



GRUAN manual discussion and adoption

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Outline

- First, thank you very much to everybody who has provided feedback on the manual so far. This is very much appreciated.
- What am I hoping to get from this meeting.
- The purpose and scope of the GRUAN manual, and why it is called a manual and not a guide.
- A quick overview of the contents of the manual (for those of you who haven't read it).
- Some general comments received from reviewers. Not all worked through yet.
- Discussion points arising during the course of the development of the manual.
- Where to from here?

What am I hoping to get from this meeting

- Input for the GRUAN manual.
- Stimulate discussion around various issues and then capture the outcomes of that discussion in the manual – so plenty of discussion.
- Understand how the GRUAN manual can be better adapted to meet the needs of GRUAN. How can the manual be used to make progress in some areas?
- Is the GRUAN manual useful? What sort of document should it be? Should it be a one off or should it be periodically revised?
- Is there anything I can do, in addition to working on the manual, to assist with GRUAN?

What's in a name?

The GRUAN manual is more of a guide than a manual so why is it being called a manual? The GRUAN manual falls within the formal body of literature of the WMO. Within WMO, **manuals** are higher level documents providing general guidance on operations while **guides** provide the more specific detail.

That said, manuals are supposed to be more 'prescriptive' than guides and should use the word 'shall' where guides are more likely to use the word 'should'. Throughout the document I have tried to bend to these style requirements of WMO without compromising the usefulness and value of the document.

Overview of what is in the Manual

PREFACE: An overview of the purpose of the manual.

- My mandate as the author of the manual? Very little. My job is to collate relevant material from elsewhere. I don't make the decisions, you do.
- If you make a valid point and I agree with it, that is still not enough to warrant its inclusion in the manual. This needs to be a consensus document and as a result, so far I have tried to walk a consensus path.
- Use the GRUAN blog to conduct discussions and to reach consensus. Then tell me the outcome so that I can add that to the manual.

Overview of what is in the Manual

Executive Summary: Key message for those who do not want to read the whole manual. **More work needed here.**

1. INTRODUCTION

1.1. A brief summary of GRUAN: What is GRUAN's purpose. Dual-purpose nature of GRUAN. The goals of GRUAN.

1.2. GRUAN Governance: Where GRUAN sits in the WMO firmament, liaison with GCOS/WCRP and governance by WG-ARO.

1.3. Links to partner networks: What differentiates GRUAN from other networks? How will/should GRUAN connect to these other networks?

1.4. Link to satellite-based measurement programmes: Key client of GRUAN. Calibration and validation of satellite-based sensors. Creating global homogeneous atmospheric climate

Overview of what is in the Manual

2. REFERENCE MEASUREMENTS

- 2.1. **The concept of a reference measurement:** A lot of material here directly from Franz's paper (Immler et al., 2010). Quantifying and dealing with measurement uncertainty. Metrological traceability and connection to National Metrological Institutes.
- 2.2. **Managing Change:** Change is not only inevitable but should also be encouraged within GRUAN. Without change there can be no improvement. But all changes must be carefully managed to avoid compromising long-term stability. Changes in instrumentation, changes in operating procedures, changes in data processing algorithms, and changes in operators.

Overview of what is in the Manual

3 MEASUREMENT UNCERTAINTY

3.1 **Estimating measurement uncertainty:** The absolute necessity of collecting and archiving as many meta-data as possible. GRUAN mantra (carve into wall of lab):

- i. **Describe/Analyze** all sources of measurement uncertainty.
- ii. **Quantify/Synthesize** the contribution of each source of uncertainty to the total measurement uncertainty.
- iii. **Verify** that the derived net uncertainty is a faithful representation of the true uncertainty.

3.2 **Reporting measurement uncertainty:** Defining characteristic of GRUAN - no measurement should be provided without also providing an estimate of the measurement uncertainty and access to meta-data describing how that uncertainty was calculated.

Overview of what is in the Manual

3.3 Reducing measurement uncertainty

3.4 Reducing operational uncertainty: Having raw data from GRUAN processed centrally.

3.5 Validating measurement uncertainty: Comparison of redundant measurements. Laboratory analysis of the measurement system.

