GCW Data Protocol

Introduction

The World Meteorological Organization's Global Cryosphere Watch (GCW – see globalcryospherewatch.org) is an international mechanism for supporting observations of all components of the Earth´s cryosphere, including snow cover, glaciers, ice caps, ice sheets, sea ice, lake and river ice, permafrost, seasonally frozen ground, and solid precipitation. GCW aims to provide authoritative, clear, and useable data, information, and analyses on the past, current and future state of the cryosphere. Improving access to data and products is a fundamental objective of GCW.

The core of the GCW surface observing network is called *CryoNet*. This network is comprised of *stations* and *sites* which meet certain requirements. The GCW surface network is a component of the WMO Integrated Global Observing System (WIGOS). Through WIGOS and the WMO Information System (WIS), GCW provides a fundamental contribution to the Global Earth Observations System of Systems (GEOSS).

The principles enshrined in this GCW Data Protocol must be applied to qualified data from each station and site operated under the auspices of GCW, including submission of metadata and data per an agreed timetable. The GCW CryoNet Team is responsible for the Data Protocol. Questions about the policy and its implementation should be directed to the CryoNet Team lead.

Objectives

The purpose of the GCW Data Protocol is to support the objectives of the Global Cryosphere Watch, which include the development of CryoNet, data and information delivery on the state of the cryosphere, and the creation of a data portal. The objective of GCW data management is to ensure the security, integrity, accessibility and free exchange of relevant data that support current research and future use of the data. The GCW Data Protocol provides initial guidance for meeting this objective. More detailed guidance is provided in separate GCW documents.

Data definition

As used here, "GCW data" includes data from stations and sites operated by the core GCW surface observing network, CryoNet, and data from contributing stations that are not part of CryoNet. All CryoNet data are produced in accordance with the minimum requirements set out for CryoNet stations and sites (see http://globalcryospherewatch.org/cryonet/requirements.html), and with the procedures laid out in the *GCW Best Practices Manual* and *GCW Best Practices Guide*. Contributing stations

may not necessarily meet the CryoNet station requirements and may not be compliant with GCW best practices. This data protocol applies to both CryoNet and contributing station data that are available through the GCW Data Portal. All stations are expected to meet GCW requirements by the beginning of the operational phase on 1 January 2020.

Metadata

Metadata are essential to the discovery, access, and effective use of data. Metadata may be defined as all the information necessary for data to be independently understood by users and for ensuring proper stewardship of the data. All GCW observational data and products must be accompanied by metadata that document and describe the data. The metadata must be in a "machine readable" (i.e. digital) form. Regardless of any data access restrictions or delays in delivery of the data itself, operators of GCW CryoNet stations and sites should promptly provide basic descriptive metadata for datasets (WIS metadata) and observations facilities (WIGOS metadata) in an internationally recognized, standard format to the GCW Data Portal. When submitting data to the Data Portal, contributors should adhere to GCW's best practices for data, as detailed in the following documents:

Guidelines for Data Centres Contributing to GCW
Operational Manual for Data Centres Contributing to GCW

Data availability and exchange

The Global Cryosphere Watch aims to make observational data and ancillary data freely available through its Data Portal, and whenever possible in near real-time. The data management is based on the FAIR Data Principles (Wilkinson et al. (2016). The GCW Data Portal is a web interface that contains information about datasets (metadata), but not the data themselves. Instead, it links to datasets that are stored at partner data centres. It is compatible with the WMO Information Service (WIS). Linkages between the GCW Portal and data partners/providers are illustrated at http://globalcryospherewatch.org/data/data.html.

At its Seventeenth Congress in 2015 (Cg-17), WMO agreed on Resolution 60 concerning the WMO policy for the international exchange of data and products to support the Global Framework for Climate Services (GFCS). Resolution 60 noted a number of other resolutions, including Resolution 40 (Cg-XII) on the policy and practice for the exchange of meteorological and related data and products including guidelines on relationships in commercial meteorological activities, and Resolution 25 (Cg-XIII) for the exchange of hydrological data. Resolution 40 adopts the following policy:

As a fundamental principle of the World Meteorological Organization (WMO), and in consonance with the expanding requirements for its scientific and technical expertise, WMO commits itself to broadening and enhancing the free and unrestricted international exchange of meteorological and related data and products.

