

1st GRUAN Implementation-Coordination Meeting (ICM-1)
Norman, Oklahoma, USA
2-4 March 2009

Item 2.2

**Recommendations by GCOS, WMO and other international
bodies regarding GRUAN implementation**
(Submitted by GCOS Secretariat)

Summary and Purpose of Document

This document is to inform about GRUAN-related recommendations made by the International TOVS Satellite Working Group, GCOS AOPC, GCOS experts, WMO Executive Council and WMO CBS Expert Teams during 2008.

Recommendations by GCOS, WMO and other international bodies regarding GRUAN implementation

1. Int'l TOVS Working Group

Background

The International TOVS Working Group is convened as a sub-group of the Radiation Commission of the International Association of Meteorology and Atmospheric Sciences (IAMAS). ITWG continues to organize International TOVS Study Conferences (ITSCs) which have met every 18-24 months since 1983. Through this forum, operational and research users of TIROS Operational Vertical Sounder (TOVS) data from the NOAA series of polar orbiting satellites and other atmospheric sounding data have exchanged information on methods for extracting information from these data on atmospheric temperature and moisture fields and on the impact of these data in numerical weather prediction and in climate studies. They have also prepared recommendations to guide the directions of future research and to influence relevant programs of WMO and other agencies (NASA, NESDIS, EUMETSAT).

At its most recent meeting (ITSC-XVI held in Brazil in May 2008) the climate working group came up with a number of specific recommendations for consideration by the community working to set up and promote GRUAN. The relevant section is reproduced below.

Need for long-term calibration

The working group recognized the key importance of robust cal/val if we are to have any confidence in the long-term climate record from satellites. Without such a system being instigated, it was recognized that in all probability we will continue to wrestle with very large inherent uncertainties in the future climate record grossly reducing their utility. The working group supported the instigation of the GRUAN network to form the ground-based component whilst also noting the benefits that a precessing orbit satellite with high quality radiometers and/or sounders as well as GPS-RO could bring. It was noted that to absolutely guarantee the satellite climate record it is not a case of either / or – both components would be required.

Recommendation Climate-2 to satellite agencies

Agencies need to recognize the critical importance of actively supporting a long term calibration framework if their data are to prove of the envisaged high utility in climate monitoring. This would consist of a fully functioning GRUAN network of 40 very high quality ground cal/val sites run for climate and a precessing orbit satellite carrying a range of microwave and infrared radiometers/sounders and a GPS-RO.

Action Climate-2

ITWG CGMS representative to communicate recommendation Climate-2 to CGMS and request that it be on the agenda. Matt Menne as GCOS representative to ET-EGOS to communicate this recommendation at their next meeting.

With respect to GRUAN plans, three specific items were raised:

1. It was strongly argued that there is a need for coincidence of radiosonde measurements as proven by EAQUATE, JAIVEx and other such campaigns.
2. For characterising hyper-spectral responses and monitoring trace gases, aerosols and dusts it was noted that one or more GRUAN Sites should be sited in regions of complex chemistry and / or particulate characteristics.
3. It was noted that in the past few years, the ability of infrared sounders to retrieve a CO₂ integrated content in the troposphere has been established and several algorithms have been developed. However, the main problem faced by current retrievals of CO₂ from existing instruments (IR sounders) is the validation. This will still be an issue for future instruments which are to be launched in the near future (OCO, GOSAT).

Recommendation Climate-3 to AOPC WG-ARO

The Climate working group of ITWG recommends that GRUAN launch a subset of “Satellite overpass coincident” launches which would consist of dual launches at T-1 h and T as has been done for JAIVEx as well as the EUMETSAT IASI calibration and which have proven to be of high utility.

Recommendation Climate-4 to AOPC WG-ARO

One or more GRUAN sites should be sited in an area where there is a prevalence of each of the following: dust events, black carbon from seasonal burning, Indian Ocean brown cloud, to help fully characterize hyper-spectral sounders in these challenging situations.

Recommendation Climate-5 to AOPC WG-ARO

GRUAN to recognize the vital role of CO₂ validation with measurements from the surface to the upper troposphere to support satellite based climate monitoring of changes.

Action Climate-3

Peter Thorne to report Recommendations Climate 3-5 to AOPC WG-ARO.

2. The GCOS/WCRP Atmospheric Observation Panel for Climate

Background

AOPC (Chair: Adrian Simmons, ECMWF) is one of the three GCOS science panels. Its function is to provide guidance to the Working Group on Atmospheric Reference Observations (WG ARO) in its implementation of GRUAN.

