15A.3 AN UPDATE ON THE GLOBAL OBSERVING SYSTEMS INFORMATION CENTER (GOSIC) PORTAL: DEVELOPMENT OF NEW DATA ACCESS TOOLS

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1. Introduction

The Global Observing Systems Information Center (GOSIC) provides users with a centralized resource to aid in finding datasets and information related to the Global Climate Observing System (GCOS), the Global Ocean Observing System (GOOS) and the Global Terrestrial Observing System (GTOS) and their partner programs, such as the Global Atmosphere Watch (GAW) and regional observing systems, such as the GOOS Regional Alliances (GRA), in a consistent fashion across a diverse array of international data centers and atmospheric, oceanic and terrestrial observing domains. The GOSIC Portal (http://gosic.org) provides a variety of search tools for data access and retrieval including newly developed data access matrices. Among the new matrices are ones that allow searching by Essential Climate Variable (ECV), GCOS/GTOS & GCOS/GOOS cross program activity, and Ocean Data themes or categories, such as Ocean Carbon Data, and Ocean Chemical Data. These new search tools are discussed in this paper.

2. Background

In response to a need identified by the global climate observing community for easier and more effective access to observational climate data and information, the GOSIC was established in 1997 at the request of the GCOS Steering Committee as a pilot project to develop methods for easy on-line access to the comprehensive base of Global Observing Systems data and information. Under a National Oceanic and Atmospheric Administration (NOAA) grant, the GOSIC was developed at the University of Delaware, College of Marine Studies, building on their experience with international climate research program information systems. Since 2007, the GOSIC has become operational and is a facility operated by the U.S. Global Climate Observing System (US GCOS) program based at National Oceanic and Atmospheric Administration's (NOAA) National Climatic Data Center (NCDC), and is run on behalf of the international observing community.

Guidance and evaluation of the GOSIC is provided by the Scientific Steering Committees of the three observing systems as well as by the GOSIC users. The GOSIC reports at these meetings and receives directions for further development. Formal performance reviews were conducted in 2001 and 2003 by groups appointed by each observing system, and the results of these were extremely helpful in shaping the form and function of the GOSIC.

The GOSIC portal does not in and of itself hold data, but rather serves as a data access service by providing a common access point to global and regional data sets and analyses for use in various aspects of climate research. The portal functions by maintaining metadata and pointers to the data centers to access data and information, and does not create or modify the presentation of data. If data centers identify the programs that are the source of data and information on a database or product, then the acknowledgement will appear on the GOSIC portal. The GOSIC, in a collaborative partnership with NASA, uses the Global Change Master Directory (GCMD) to provide users with metadata on a variety of global observational data sets. In general the GOSIC portal seeks to: (1) provide a capability to search for data and information across all participating global observing systems' data centers using the Internet; (2) return results regardless of the data format, or where the data are located; (3) provide results back in a standard easy-to-read, easy-to-understand format; (4) allow users to determine the type and quality of the data through documentation provided by the participating data centers; and (5) allow users to obtain data sets as easily as possible with minimal amounts of steps.

3. Development of New Data Access Tools

The GOSIC staff has developed a variety of user friendly data search tools that provides users with access to data sets and derived products. The most outstanding feature of the GOSIC is its ability to help users navigate hundreds of data centers across the globe and get to the data they want in an effective and efficient manner.

