets relevant to global change research (<http://gcmd.nasa.gov>) and GOSIC have formed a collaboration whereby metadata for these global observing systems datasets can be easily located and retrieved through the GCMD database.

## INTRODUCTION

The Global Observing Systems Information Centre (GOSIC) is intended to provide a single point of access to data and information, observational requirements, data flows, and products within the three global observing systems: Global Ocean Observing System (GOOS), Global Terrestrial Observing System (GTOS), and Global Climate Observing System (GCOS). NASA's Global Change Master Directory (GCMD), an information system for locating and discovering Earth science datasets relevant to global change research, and GOSIC have formed a collaboration whereby metadata for GTOS, GOOS and GCOS datasets can be located and retrieved through the GCMD database.

## GOSIC BACKGROUND

GOSIC is a data and information center in support of the three Global Observing Systems. The development of GOSIC is intended to create a system that meets scientific requirements and is carried out in accordance with guidelines and recommendations established by the steering committees of the three global observing systems. GOSIC will become operational under the management of the US NOAA National Climatic Data Center (NCDC) in 2006.

The role of GOSIC is to:

- Function as a central source for all global observing systems data and by providing information on observing requirements,

operational data systems, and access procedures for finding and obtaining global observing systems data and products.

- Provide users with the ability to search for and identify the availability, the data processing status, the location(s), and the accessibility of relevant data.

- Provide users with metadata to determine if data meet their requirements in terms of content, coverage, and quality. GOSIC collaborates with NASA's GCMD to provide metadata from the three global observing systems.

- Provide access to an integrating overview of the management and development of the three global observing systems programs, including such things as observing requirements and standards and terms of reference of the panels and expert teams.

GCOS, GOOS and GTOS are international programs that provide a systematic and comprehensive global set of observations that will allow participating nations to:

- Detect climate change at the earliest possible time
- Document natural climate change variability and extreme climate events
- Model, understand, and predict climate variability and change
- Assess the potential impact on ecosystems and socio-economics

- Develop strategies to diminish potentially harmful effects
- Support sustainable development



**Figure 1.** GOSIC Home Page. Provides access to Global Observing System data and information. (<http://gosic.org>)

These global observing systems use a variety of observation methods, ranging from space platforms to in-situ measurements. They encompass all components of the climate system including the atmosphere, biosphere, cryosphere, hydrosphere, and land surface, as well as socio-economic relationships. They use existing operational programs such as the World Weather Watch and the Global Atmospheric Watch (GAW), and ongoing research programs, such as the Global Climate Precipitation Project, the Global Energy and Water Cycle Experiment, the Climate Variability and Predictability Program, and other elements of the World Climate Research Program. The GOSIC web site can be accessed at <http://gosic.org>.

## GCMD BACKGROUND

Since 1994, NASA's GCMD has facilitated the search and discovery of Earth science datasets for global change research through online and web-based interfaces (Figure 2). Over 15,000 Earth science dataset descriptions (or metadata) can be searched from the following areas:

- Agriculture and food production
- Atmosphere, meteorology and climatology including past climate changes

- (paleoclimatology)
- Biosphere, biodiversity, and ecosystems studies
- Land surface processes and land-cover changes
- Human dimensions of climate change such as land use, population and health
- Hydrology, including surface and ground water processes
- Oceanography and ocean-atmosphere climate patterns such as El Nino
- Snow and ice dynamics, including glaciological and polar processes
- Geophysics and geological processes
- Sun-Earth interactions
- Imagery and satellite remote sensing

Researchers can also discover over 1000 Earth science dataset services and tools, such as data analysis and visualization tools, data handling tools, models, and educational resources. Users can select Earth science services keywords to query the database or use free-text to locate dataset services of interest.



