



Thank you for your interest in GRUAN. This document answers a number of questions that sites considering joining GRUAN have previously posed.

What is GRUAN?

GRUAN is the Global Climate Observing System Reference Upper Air Network. GRUAN has been mandated by its parent organisations (UNEP, IOC, ICSU and WMO) to make long-term reference quality measurements of essential climate variables in the upper atmosphere in support of:

- Detection and attribution of trends and variability in upper air climate.
- Numerical 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 way of operation, to join GRUAN?

GRUAN has minimum requirements for a site and these are detailed in the *GRUAN Manual*¹ and *Guide to Operations*². However, the Working Group on GRUAN (WG-GRUAN), when assessing the application for a new site, focusses on the *added value* that the site would bring to the network as a whole. A new site in a currently data-sparse region of the globe would be assessed more favourably than an equally well instrumented and resourced site in a region where many other GRUAN sites are already in operation. Sites in data sparse regions may bring enough added value to the network that they could be certified as a GRUAN site without, in the short-term, meeting the minimum requirements. The WG-GRUAN would then work with the site to apply for additional funding to bring the site to the stated minimum requirements. GRUAN cannot provide funding to support sites and therefore recognizes that it will be necessary to work with sites to achieve its goals. GRUAN is not a command and control organisation. The WG-GRUAN stands ready to work *with* you. Talk to us.

How is GRUAN managed?

GRUAN is jointly overseen by the Global Climate Observing System (GCOS) and World Meteorological Organization (WMO). The WG-GRUAN and a number of task and analysis teams exist to support GRUAN's development. Day-to-day operations are overseen by a dedicated Lead Centre facility at Deutscher Wetter Deinst's Lindenberg facility. All stakeholders, including data providers, are invited to annual implementation and coordination meetings, held at a host GRUAN-contributing site, which afford the opportunity to inform the network development and practices. GRUAN has in place a thorough site assessment and certification process that includes periodic auditing and ensures the quality of the network as a whole.

What is GRUAN data?

A GRUAN data product is a set of measurements from a given instrument system that have been undertaken in a sufficiently similar manner across all contributing sites to be intercomparable. Measurements are taken in such a manner as to be traceable to SI or community accepted standards with fully quantified uncertainty budgets. The data are collected using a tool that captures not only all of the data but also all relevant metadata that may be required in subsequent reprocessing. Processing is undertaken for each data type at a dedicated processing centre where uncertainty estimates are quantified and added and flags are appended providing additional information on data quality.

- 1) *GRUAN Manual*: <http://www.wmo.int/pages/prog/gcos/Publications/gcos-170.pdf>
- 2) *GRUAN Guide*: <http://www.wmo.int/pages/prog/gcos/Publications/gcos-171.pdf>

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That sounds complicated. Are we committing to a massive additional outlay here?

No. The data and metadata collection tool should not be too great an additional time demand on site staff /and IT resources as long as you have a reasonably fast network connection. Measurement practices are clearly laid out in technical documents but are generally minor perturbations to existing day-to-day operational practices at stations. They are certainly not wholesale changes to equipment or practices requiring significant additional capital outlay.

Can our own data still be served?

Absolutely. GRUAN data products are served through NOAA's National Climatic Data Center in delayed mode. GRUAN neither expects nor requires this to be the only means by which data taken at a given site are disseminated to data users. GRUAN data are clearly labelled as such and sufficiently distinct as to avoid potential for conflation.

I want to submit data to some of your data streams, but not others is that a problem?

Not at all, although obviously we would like you to submit data to GRUAN for all those instruments which GRUAN have developed data streams for. However, assessment and certification is on a data stream rather than site basis. So, if you decide that a given measurement system should not be submitted for consideration, that does not mean the remainder of the instrument streams will not be considered.

What do we get back?

First, the lead centre will provide, on a regular basis, information on the processing performance of each data stream delivered, including statistics for the same data stream for other sites. Second, the data themselves will be made publicly available, allowing the data from constituent sites to be directly compared over both space and time in a consistent manner afforded by the centralized processing and appending of quantified uncertainty estimates.

What other benefits are there?

- Organizations hosting a GRUAN site are recognized as maintaining and operating a state-of-the-art measurement programme, supporting the core goals of GCOS, for measuring essential climate variables in the upper atmosphere.
- Given the high profile of GCOS, GRUAN endorsement of the quality of a site's measurement programmes has been shown to be attractive to funding agencies. In addition, should international funding become available in support of climate monitoring e.g. through IGFA (International Group of Funding Agencies for Global Change Research), established and internationally endorsed networks such as GRUAN would be accorded high priority.
- Through GRUAN's governing bodies, sites have access to the support and service structures provided by the AOPC (Atmospheric Observation Panel for Climate), the WCRP (World Climate Research Programme), UNEP (United Nations Environment Programme), IOC (Intergovernmental Oceanographic Commission), ICSU (International Council for Science) and WMO (World Meteorological Organization).
- As well as requiring long-term homogeneity of measurements at specific sites within the network, GRUAN also emphasizes network-wide homogeneity of its data products. Measurements at a site are anchored to a reference network that provides traceability to internationally recognized measurement standards. By making measurements that are directly comparable to those made at numerous other global sites, users benefit from access to those additional data at no extra direct cost.
- GRUAN has established a number of Task Teams to entrain skills and expertise from across the international community in measurement sciences. Sites joining GRUAN have access to this pool of expertise.
- GRUAN has developed and implemented a state-of-the-art data delivery service through the NOAA's National Climate Data Center. Raw measurements made at GRUAN sites are processed at a centralised data processing facility and are provided to a wide range of data users. Therefore organizations hosting a GRUAN site do not need to commit resources to this activity.
- Observations from GRUAN sites are used in global climate monitoring and research, with potential participation by site scientists.