By user request, several matrices have been developed in order to provide quick overviews and efficient access to data; one such matrix provides users with access to global observing systems terrestrial data by variable type (e.g., biodiversity, climate, coastal, land and water) (http://gosic.org/ios/GTOS_observing_system.asp) while another one in development provides access to global datasets via the 44 GCOS Essential Climate Variables (ECV). Given the importance of the GCOS ECVs to a number of climate monitoring applications, this matrix in particular is proving to have a high degree of utility for a number of users and this will only increase

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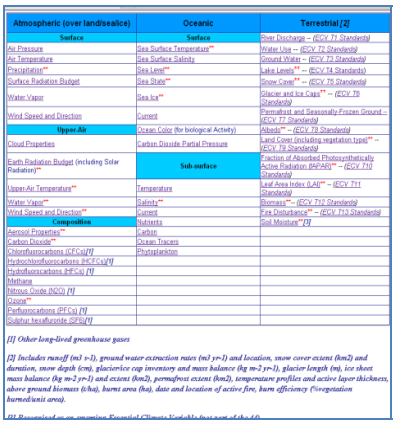
as it evolves. The ECV Matrix (Figure 1) is available at http://gosic.org/ios/MATRICES/ECV/ecv-matrix.htm .



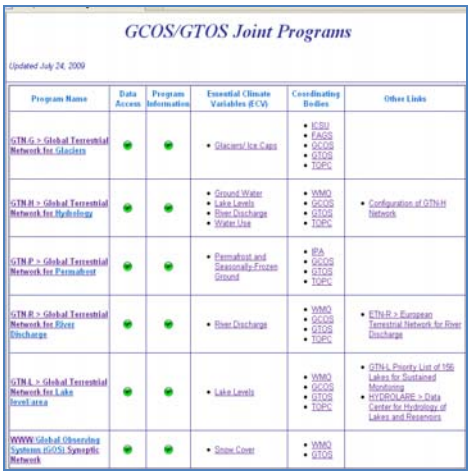
Atmospheric (over land/sea/ice)	Oceanic	Terrestrial [2]
Surface	**Surface**	River Discharge -- (ECV 71 Standards)
Air Pressure	Sea Surface Temperature**	Water Use -- (ECV 72 Standards)
Air Temperature	Sea Surface Salinity	Ground Water -- (ECV 73 Standards)
Precipitation**	Sea Level**	Lake Levels** -- (ECV 74 Standards)
Surface Radiation Budget	Sea State**	Snow Cover** -- (ECV 75 Standards)
Water Vapor	Sea Ice**	Glaciers and Ice Caps** -- (ECV 76 Standards)
Wind Speed and Direction	Current	Permafrost and Seasonally-Frozen Ground -- (ECV 77 Standards)
Upper-Air	Ocean Color (for biological Activity)	Albedo** -- (ECV 78 Standards)
Cloud Properties	Carbon Dioxide Partial Pressure	Land Cover (including vegetation type)** -- (ECV 79 Standards)
Earth Radiation Budget (including Solar Radiation)**	**Sub-surface**	Fraction of Absorbed Photosynthetically Active Radiation (fAPAR)** -- (ECV 710 Standards)
Upper-Air Temperature**	Temperature	Leaf Area Index (LAI)** -- (ECV 711 Standards)
Water Vapor**	Salinity**	Biomass** -- (ECV 712 Standards)
Wind Speed and Direction**	Current	Fire Disturbance** -- (ECV 713 Standards)
Composition	Nutrients	Soil Moisture** [3]
Aerosol Properties**	Carbon	
Carbon Dioxide**	Ocean Tracers	
Chlorofluorocarbons (CFCs) [1]	Phytoplankton	
Hydrochlorofluorocarbons (HCFCs) [1]		
Hydrofluorocarbons (HFCs) [1]		
Methane		
Nitrous Oxide (N2O) [1]		
Ozone**		
Perfluorocarbons (PFCs) [1]		
Sulphur hexafluoride (SF6) [1]		

[1] Other long-lived greenhouse gases

[2] Includes runoff (m3 yr-1), ground water extraction rates (m3 yr-1) and location, snow cover extent (km2) and duration, snow depth (cm), glacier/ice cap inventory and mass balance (kg m-3 yr-1), glacier length (m), ice sheet mass balance (kg m-2 yr-1) and extent (km2), permafrost extent (km2), temperature profiles and active layer thickness, above ground biomass (t/ha), burnt area (ha), date and location of active fire, burn efficiency (%vegetation burned/unit area).