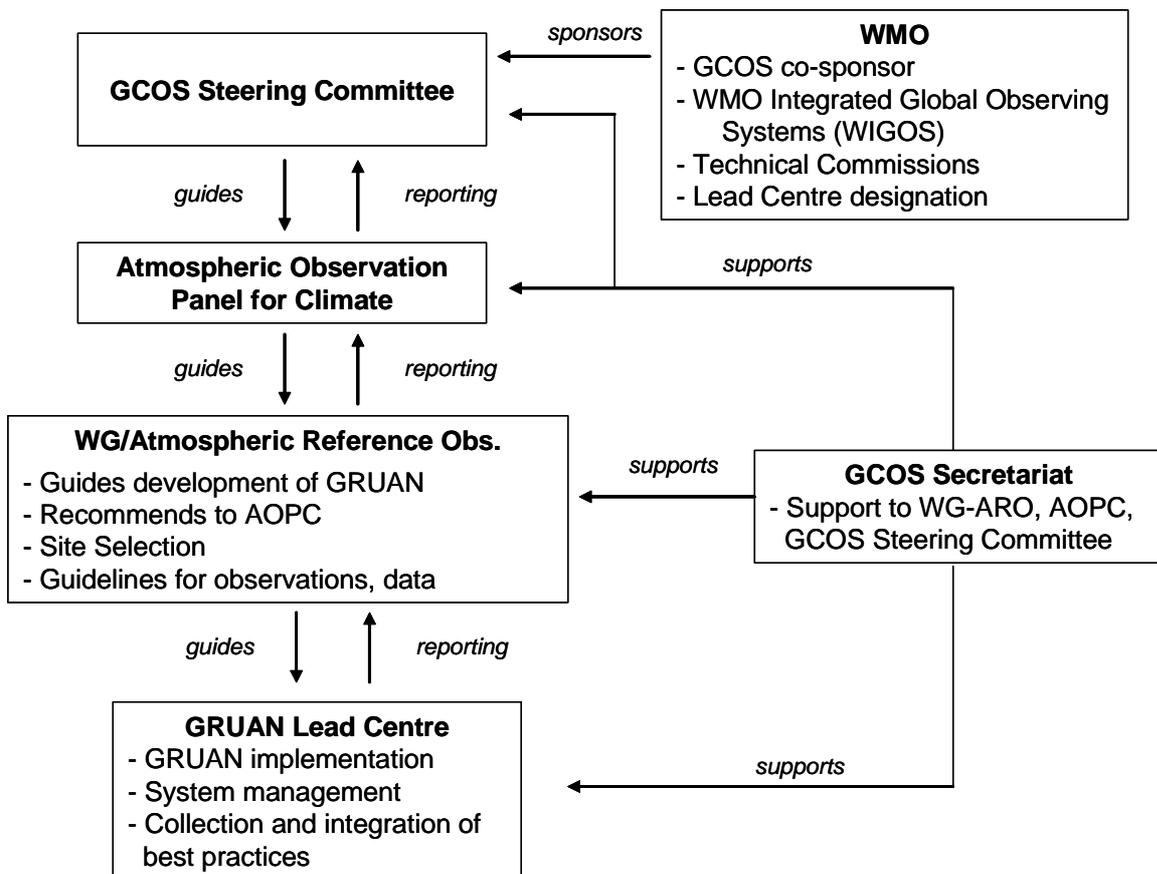


Fig. 1 Schematic of GRUAN governance (cf. GCOS-121, Appendix V)

AOPC-XIV (2008)

At its XIVth session in April 2008, Peter Thorne (Chair WG ARO) reported on GRUAN implementation. The Panel recommended the following

(<http://www.wmo.int/pages/prog/gcos/Publications/gcos-122.pdf>):

19. AOPC welcomed the report by WG ARO and commended the work done so far on developing the GRUAN. It stressed that full consideration should be given by WG ARO to ground-based remote sensing capabilities as well as to radiosonde capabilities, noting that a combination of both techniques will yield optimum results.
20. AOPC agreed that the Lindenberg meeting report be published as a GCOS report in due course.
21. AOPC endorsed the revised terms of reference of WG ARO in proviso that (i) the Panel has the final say in endorsing the GRUAN network composition that, (ii) the Lead Centre be requested to report at least twice a year to WG ARO, and that (iii) final copy editing be made. It also endorsed the proposed Membership of the Working Group and suggested adding the President of CIMO as a full member.
22. AOPC requested that WG ARO provide specifications for a reference radiosonde to HMEI with a view to vendors providing such sondes for the 2010 intercomparison.
23. AOPC recommended that radiosonde schedules at GRUAN sites be made at Local Solar Time (LST) but recognized that local operational constraints may lead to other launch schedules at some stations, which should not preclude these stations from being designated as GRUAN stations. Site operators should provide appropriate information on launch schedules to WG ARO.
24. AOPC recommended that GRUAN data policy should request sites to provide all data in a free and unrestricted manner (in accordance with WMO Resolution 40 (Cg-XII)), and if possible in real time, in order to be of maximum value for all applications, for example enabling the data to be monitored and assimilated in numerical weather prediction systems.
25. AOPC encouraged GCOS to be involved in intercomparisons under the auspices of CIMO, in particular through members of WG ARO and the GRUAN Lead Centre, taking note of the need for an objective selection of the reference instruments through the CIMO upper-air systems intercomparison campaign planned for 2010. It also encouraged these groups to take part in planning and conducting of the instrument intercomparisons relevant to climate monitoring and to the GCOS climate monitoring principles.