Overview of what is in the Manual

4 ECVs MEASURED IN GRUAN

- 4.1 **Justification and context for ECVs:** Setting targets for ECVs and the need for a 'goldilocks' approach.
- 4.2 **Priority 1 ECVs:** There are fairly long (~1 page) discussions in this section on the scientific justification for having temperature and water vapour as priority 1 ECVs. One reviewer felt that these sections were too long. However, it was felt that no other document outlines in detail why these ECVs are so important and why they have such a high profile in GRUAN.
- 4.3 **Moving beyond priority 1 variables:** Expectation of greater diversity amongst GRUAN sites in this regard.

Overview of what is in the Manual

5 GRUAN SITES: New section added on network design.

5.1 Site certification and assessment: What will be the formal 'handshake' process by which sites join GRUAN? The material that is currently in the manual is just some very rough ideas and this needs to be progressed in close consultation with the **Site assessment, expansion and certification Task Team - now WG-ARO job?**

5.2 Site selection: Site requirements - there is a spectrum:

Very prescriptive:
measure these
quantities on these days
using these instruments

Matters less much what you
measure, matters more is how you
make your measurement and
quantify your uncertainties.



Overview of what is in the Manual

5.2 Site selection

Initial requirements

- 1 weekly production radiosonde measurement of TPU but with a strong focus on quantifying uncertainties.
- 1 monthly water vapour sonde flight together with the radiosonde. Aiming for precise H₂O in the UT/LS.

Eventual requirements

- Regular 00 and 12 LST production radiosonde measurements of TPU. Occasionally dual radiosonde flights.
- Dual launches of sondes with highest quality humidity sensing capability.
- Periodic intercomparisons of a large range of sonde types.

Overview of what is in the Manual

6 INSTRUMENTATION

6.1 Instrument selection

6.2 Measurement redundancy

6.3 **Surface measurements:** There is no formal requirement for GRUAN stations to include surface measurements.

6.4 **Upper-air measurements:** Use of high quality and more expensive instruments. Highlights the need to retrieve instruments where possible. See e.g.

<http://www.gpsboomerang.com/>

6.5 Instrument co-location

6.6 Calibration, validation and maintenance

Overview of what is in the Manual

7 METHODS OF OBSERVATION

- 7.1 Measurement scheduling:** Some unresolved issues here. Is the intention that GRUAN will provide measurements that can quantify trends and variability on all scales? Or will GRUAN just provide a reference network for other measurement systems, that might sample more frequently or more globally, that themselves will quantify trends and variability on all scales? Answers to these questions will dictate measurement scheduling in GRUAN.
- 7.2 Operation and maintenance, quality standards:** Likely a different philosophy to operational measurement networks. Not so much a pass/fail with respect to a predefined standard, but more emphasis on describing, quantifying and verifying measurement uncertainty estimates and then communicating the quality of the measurement through that uncertainty estimate.

Overview of what is in the Manual

8 DATA MANAGEMENT

8.1 **Overview of GRUAN data flow:** Michael discussed this in detail yesterday.

8.2 **GRUAN data policy:** Need IP protection for circulation of data within the GRUAN community and for dissemination of GRUAN products to end-users. Also a need to distinguish between standard data and enhanced or experimental data.

Definition of 'pre-GRUAN' data - data supplied for input for NWP. Have also added a new section here on collation of meta-data (Kevin's question yesterday).

Some discussion required here around primary use of GRUAN data.

Overview of what is in the Manual

8.3 Data format

8.4 Data submission

8.5 Data dissemination: Through one source and one source only.

8.6 Data archiving

8.7 Quality control at the instrument/site level

9 POST-PROCESSING ANALYSIS AND FEEDBACK

More work to be done here

10 QUALITY ASSURANCE

More work to be done here

Some comments on the manual from reviewers

- Good start. Very useful and well put together but...
- Too long and should be shortened. More material needs to be added to make it more comprehensive.
- Temporal sampling issue is not adequately addressed. The confounding issue of synoptic variability is not addressed in the document.
- Anything that is not just a cut and paste from other GCOS documents should be clearly flagged as such.

Issues for discussion

There are now 7 issues for discussion. We will spend 5 minutes on each point (Franz please help to keep us on track). This will just be initial discussion. The intention would then be to progress and finalize these discussions either through the GRUAN blog, through discussion within Task Teams, or through brawls in the bar later this evening.

