

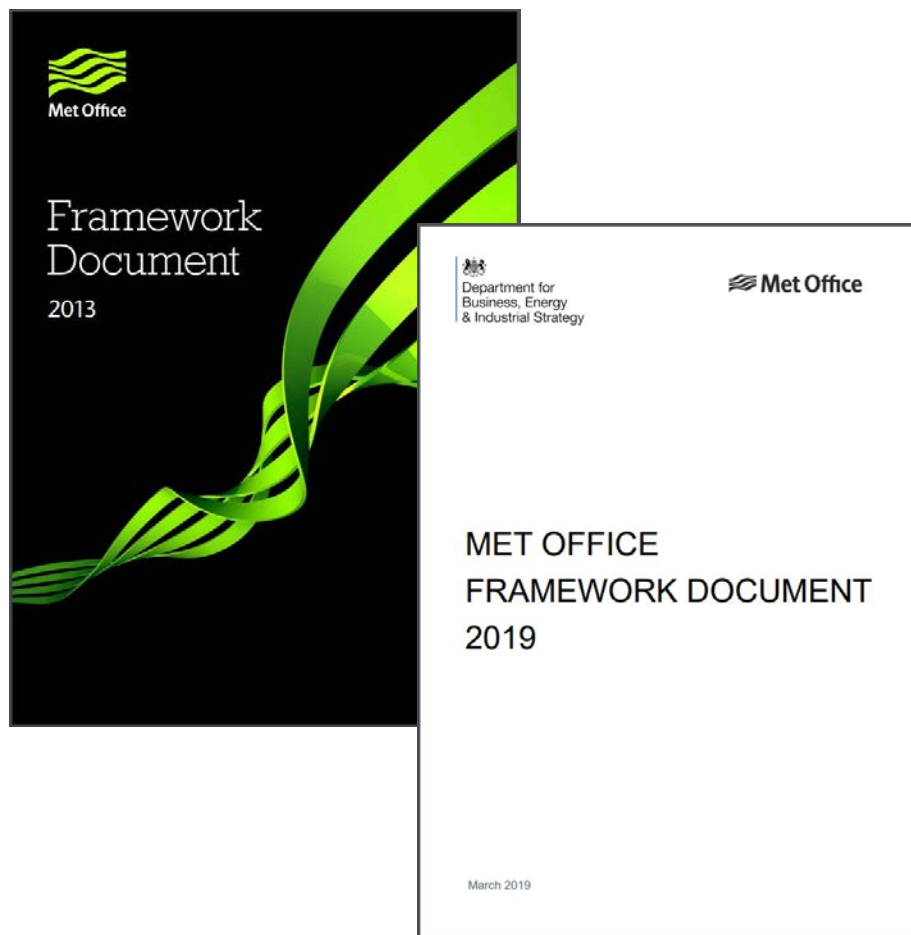
Discussion on protocols for GRUAN documentation review

Mentions of documentation periodic revision:

- GCOS-170 The GRUAN MANUAL
 - None
- GCOS-171 The GRUAN GUIDE
 - None
- GCOS-205 GRUAN Implementation Plan 2017-2021
 - None

Current guidelines

“This framework document will be reviewed at intervals of not more than three years [...]” (p. 24)



TD-3 User Guide of GRUAN RsLaunchClient

v0.7 (2014-02-05)

TD-4 Brief Description of the RS92 GRUAN Data Product (RS92-GDP)

v2.0 (2016-02-11)

TD-5 Technical characteristics and GRUAN data processing for the Meisei RS-11G and iMS-100 radiosondes

v1.0 (2018-02-21)

TD-6 GRUAN Ground-based GNSS Site Guidelines

v1.0 (2012-05-23)

TD-7 Review of Multiple-payload Radiosonde Sounding Configurations for Determining Best-Practice Guidance for GRUAN Sites

v1.0 (2019-01-25)

Technical Documents

Title	Author(s)	Date
Optimising the accuracy of radar products with dual polarisation : Project benefits	Tim Darlington Donal Adams, Steven Best, Nawal Husnoo, Sam Lyons, Katie Norman	2016
Designing an operation C-band radar to realise the benefits of dual-polarisation	T Darlington, M R A Edwards, V A Lissaman, R Riley, J Sugier, M Kitchen, D Adams, R Cox, N Freeman, K Norman, R O'Boyle, C Sloan, M Smees	2016
Final Report on the WVSS-II Sensors fitted to the FAAM BAe 146	Vance, A.K., Woolley, A., Cotton, R., Turnbull, K., Abel, S., Harlow, C.	2011
Areal Forecasting Science Specifications (working paper)	Sarran, C	2011
The Development of GML Weather Objects for use in decision aid technologies, with particular application to aviation technologies.	Mirza A.K.	2009

TN-1 Establishing Data Products For New Radiosondes in GRUAN

(2013-07-08)

TN-2 Guidelines on the Structure of Instrument Specific Technical Documents for GRUAN

(2014-12-05)

TN-3 Essential Meta-data of New GRUAN Stations

(2015-10-21)