Figure 1: The ECV Matrix (partial view)

Two newly available matrices show the joint programs and overlap of the observing systems so users can search for data that observing systems have in common. This is a unique feature of the GOSIC Portal. The GCOS/GTOS joint program matrix (Figure 2) is available at http://gosic.org/ios/GCOS-GTOS-matrix.htm.



GCOS/GTOS Joint Programs

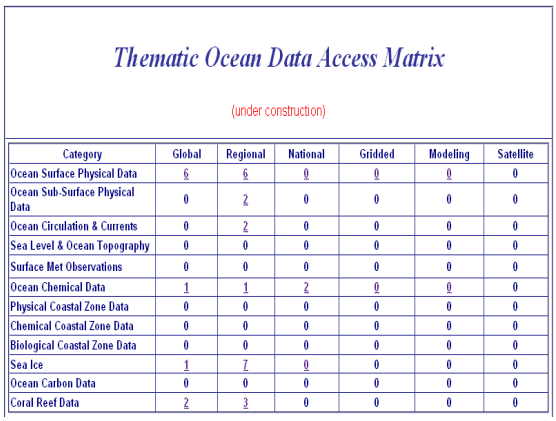
Updated July 24, 2009

Program Name	Data Access	Program Information	Essential Climate Variables (ECV)	Coordinating Bodies	Other Links
GTN.G > Global Terrestrial Network for Glaciers	●	●	• Glaciers/ Ice Caps	• ICSU • FAGS • GCOS • GTOS • TOPC	
GTN.H > Global Terrestrial Network for Hydrology	●	●	• Ground Water • Lake Levels • River Discharge • Water Use	• WMO • GCOS • GTOS • TOPC	• Configuration of GTN-H Network
GTN.P > Global Terrestrial Network for Permafrost	●	●	• Permafrost and Seasonally-Frozen Ground	• IPA • GCOS • GTOS • TOPC	
GTN.R > Global Terrestrial Network for River Discharge	●	●	• River Discharge	• WMO • GCOS • GTOS • TOPC	• ETN-R > European Terrestrial Network for River Discharge
GTN.L > Global Terrestrial Network for Lake Level area	●	●	• Lake Levels	• WMO • GCOS • GTOS • TOPC	• GTN-L Priority List of 156 Lakes for Sustained Monitoring • HYDROLARE > Data Center for Hydrology of Lakes and Reservoirs
WWW Global Observing Systems (GOS) Synoptic Network	●	●	• Snow Cover	• WMO • GTOS	

Figure 2: GCOS/GTOS Joint Program Matrix

The GCOS/GOOS matrix is available at http://gosic.org/ios/GCOS-GOOS-matrix.htm.

Another Matrix in development by user request allows users to search ocean data by theme such as Ocean Surface Physical Data or Ocean Carbon Data (Figure 3) (http://gosic.org/ios/MATRICES/OCEAN-DATA-ACCESS/Ocean-Data-Access-matrix.htm).



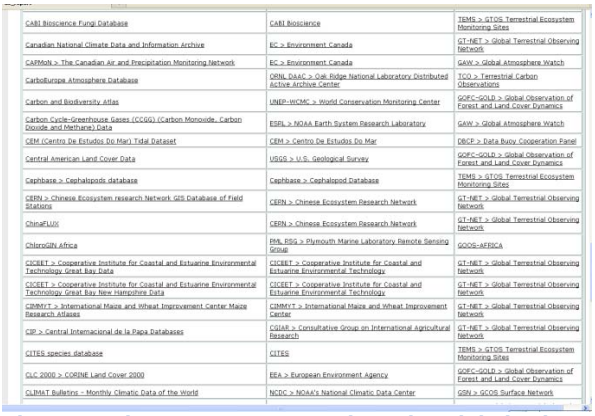
Thematic Ocean Data Access Matrix

(under construction)