The list is by no means exhaustive.

I will try and capture as much of the discussion as possible for incorporation in the manual but in most cases I expect that the final outcome on these points will come much later.

1) Intercomparisons of sonde types at stations

The issue: One of the key requirements for GRUAN sites is that periodic intercomparisons of a large range of sonde types be undertaken. Why not do this just at the Lead Centre?

Response: A strength of GRUAN is the dedication to understanding the sources of uncertainty in the measurements resulting from the use of different types of sondes. It is important that that body of evidence spans the widest possible range of operating conditions. Diversity in these investigations will be a strength. Nobody can do a better job in understanding the issues resulting from changes in sonde types than the people at the stations where those changes in sonde type are occurring. **Distributed responsibility.**

2) Trust Fund

The issue: GRUAN might benefit from having access to resources that can be used to address issues that are relevant across the network as a whole.

Response: Establish a trust fund in a similar manner to the GCOS Cooperation Mechanism. The fund would receive voluntary contributions from GRUAN members and would use this fund to implement activities across the network for the communal benefit of the network. This might help to reduce duplication of effort in some areas.

The discussion of this trust fund has been removed from the manual but should be considered by GRUAN.

3) Improved links to satellite community

The issue: The satellite measurement community is certain to be a key client of the GRUAN products. Formalized ties with the relevant space agencies should be established.

Response: Establish a task team/working group within GRUAN to establish and maintain communication with key clients in the satellite community, and with other data providers, to ensure that GRUAN data products are tailored, where possible, to best meet the needs of this community.

For example: there is a WOAP workshop on 'Evaluation of Satellite-Related Global Climate Datasets' in Frascati 18-20 April. Will GRUAN be well represented there? In addition to achieving its stated goals, GRUAN will need to market its products.

4) Temporal sampling

The issue: Is it intended that GRUAN measurements are to be useful on their own (e.g. to establish CDRs) or will they be useful only in the context of other measurements? If GRUAN measurements are to be placed in the context of global analyses, does this mean that real-time data assimilation is required? If so, that will likely compromise the primary goals of GRUAN.

Response: GRUAN will be useful for calibrating variability and trends on all time scales from other observations and analyses and removing biases. More discussion is required and the outcomes of that discussion should then be reflected in a revised version of the 'Measurement Scheduling' section of the manual.

Measurement scheduling Task Team.

5) Site Selection

The issue: Thinking about key requirements for GRUAN sites: currently we have **Initial Requirements** and **Eventual Requirements**. The aim here is to make it clear what is required for a site to join GRUAN but not so onerous that potential sites will be discouraged from joining GRUAN.

Response: Last year in September Holger and I discussed the idea of having 'Tiers' of GRUAN sites. Tier 1 would have low entrance requirements but would still strictly enforce the GRUAN operational philosophy. Incremental improvements in the suite of parameters measured, or other measures of site performance, would move sites to higher Tiers. This may also help when it comes to applying for funding e.g. a small increment in funding might be sought to move a site from Tier N to Tier N+1. There could be an explicit expectation that GRUAN sites move to higher Tiers on a prescribed timetable.

6) Surface measurements

The issue: There are no formal requirements for GRUAN stations to include surface measurements. Should there be? If so, what measurements should be made?

7) Use of GRUAN in real-time 4D-Var data assimilation for global analyses

The issue: Some people have suggested that GRUAN data should be made immediately available for use in NWP and/or in 4D-Var data assimilation.

Response: The manual makes a strong case for why providing real-time data should be a low priority for GRUAN. Specifically it states that "The primary goals of GRUAN (see Section 1.1) are not consistent with near real-time dissemination of measurements made at GRUAN sites".

Some random thoughts

- WCRP OSC: I am co-convening a poster session titled 'Integrating regional data sets into global products' that might be suitable for GRUAN presentations.
- As GRUAN data become available (as of noon today?) more effort should be spent promoting GRUAN to potential users of the data.

Conclusions

- The GRUAN manual is far from finished. What does 'finished' mean in this context? What sort of document do you want this to be?
- There will be later versions to comment on. How do you want to do this?
- Do you want to be able to provide more direct input?
- I need to be able to capture the outcomes of discussions. How best to do that?