AOPC-XIII (2007)

At its XIIIth session in April 2007, the Panel recommended the following

(<http://www.wmo.int/pages/prog/gcos/Publications/gcos-114.pdf>):

20. The AOPC reaffirmed the importance to the success of GRUAN of in situ observations throughout the atmospheric column. The Panel recognized the broad spectrum of opinions both within and outside the working group on the issues of launch scheduling and affordable reference-quality radiosondes. It recommended that the GRUAN network start with the highest-quality currently-operational radiosondes, mixed with periodic higher-quality reference radiosondes, and/or dual launches consisting of different radiosonde models. For immediate scheduling issues, the Panel recommended that GSICS (Global Space-based Inter-Calibration System) be engaged to assess the likely utility and operation of coincident launches. In view of the importance of these issues, the AOPC requested that the WG-ARO prepare, in collaboration with relevant parties including the GRUAN Lead Centre, a report on these issues for consideration at

AOPCXV in April 2009.

22. The AOPC concurred with the WG-ARO view that data management issues for GRUAN have not been adequately considered to date. The major challenge here is to create collocation databases. The Panel recommended that the WG-ARO and the GRUAN Lead Centre consider lessons learned from GSICS and similar efforts such as those at NESDIS to create collocation databases. The AOPC reaffirmed the importance of making the data freely available in easy-to-use formats and as close to real-time as possible, to cater to all potential users including the operational community.
23. The AOPC recognized that the GSICS and GRUAN activities are complementary and that more collaboration is needed between these activities. The Panel recommended that representatives from GSICS and GRUAN participate in each others' planning activities at a relevant level.
24. In recognition of the importance of truly independent validation, the AOPC recommended that if GRUAN is successfully implemented, GSICS should strongly consider withholding at least some of the GRUAN sites from its calibration/validation activities to permit those sites to be used as independent checks.

[..]

3. GCOS Expert Team on Updating the GCOS Implementation Plan

At an expert meeting held 2-5 February 2009 in Geneva, Switzerland, about 30 participants covering the atmospheric, oceanic and terrestrial domains of the global observing systems for climate (e.g., from the modelling, in-situ and satellite, proxy data communities) met to undertake a critical review of existing requirements in the GCOS Implementation Plan, such as the GCOS networks and the list of Essential Climate Variables.

The meeting recommended, through the draft updated Plan, that GRUAN “develop an implementation strategy up to 2013.”

4. WMO Executive Council

Background

The Executive Council (EC) of WMO is the executive body of WMO which meets annually, coordinates WMO programmes, examines the utilization of budgetary resources, considers and takes action on recommendations of regional associations and technical commissions. It is composed of 37 directors of national meteorological services.

EC-LX (2008)

At its 60th session, the Executive Council inter alia concluded that (WMO-No. 1032):

- 3.4.15** The Council agreed that the GCOS Reference Upper-air Network (GRUAN) would provide high-quality observing sites for the atmospheric profile, including surface and upper-air measurements, in support of climate applications, validation of satellite products and climate research. The Council agreed that the contribution from Germany to support the GRUAN by establishing the GRUAN lead centre at the Meteorological Observatory at Lindenberg was an important first step. The Council requested an update on the progress of the selection of GRUAN sites as well as minimum instrumentation requirements at its sixty-first session in June 2009.
- 3.4.16** The Council requested Members, in collaboration with CIMO and GCOS/WCRP Atmospheric Observation Panel for Climate, to support the implementation of the

GCOS Reference Upper-air Network, using wherever possible existing infrastructure, such as GCOS Upper-air Network (GUAN) sites. At the same time, the Council encouraged Members to continue the operation of the existing GUAN.