TN-4 Guidelines on requirements for the initial development of a GRUAN data product

(2016-04-21)

TN-5 Procedures for (re)certifying a GRUAN measurement programme at an existing GRUAN-certified site
(2016-04-21)

TN-7 Rigging Recommendations For Dual Radiosonde Soundings
(2016-08-12)

TN-8 GRUAN Monitor MW41 and the Vaisala RS41 Additional Sensor Interface
(2019-05-15)

Technical Notes

Number	Title	Author	Year
106	Attribution of the 2018 summer heatwave in the UK	Christidis, N.; Stott, P.A.	2018
105	Rainfall disaggregation via multiplicative random cascades in the JULES land surface model	Paspaldzhiev, I.; Williams, K.; Falloon, P.	2019
104	Disaggregating daily accumulations of 3-hourly WFDEI-GPCC rainfall via a multiplicative cascade procedure	Paspaldzhiev, I.; Williams, K.; Falloon, P.	2019
103	HadISD version 3: monthly updates	Dunn, R.J.H.	2019
101	The elicitation of distributions of parameters in HadGEM3 versions GA4 and GA7 for use in perturbed parameter ensembles.	Sexton, D.M.H.; Murphy, J.; Booth, B (Met Office Hadley Centre); Karmalkar, A (University of Massachusetts); Regayre, L.; Johnson, J (University of Leeds).	2018
100	Marine Projections	Palmer, M.; Howard, T.; Tinker, J.; Lowe, J	2016
99	Assessment of the UKCP09 probabilistic land scenarios, including comparison against IPCC CMIP5 multi-model simulations.	Sexton, D.; Murphy, J.; Richardson, K.; Harris, G.; Brown, S.; Tinker, J (Met Office); Karmalkar, A (University of Massachusetts).	2016
98	Meridional overturning circulations driven by surface wind and buoyancy forcing.	Bell, M.J.	2015

Visibility



GRUAN The GCOS Reference Upper Air Network

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(4) The Working Group for Atmospheric Reference Observations

What is GRUAN?

The Global Climate Observing System (GCOS) Reference Upper Air Network (GRUAN) is an international reference observing network, designed to meet climate requirements and to fill a major void in the current global observing system. GRUAN observations will provide long-term, high-quality climate records from the surface, through the troposphere, and into the stratosphere. These will be used to determine trends, constrain and validate data from space-based remote sensors and to provide accurate data for the study of atmospheric processes. GRUAN is envisaged as a global network of 30-40 stations, where possible building on existing observational networks and capabilities.

Key scientific questions addressed by GRUAN:

- Characterization of changes in humidity, and wind
- Understanding the climatology and water vapour, particularly in the upper-troposphere
- Importance for ascertaining climate sensitivity
- Understanding changes in the hydrology
- Understanding and monitoring characteristics
- Understanding the vertical profile of winds
- Bringing closure to the Earth's radiative balance
- Understanding climate processes and climate models.

Example: water vapour
Water vapour is the most important greenhouse effect. There are vigorous within the research community, atmospheric humidity has changed any further change is expected to be effect of global warming. At the same water measurements, particularly in troposphere/lower stratosphere (UTLS) affected with high measurement. Even key mechanisms are not fully leading to significant deficiencies in state of global climate models. Current special research quality equipment and balloon platforms are the main information about UTLS water differences among these measurements have been difficult to reconcile.

What does reference mean?

A GRUAN reference observation:
- is traceable to an SI unit or an accepted provides a comprehensive uncertainty - is documented in accessible literature - is validated (e.g. by intercomparison observations)
- includes complete meta data description

- ### GRUAN goals:
- Provide long-term high-quality upper-air climate records
 - Constrain and calibrate data from more spatially-comprehensive global observing systems (including satellites and current radiance networks)
 - Fully characterize the properties of the atmospheric column and their changes (Fig 2)
 - Measure a large suite of co-related climate variables with deliberate measurement redundancy
 - Focus efforts on characterizing observational biases, including complete estimates of measurement uncertainty (Fig 3)
 - Ensure traceability of measurements by extended metadata collection and comprehensive documentation of observational methods (Fig 4)
 - Ensure long-term stability by managing instrumental changes
 - The measurements to SI units or internationally accepted standards
 - Ensure that potential gaps in 1) do not invalidate the long-term thus leading to improved solid
 - Further the understanding of climate change



Science highlights from the GCOS Reference Upper Air Network (GRUAN)

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GRUAN's goals

- Match observations over several decades for accurately inferring climate trends
- Constrain and calibrate data from more spatially-comprehensive global observing systems (including satellites and current radiance networks)
- Fully characterize the properties of the atmospheric column and their changes
- Measure a large suite of related climate variables with deliberate measurement redundancy
- Focus efforts on characterizing observational biases, including complete estimates of measurement uncertainty
- Ensure traceability of measurements by extended metadata collection and comprehensive documentation of observational methods
- Ensure long-term stability by managing instrumental changes
- Ensure that potential gaps in 1) do not invalidate the long-term thus leading to improved solid products
- Further the understanding of climate variability and change