The GCW Data Protocol will adhere to the above-mentioned resolutions and to the following open-access resolutions passed by international scientific organizations in the past 20 years:

- ICSU 1996 General Assembly Resolution
- ICSU Assessment on Scientific Data and Information
- Article III-1c from the Antarctic Treaty
- Intergovernmental Oceanographic Commission Data Exchange Policy

"Full and open access" is defined by ICSU (2004) as equitable, non-discriminatory access to all data preferably free of cost, but some reasonable cost-recovery is acceptable. WMO Resolution 40 uses the terms "free and unrestricted" and defines these terms as meaning "non-discriminatory and without charge". "Without charge" in the context of this resolution means at no more than the cost of reproduction and delivery without charge for the data and products themselves.

Data preservation

Recognizing that the true value of scientific data is often realized long after they have been collected, it is essential to ensure long-term preservation and sustained access to GCW data. All GCW data must be archived in their simplest, useful form and be accompanied by a complete metadata description (including export of discovery metadata to the GCW Portal). Given that the GCW Data Portal does not store data, long-term preservation of GCW datasets is generally the responsibility of the data providers.

Data acknowledgment/attribution

To recognize the valuable role of data providers (those who collect, prepare, and provide the data) and to facilitate repeatability of experiments in keeping with the scientific method, users of GCW data must formally acknowledge data authors (contributors) and sources. Where possible, this acknowledgment should take the form of a formal citation, such as when citing a book or journal article. GCW encourages data citation according to the principles outlined by DataCite (https://www.datacite.org/), and recommends the form:

Creator (Publication year)
Title
Version
Publisher
ResourceType
Identifier
Example:

Doe. J. (2016).

Arctic Sea Ice Extent 1900-2016. Version 1.

My Institute/My Data Centre.

Dataset.

http://www.data.int/mydata-1900-2016.html

[Accessed 2016-11-25]

To simplify this process, GCW recommends that all datasets have a digital object identifier (DOI).

Acknowledgments

Data protocol documents created by SCAR, IPY, SVALI, IASC and the ICSU WDS data sharing principles were consulted during preparation of this document (see References).

References

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SVALI data policy (2011). Declaration of Intent between the Nordic Centres of Excellence (NCoE) within the sub-programme *Interaction between Climate Change and the Cryosphere (ICCC)* regarding an Open Data Policy. *Nordic Top-level Research Initiative* (2011). Available at: https://www.wmo.int/pages/prog/www/OSY/Meetings/GCW-CN1/INF21_Svali_Data_Policy.pdf.

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World Data System Data Sharing Principles (2015). WDS Scientific Committee. DOI: 10.5281/zenodo.34354 Available at: https://www.icsu-wds.org/files/WDS_Data_Sharing_Principles_2015.pdf.

World Meteorological Organization Congress, Resolution 60 (Cg-17, 2015): WMO Policy for the International Exchange of Climate Data and Products to Support the Implementation of the Global Framework for Climate Services.

World Meteorological Organization Congress, Resolution 40 (Cg-XII, 1995): WMO Policy and Practice for the Exchange of Meteorological and Related Data and Products Including Guidelines on Relationships in Commercial Meteorological Activities. Available at http://www.wmo.int/pages/prog/www/ois/Operational_Information/Publications/Congress/Cg_XII/res40_en.html.

World Meteorological Organization Congress, Resolution 25 (Cg XIII, 1999). Exchange of Hydrological Data and Products. Available at: http://www.wmo.int/pages/prog/hwrp/documents/Resolution_25.pdf.

Appendix

To create a framework for sustained in-situ and satellite-based observations of snow, ice and permafrost, GCW has formed partnerships with several international organizations that coordinate monitoring of individual components of Earth´s cryosphere, and with major data centres and distribution networks. Data partners include (in alphabetical order):

AARI	Arctic and Antarctic Research Institute, St. Petersburg, Russia
BAS	British Antarctic Survey, Cambridge, UK
ESA	European Space Agency
CCIN	Canadian Cryosphere Information Network
CryoClim	Norwegian Space Centre (NSC), Oslo, Norway
IASC	International Arctic Science Committee
ICSU	International Council for Science
IPY	International Polar Year
NSIDC	National Snow and Ice Data Center, Boulder, Colorado, USA
SCAR	Scientific Committee on Antarctic Research
SVALI	Stability and Variations of Arctic Land Ice
WDS	World Data System

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