5. WMO CBS Expert Teams (see also doc 8.1)

ET-EGOS-4 (July 2008)

The Expert Team on Evolution of the Global Observing System (Chair: John Eyre, MetOffice, UK) provides advice to the WMO Commission for Basic Systems, and recommended the following:

- 5.5.3 The ET noted with appreciation progress towards implementing the GCOS Reference Upper-Air Network (GRUAN) and supported the proposed work plan. It requested that CBS and CIMO be strongly involved in the development of a manual for operating practices at GRUAN sites. The ET also noted that implementation of GRUAN was in the spirit of the WIGOS PPs and recommended that the GCOS groups overseeing GRUAN consider following the example given by these projects

CBS/OPAG-IOS/ICT-IOS-5 (September 2008)

The Commission for Basic Systems (CBS) Open Programme Area Group on Integrated Observing Systems (OPAG-IOS) Implementation/Coordination Team on the Integrated Observing System (ICT-IOS; Chair: James Purdom, Colorado State University, USA) noted the report from the ET-EGOS-4 (see above) and recommended in the report of its fifth session in September 2008

<http://ftp.wmo.int/pages/prog/www/OSY/Reports/ICT-IOS5-Geneva2008.pdf>:

- 5.4.7 It was pleased to note the dialogue initiated among GSICS and the GRUAN initiative, whilst clarifying that the primary focus of GSICS was the calibration of level 1 data (typically instrument radiances) rather than the validation or quality monitoring of higher level products algorithms.
- 7.3.5 The ICT-IOS was briefed on the current status of GRUAN, especially regarding the network configuration and standard practices for GRUAN operations. It recalled that "The scientific evidence clearly shows that there is a pressing need to implement such a network. Equally, it is emphasized that the GCOS Reference Upper-Air Network would be part of a tiered system of networks to which both the GCOS Upper-Air Network (GUAN) and the WMO Global Observing System (GOS) are vital components." Following a discussion on GRUAN establishment, the ICT-IOS concluded that it is premature for CBS to endorse GRUAN establishment before GCOS provides clarification of how the GRUAN will be established in the context of the GOS. Upon a positive response from GCOS, the ICT-IOS recommends the establishment of GRUAN as a WIGOS PP (see agenda item 9.2.4 and related Recommendation Rec. 9.2.4 c) "WIGOS Pilot Project for GRUAN").

RECOMMENDATION 9.2.4 c) "WIGOS Pilot Project for GRUAN"

Noting that implementation of GRUAN was in the spirit of the WIGOS Pilot Projects the ICT-IOS recommended that the GCOS groups overseeing GRUAN consider following the example given by WIGOS Pilot projects

List of Acronyms

AOPC	Atmospheric Observation Panel for Climate (GCOS)
AQUA	NASA Satellite, formerly named EOS PM
ARM	Atmospheric Radiation Measurement Programme
CBS	Commission for Basic Systems (WMO)
CGMS	Coordination Group for Meteorological Satellites
CIMO	Commission for Instruments and Methods of Observation (WMO)
EAQUATE	European AQUA Thermodynamic Experiment
EC	Executive Council (WMO)
EOS	Earth Observing System (series of polar-orbiting NASA satellites)
ET-EGOS	Expert Team on Evolution of the Global Observing System (WMO/CBS)
EUMETSAT	European Organisation for the Exploitation of Meteorological Satellites
GSICS	Global Space-based Inter-Calibration System
GOSAT	Greenhouse Gases Observing Satellite (JAXA Satellite)
IAMAS	International Association of Meteorology and Atmospheric Sciences
IASI	Infrared Atmospheric Sounding Interferometer
ICT-IOS	Implementation/Coordination Team on the Integrated Observing System (WMO/CBS)
ITSC	TOVS Study Conferences
ITWG	International TOVS Working Group
JAIVEx	Joint Airborne IASI Validation Experiment
JAXA	Japan Aerospace Exploration Agency
NASA	National Aeronautics and Space Administration (USA)
NCAR	National Center for Atmospheric Research (USA)
NCDC	National Climatic Data Center (USA)
NESDIS	National Environmental Satellite, Data, and Information Service (NOAA)
NOAA	National Oceanic and Atmospheric Administration (USA)
OCO	Orbiting Carbon Observatory (NASA satellite mission of the Earth System Science Pathfinder Program)
OPAG	Open Programme Area Group (WMO)
TIROS	Television Infrared Observation Satellite (NOAA polar orbiting satellite)
TOVS	TIROS Operational Vertical Sounder
WCRP	World Climate Research Programme
WG-ARO	Working Group on atmospheric Reference Observations (AOPC)
WIGOS	WMO Integrated Observing System