Determining optimal GRUAN sites

A GRUAN reference site has to fulfil criteria to guide the observation network with a strong focus on ensuring that the needs of being met. Outstanding were:

- Stable and homogeneous climate
- Clear and homogeneous conditions
- Low variability in meteorological and climatic parameters
- Low background contamination
- Low anthropogenic influence
- Low interference from other observing systems
- Low infrastructure costs
- Low operational costs
- Low maintenance costs
- Low risk of damage to the site
- Low risk of land use changes

Assessing and certifying GRUAN sites

The quality of GRUAN sites is assessed through a rigorous assessment and certification process. GRUAN is based on a collection of measurements made at reference sites. Part of the scientific benefit that accrues from GRUAN results from the homogeneity of the reference quality. The quality of the measurements made at reference sites. A structured measuring that quantity stability at one site reduces the error confidence in measurements made across comparison and scientific results to those obtained at a reference site. The site verification process, homogeneity analysis, assesses that all GRUAN sites in the network will be able to provide quality standards to guarantee homogeneity of quality across the network (Fig 2).

GRUAN Promotional Video 2016

www.gruan.org

GRUAN

Thank you for your interest in GRUAN. This document answers a few of the questions that you might have considered joining GRUAN have previously posed.

What is GRUAN?

GRUAN is the Global Climate Observing System Reference Upper Air Network (GRUAN) established by its parent organisations (UNEP, IOC, ICSU and WMO) to measure measurements of essential climate variables in the upper atmosphere in order to detect and attribution of trends and variability in upper air climate and weather prediction and reanalyses. Atmospheric process studies. Calibration and validation of satellite observations. GRUAN collaborates with international partners to achieve these goals.

Will it require a lot of work, and changes to our current operations?

GRUAN has minimum requirements for a site and these are detailed in the GRUAN Manual. However, the Working Group on GRUAN (WG-GRUAN), which is currently data-focused region of the globe would be assessed more instrumented and resourced site in a region where many other GRUAN sites in data sparse regions may bring enough added value to the network. GRUAN site without, in the short-term, meeting the minimum requirements with the site to apply for additional funding to bring the site to the GRUAN cannot provide funding to support sites and therefore recognition with sites to achieve its goals. GRUAN is not a command and control organization, it is a voluntary network of scientists and operational staff. GRUAN is ready to work with you. Talk to us.

How is GRUAN managed?

GRUAN is jointly overseen by the Global Climate Observing System (GCOS) and the World Meteorological Organization (WMO). The WG-GRUAN and a number of task and analysis working groups are established and overseen by a dedicated Lead Centre, the Deutsche Wetterdienste (DWD) at Lindenberg facility. All stakeholders, including data providers, are invited to participate in coordination meetings, held at a host GRUAN centre, to inform the network development and practices. GRUAN is a self-organizing network and its development and practices. GRUAN instrument and certification process that includes periodic auditing and work as a whole.

The role of the GCOS Reference Upper-air Network (GRUAN) in climate research

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Research in support of GRUAN

GRUAN is a key component of the climate research infrastructure. GRUAN observations are essential for understanding the role of the atmosphere in climate change and for validating climate models. GRUAN data are used in a wide range of research areas, including:

- Understanding the hydrological cycle
- Understanding the role of water vapour in climate change
- Understanding the role of clouds in climate change
- Understanding the role of aerosols in climate change
- Understanding the role of ozone in climate change
- Understanding the role of stratospheric ozone in climate change

GRUAN as part of a system of climate observing architecture

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GRUAN

www.gruan.org

GCOS Reference Upper-Air Network



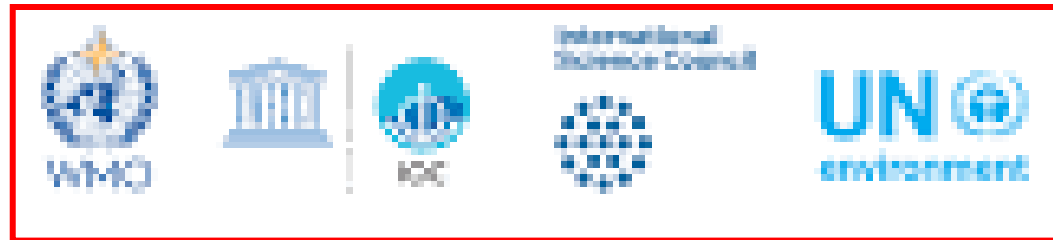
GCOS

GLOBAL CLIMATE OBSERVING SYSTEM



GCOS

KEEPING WATCH OVER OUR CLIMATE



- GCOS documents should be reviewed:
 - Now. And then every three years.
 - Review doesn't mean re-write.

- Technical Documents and Technical Notes are in reasonable shape:
 - But we need a number(s) for review protocols going forward (3-4 years).

- Promotional material needs a major look-at:
 - Now. And review every 3-4 years.