

GCOS REFERENCE UPPER AIR NETWORK (GRUAN) DATA POLICY

1. INTRODUCTION

The Global Climate Observing System (GCOS) is a programme sponsored by the World Meteorological Organization (WMO), the Intergovernmental Oceanographic Commission (IOC) of UNESCO, the International Council on Science (ICSU), and the United Nations Environment Programme (UNEP). The GCOS Reference Upper Air Network (GRUAN) is a global network for atmospheric reference observations, and will provide the foundation for long-term datasets that can be used reliably to monitor and detect emerging signals of global and regional climate change. Specifically, GRUAN is required to provide long-term high quality climate records, to constrain and calibrate data from more spatially-comprehensive global observing systems (including satellites and current radiosonde networks), and to fully characterize the properties of the atmospheric column.

GRUAN stations are operated by national environmental agencies (including but not limited to national meteorological services) or research institutions, under the auspices of the Working Group on Atmospheric Reference Observations (WG-ARO), the Atmospheric Observation Panel for Climate (AOPC) jointly sponsored by GCOS and the World Climate Research Programme (WCRP), and the GCOS Steering Committee. In 2007, the Richard-Aßmann Observatory in Lindenberg, Germany, has been designated by WMO as a Lead Centre for the network. Implementation of the network and the establishment of a data archive are currently under development.

The observational requirements for GRUAN are defined in the report 'GCOS Reference Upper-Air Network (GRUAN): Justification, Requirements, Siting and Instrumentation Options' (GCOS-112) summarizing the results of two workshops on upper-air observations in Boulder, USA (February, 2005) and Seattle, USA (May 2006).

At the GRUAN Implementation Meeting (Lindenberg, Germany, 26 - 28 February 2008; see report GCOS-121), the following recommendations were made in terms of data policy:

- Compliance with WMO Resolution 40 (Cg-XII),
- Definition of all data from the instrument systems which are specified in GCOS-112 or any agreed revision of GCOS-112 as 'essential' at all GRUAN sites, to ensure the free and unrestricted availability of these data, and
- Dissemination in (near) real time to be considered for operational purposes, with use of the QC/QA software as employed for operational monitoring of radiosonde data.

AOPC recommended at its XIVth session (Geneva, 21-25 April 2008, report GCOS-122) that GRUAN sites should provide all GRUAN data in a free and unrestricted manner, if possible in real time, in order to be of maximum value for all applications, for example enabling the data being monitored and assimilated in numerical weather prediction systems.

2. DATA POLICY FOR THE GCOS REFERENCE UPPER AIR NETWORK (GRUAN)

2.1 WMO Resolution 40 (Cg-XII)

GRUAN was initiated by the Global Climate Observing System (GCOS), co-sponsored by, among others, WMO. It is thus appropriate that any policy for release and dissemination of GRUAN data complies with WMO policy, practice and guidelines for the exchange of meteorological and related data and products, as embodied in Resolution 40 of the Twelfth WMO Congress 1995. In this Resolution, WMO calls for free and unrestricted international exchange of meteorological data and related data and products, as described at <http://www.wmo.int/pages/about/Resolution40.html>.

In the GRUAN network, GRUAN sites should designate all data from instrument systems specified in GCOS-112 (Section 6) or any revision of GCOS-112 as 'essential' data [in the sense of Annex 1 to Resolution 40 (given in Annex I of this document) , not in the sense of 'Essential Climate Variables']. A list of possible additional data shall be maintained by the GRUAN Lead Centre.

Metadata associated with GRUAN should include the identification of the GRUAN sites and information related to the acknowledgement and co-authorship aspects mentioned in hereunder paragraphs 2.3 and 2.4. The metadata should provide the information required for the use of the data. Details on metadata formats are to be provided by GRUAN data dissemination guidelines.

2.2 Timing of Data Release

The timing of data release involves conflicting aspects. As its core objective, GRUAN is designed to provide reference-type climate datasets of the atmospheric column. Therefore, ensuring the highest attainable quality of data is the primary goal, which will generally involve extensive, time-consuming quality checks, disallowing rapid data release. Some potential data users, particularly in the numerical weather prediction community, however, will be interested in obtaining the data as soon as possible after the time of measurement.

It is therefore suggested to separate between 'Standard Data' [1] and 'Enhanced or Experimental Data' [2] obtained at GRUAN sites:

[1] Standard Data (e.g., near surface synoptic observations, radiosonde observations) with the following characteristics:

General exploitation value, measurement technology common, generally well understood, little problems with data interpretation.

[2] Enhanced or Experimental Data (e.g., Raman LIDAR, Microwave, Surface radiation, GPS PW) with the following characteristics:

High exploitation value, measurement technology sophisticated and/or of experimental nature, contact to site scientist recommended for correct interpretation of data, high efforts necessary to maintain continuous measurements and high quality of data.