Category	Global	Regional	National	Gridded	Modeling	Satellite
Ocean Surface Physical Data	6	6	0	0	0	0
Ocean Sub-Surface Physical Data	0	2	0	0	0	0
Ocean Circulation & Currents	0	2	0	0	0	0
Sea Level & Ocean Topography	0	0	0	0	0	0
Surface Met Observations	0	0	0	0	0	0
Ocean Chemical Data	1	1	2	0	0	0
Physical Coastal Zone Data	0	0	0	0	0	0
Chemical Coastal Zone Data	0	0	0	0	0	0
Biological Coastal Zone Data	0	0	0	0	0	0
Sea Ice	1	7	0	0	0	0
Ocean Carbon Data	0	0	0	0	0	0
Coral Reef Data	2	3	0	0	0	0

Figure 3: Thematic Ocean Data Access Matrix

Another search tool, the GOSIC Data Registry (Figure 4) allows users to search all global observing system data and metadata within the GOSIC Portal. Users can search cross observing systems by key word, data center, program and metadata (http://gosic.org/Datasets/ds-report.asp).



CABI Bioscience Fungi Database	CABI Bioscience	TEMS > GTOS Terrestrial Ecosystem Monitoring Sites
Canadian National Climate Data and Information Archive	EC > Environment Canada	GT-NET > Global Terrestrial Observing Network
CAPMoN > The Canadian Air and Precipitation Monitoring Network	EC > Environment Canada	GAW > Global Atmosphere Watch
CarboEurope Atmosphere Database	ORNL DAAC > Oak Ridge National Laboratory Distributed Active Archive Center	TCO > Terrestrial Carbon Observations
Carbon and Biodiversity Atlas	UNEP-WCMC > World Conservation Monitoring Center	GOFC-GOLD > Global Observation of Forest and Land Cover Dynamics
Carbon Cycle-Greenhouse Gases (CCGG) (Carbon Monoxide, Carbon Dioxide and Methane) Data	ESRL > NOAA Earth System Research Laboratory	GAW > Global Atmosphere Watch
CEM (Centro De Estudos Do Mar) Tidal Dataset	CEM > Centro De Estudos Do Mar	DBCP > Data Buoy Cooperation Panel
Central American Land Cover Data	USGS > U.S. Geological Survey	GOFC-GOLD > Global Observation of Forest and Land Cover Dynamics
Cephbase > Cephalopods database	Cephbase > Cephalopod Database	TEMS > GTOS Terrestrial Ecosystem Monitoring Sites
CERN > Chinese Ecosystem research Network GIS Database of Field Stations	CERN > Chinese Ecosystem Research Network	GT-NET > Global Terrestrial Observing Network
ChinaFLUX	CERN > Chinese Ecosystem Research Network	GT-NET > Global Terrestrial Observing Network
ChloroGIN Africa	PML RSG > Plymouth Marine Laboratory Remote Sensing Group	GOOS-AFRICA
CICEET > Cooperative Institute for Coastal and Estuarine Environmental Technology Great Bay Data	CICEET > Cooperative Institute for Coastal and Estuarine Environmental Technology	GT-NET > Global Terrestrial Observing Network
CICEET > Cooperative Institute for Coastal and Estuarine Environmental Technology Great Bay New Hampshire Data	CICEET > Cooperative Institute for Coastal and Estuarine Environmental Technology	GT-NET > Global Terrestrial Observing Network
CIMMYT > International Maize and Wheat Improvement Center Maize Research Atlases	CIMMYT > International Maize and Wheat Improvement Center	GT-NET > Global Terrestrial Observing Network
CIP > Central Internacional de la Papa Databases	CGIAR > Consultative Group on International Agricultural Research	GT-NET > Global Terrestrial Observing Network
CITES species database	CITES	TEMS > GTOS Terrestrial Ecosystem Monitoring Sites
CLC 2000 > CORINE Land Cover 2000	EEA > European Environment Agency	GOFC-GOLD > Global Observation of Forest and Land Cover Dynamics
CLIMAT Bulletins - Monthly Climatic Data of the World	NCDC > NOAA's National Climatic Data Center	GSN > GCOS Surface Network