**Figure 2:** GCMD Home Page. Search by Earth science or services keywords or free-text. (<http://gcmd.nasa.gov>)

Successful retrieval of information depends on well-structured metadata and comprehensive indexing of records from a controlled vocabulary, combined with well-populated text fields to enhance free-text searching. An extensive Earth science keyword vocabulary has been developed to describe Earth science data products for global change research. Earth science keywords are arranged in a tiered

hierarchy and every metadata record is indexed with one or more of these keywords. The syntax of the science keyword hierarchy is:

TOPIC > TERM > VARIABLE > detailed variable

TOPIC, TERM, VARIABLE are controlled Earth science keywords and the detailed variable is an uncontrolled, yet searchable word or phrase that provides a higher level of descriptor detail. For example:

*Oceans > Ocean Chemistry > Carbon Dioxide > partial carbon dioxide*

*Oceans* is the TOPIC

*Ocean Chemistry* is the TERM

*Carbon Dioxide* is the VARIABLE

*Partial carbon dioxide* is an uncontrolled detailed variable

Currently the GCMD has over 1200 Earth science keywords, which allow dataset providers to choose to classify their dataset descriptions and allow users to select keywords to query the GCMD database. Users can also form their own query by using any keywords or phrases. Metadata authoring tools are available for data providers to update or create new metadata descriptions.

## FINDING GOSIC DATASET INFORMATION

To meet the information needs of the GOSIC community, several information technology applications have been utilized. These include tools for metadata interoperability, database access over the Internet using an API, and customized search interfaces.

### *GCMD portals for easier access to GOSIC information*

Customized views of the database have been created so that users only need search a subset of the 15,000+ available metadata records. These views, or portals, provide a customization of information content to meet the needs of the Earth science community. The information content viewable through the portal represents a subset of the information in the GCMD database. Portal content can be based on science keywords, projects, data center, or any combination of terms that are available in the GCMD database.

Portals have been created for each of GCOS, GTOS, and GOOS to provide search and retrieval of GOSIC dataset information

(<http://gcmd.nasa.gov/Data/portals/gosic>). [See Figure 3]. To date, more than 350 Global

Observing Systems (GOS) datasets have been identified and entered into the GCMD. The GCMD-GOSIC collaboration allows users to quickly locate datasets of interest from the global observing systems portals, and where possible, download the data.



**Figure 3:** GOSIC Portal. Provides search capabilities for dataset information from the Global Observing Systems.

(<http://gcmd.nasa.gov/Data/portals/gosic>)

### *Metadata exchange with GOSIC-identified datasets*

Other data contributors to the GOS have their own metadata catalogs, yet desire to have their metadata records searchable through the GCMD-GOSIC portals. Fortunately, information technologies are available to assist in the process of translating between different metadata formats. The GCMD and GOSIC, along with NCDC, a major data provider to the GOS, began discussions to determine how to streamline the process of exchanging metadata. Because both GCMD and NCDC hold metadata in the eXtensible Markup Language (XML) format, both organizations were in a position to utilize the latest tools available for translating XML. The eXtensible Stylesheet Language Transformation (XSLT), Version 1.0, is the W3C standard for translating one XML document to another. XSLT was applied to transform NCDC's Content Standard for Digital Geospatial Metadata (CSDGM) metadata to the

metadata format used in the GCMD (Directory Interchange Format (DIF)) so that NCDC metadata records could be represented in the GCMD database and available through the GOSIC portals. The GCMD has found that XSLT produces a more accurately translated metadata file with less loss of information and mismatched fields. Therefore, minimal manual manipulation is required, and the time it takes to synchronize the database has been significantly reduced.

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## **FUTURE INTERACTIONS**

GCMD and GOSIC representatives will continue to work on enhancing the set of scientific keywords for indexing and searching for GOS datasets, increasing the population of the GCMD with global observing system datasets and using geospatial technologies for improved search and retrieval. The GTOS TEMS was recently identified as a major platform for metadata exchange through the GTOS Data Matrix. Further improvements in query refinement and management of GTOS datasets will meet the data and metadata needs of the global change community. GCMD and GOSIC are expanding the efforts undertaken with GTOS to the GCOS and GOOS communities.

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