'GRUAN data' are defined as datasets obtained at GRUAN sites that have been subject to sufficient quality checks to be expected to meet GRUAN requirements for climate applications, as laid down in GCOS-112, Appendix 1. This includes both Standard and Enhanced or Experimental Data and generally leads to delayed data release, but no later than after a turn-around period of up to six months. These data will be disseminated through a GRUAN designated data distribution system.

Furthermore, it is recommended to, if and when possible, release Standard Data in real time or near real time, for operational purposes. Data released in this way would generally not qualify as 'GRUAN data' given the quality requirements mentioned above. However, (near) real time data release will facilitate the quality control link between GRUAN and GUAN, and other networks. The timely release of data will also enable the data being monitored and used in numerical weather prediction systems.

In addition, site operators should consider the (near) real-time release of Enhanced or Experimental Data if this is being requested by the numerical weather prediction community. Again, data released in this way would generally not qualify as 'GRUAN data' given the quality requirements mentioned above.

These recommendations are consistent with the WMO *Guide to Climatological Practices* (WMO-No. 100; Chapter II, 2.6 and Chapter III, 3.4) and the WMO *Guide to the Global Observing System* (WMO-No. 488; Part III, 3.7).

2.3 Acknowledgement

Whenever GRUAN data have been used in scientific work that is being published, the data origin must be acknowledged and referenced. A minimum requirement is to reference GRUAN, as a reference network of GCOS, and the data archive [not yet designated]. If only data from one GRUAN site (or a limited number of sites) has been used, additional acknowledgement to the reference site(s) and their sponsoring institutions or organizations shall be given, according to the recommendation for citation and acknowledgement given by the originator of the data.

2.4 Co-Authorship

The GRUAN was developed by an international panel of scientists including experts in radiosondes and remote sensing measurements for water vapour, temperature and pressure in the upper troposphere and lower stratosphere. GRUAN sites are equipped with sophisticated, state-of-the-art instrumentation and comply with strict requirements of station maintenance, exposure of instruments, calibration, quality assurance procedures and the like. To ensure that the goal of long-term high quality climate records is reached, site scientists who are leading experts for the instruments used at the respective GRUAN sites often take responsibility for individual instruments operated at the GRUAN site.

Inclusion of GRUAN scientists as co-authors of papers making extensive use of GRUAN data is justifiable and highly recommended, in particular if a site scientist has responded to questions raised about data quality and/or suitability for the specific study in question, or has been directly involved in contributing to the paper in other ways. The co-authorship is not a pre-condition for release of GRUAN data. However, it is highly recommended that any data user should contact the responsible site scientist and ask if he/she wants to become co-author, or if an acknowledgement would be sufficient. Users of GRUAN data are encouraged to establish direct contact with site scientists for the purpose of complete interpretation and analysis of data for publication purposes.

Whenever GRUAN data distributed by the data archive are being used for publication of scientific results, the author(s) shall send a copy of the respective publication, preferably in electronic form, to the Lead Centre.

Address of GRUAN Lead Centre:

Dr Holger Vömel
Deutscher Wetterdienst
Meteorological Observatory Lindenberg / Richard-Assmann Observatory
OT Lindenberg, Am Observatorium 12
D-15848 Tauche, Germany
Tel.: +49 33677 60-260
Email: holger.voemel@dwd.de
Web: <http://www.dwd.de/mol>

ANNEX I: ANNEX 1 TO WMO RESOLUTION 40 (CG-XII)

Data and Products to be exchanged without Charge and with no Conditions on Use

Purpose

The purpose of this listing of meteorological and related data and products is to identify a minimum set of data and products which are essential to support WMO Programmes and which Members shall exchange without charge and with no conditions on use. The meteorological and related data and products which are essential to support WMO Programmes include, in general, the data from the RBSNs and as many data as possible that will assist in defining the state of the atmosphere at least on a scale of the order of 200 km in the horizontal and six to 12 hours in time.

Contents

- (1) Six-hourly surface synoptic data from RBSNs, e.g. data in SYNOP, BUFR or other general purpose WMO Code;
- (2) All available *in situ* observations from the marine environment, e.g. data in SHIP, BUOY, BATHY, TESAC codes, etc.;
- (3) All available aircraft reports, e.g. data in AMDAR, AIREP codes, etc.;
- (4) All available data from upper air sounding networks, e.g. data in TEMP, PILOT, TEMP SHIP, PILOT SHIP codes etc.;
- (5) All reports from the network of stations recommended by the regional associations as necessary to provide a good representation of climate, e.g. data in CLIMAT/CLIMAT TEMP and CLIMAT SHIP/CLIMAT TEMP SHIP codes, etc.;
- (6) Products distributed by WMCs and RSMCs to meet their WMO obligations;
- (7) Severe weather warnings and advisories for the protection of life and property targeted upon end-users;
- (8) Those data and products from operational meteorological satellites that are agreed between WMO and satellite operators. (These should include data and products necessary for operations regarding severe weather warnings and tropical cyclone warnings).