Figure 4: The GOSIC Data Registry (partial view)

4. The GOSIC's Role in Facilitating Community Access to Climate Data

The basic tenet of physical climate data management at NOAA is full and open data access. All raw physical climate data available from NOAA's various climate observing systems as well as the output data from state-of-the-science climate models are openly available in as timely a manner as possible. The timeliness of such data is dependent upon its receipt and the associated quality control procedures necessary to ensure that the data are valid. In addition, the latest versions of all derived data sets are made available to the public. NOAA also provides access to all of it major climate-related model simulations.

NOAA is a strong advocate of the scientific peer review process. Our major climate products are derived from algorithms that have been reviewed and published in the open peer-reviewed literature. This helps to

ensure adequate information is available about the algorithms used to transform data into our many hundreds of climate-related products.

NOAA participates in numerous international and national scholarly bodies whose goal is to increase the accessibility of data worldwide. This includes the Global Earth Observation System of Systems (GEOSS), the Global Climate Observing System (GCOS), the World Meteorological Organization (WMO), the Intergovernmental Oceanographic Commission, the International Council of Science (ICSU), and other international bodies dedicated to the exchange and open-access of climate-related data.

The World Data Center (WDC) system was created under the auspices of the International Council for Science (ICSU) to archive and distribute data collected from the observational programs of the 1957-1958 International Geophysical Year. Originally established in the U.S., Europe, Russia, and Japan, the WDC system has since expanded to other countries and to new scientific disciplines. The WDC system now includes 50 Centers in 12 countries. NOAA hosts a total of 5 WDCs at its 3 National Data Centers (2 at the National Climatic Data Center (NCDC); 2 at the National Geophysical Data Center, and 1 at the National Oceanographic Data Center) covering a wide range of thematic disciplines including meteorology, climatology, paleoclimatology, oceanography, marine geology and geophysics, and solar terrestrial physics. The WDC system has worked very well in the context of the NOAA National Data Center structure, as it provides a non-governmental portal that in many cases allows a much easier and more seamless. Its holdings include a wide range of solar, geophysical, environmental, and human dimensions data.

Navigating all those international data centers can sometimes be a bit daunting, and that is where the GOSIC plays a key role to try and help people get to international climate related datasets as easily as possible. The GOSIC is also flexible enough to present new views to data as required, and NCDC continues to work on improving the interface to data from many global and national data centers, along with the associated metadata holdings. The GOSIC also has a presence on the GEOSS data portal (GEOportal) in order to further the availability of climate data.

The key for the GOSIC to continue its value to the community is in continuing to publicize its functionality to the scientific community. As such, an article on the GOSIC was published in the September 29, 2009, edition of *EOS* (http://www.agu.org/pubs/crossref/2009/2009EO390001.shtml).

5. Conclusion

The unique value the GOSIC Portal offers its users is the ability to search for global observing system data, products and metadata, using a variety of tools such as matrices, registries and search by key word, global observing system(s), data center, program, theme, and variable, and quickly link, with the least amount of steps, to a wide range of downloadable data sets that reside at multiple data centers around the world via a consistent and user friendly interface.

The newly developed matrices such as the Essential Climate Variables (ECV) Matrix, the GCOS/GTOS & GCOS/GOOS Joint Program Matrices, and Thematic Ocean Data Access Matrix give the users a quick overview of available data that can easily be accessed and downloaded.

The GOSIC is constantly evolving to help meet users' data access needs. The GOSIC staff is quite open to incorporating new features and improving existing ones, as well in collaborating with other global environmental data access activities.