



**GCOS
Reference
Upper-
Air
Network**

GRUAN Technical Note 2

**Guidelines on the Structure of Instrument Specific
Technical Documents for GRUAN**

AOPC WORKING GROUP ON GRUAN (WG-GRUAN)

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Abstract

This document provides general guidance on the expected content and structure of GRUAN Technical Documents.

Revision History

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Purpose

This document provides general guidance on the expected content and structure of GRUAN Technical Documents. This guideline document is terse in that little additional explanatory material is included as that would significantly bloat the document if included. If, as an author of a GRUAN Technical Document, you require additional clarification on any section, please do not hesitate to contact Greg Bodeker at greg@bodekerscientific.com.

Background

The decision was made at the 5th GRUAN implementation and coordination meeting to create a single document for each instrument-specific technical document. To the extent possible, these technical documents will follow the structure of *The GRUAN Guide* (GCOS-171). This proposed structure is expanded in greater detail below. These Guidelines should be seen only as a starting point. For some instruments it will be necessary to modify this structure to best meet the needs of the instrument community. If adhering to this structure in any way compromises the utility of the document, change the structure as required.

Note: Some of the sections outlined below in ‘Technical document structure’ may not be needed for a particular instrument in which case they can be omitted from the Technical Document.

Technical document structure

1 Introduction

- 1.1 Instrument heritage – explain something of the history of the instrument and its measurements. What have been the scientific uses for the data coming from this instrument? To what extent does this measurement system fulfil the WMO rolling review of requirements? What is the state-of-the-art capability of this system?
- 1.2 The role of the instrument in GRUAN and the data products it will provide. What GRUAN data products does this instrument serve (connect to Section 6.10)? Which essential climate variables does this measurement programme target? Which GRUAN Task Team(s) will oversee the operation of this instrument?
- 1.3 Organisation and design concepts of the GRUAN measurement programme. Define the descriptive terms used in the document (terminology), and who is responsible for what. (The content included here should focus more on ‘operational’ aspects than 1.2 above.)
- 1.4 Implementation of the measurement programme. How do the various components of the network-wide measurement programme interact? (E.g. in terms of instruments being operated at multiple sites, raw data and meta-data flowing to centralised data processing, dissemination of the resultant data products, QA/QC across the programme, oversight that the protocols outlined in this document are adhered to, etc.)
- 1.5 Use in partner networks – in what other networks is this instrument used and where else can GRUAN call on expertise?
- 1.6 Use of this instrument in serving GRUAN’s key user communities (satellite validation, monitoring changes in climate, numerical weather prediction, process studies) – how has this instrument been used to meet the needs of these groups and how might it be used in these roles in the context of GRUAN?

- 1.7 Finances – provide a rough indication of the estimated capital costs for the instrumentation as well as on-going operational costs. It is recognized that this information will date, but potential users of this instrument will want some indication of these values. If the instrument relies on other instruments for the generation of data products (see Section 6.2) those costs should be included in the estimate.

2 *Instrumentation*

- 2.1 Terminology¹ – defines how the terms measurement accuracy, measurement uncertainty, measurement error, random error, random uncertainty, systematic error stability, correction lifetime are used in the context of this measurement system.
- 2.2 Theoretical basis – provides the technical details on how the measurement is made.
- 2.3 Justification for instrument selection – why should this instrument be considered over other similar instrument types for use in GRUAN?
- 2.4 Instrument redundancy – what other measurement systems might provide the redundant measurements required to validate the measurements and their uncertainties?
- 2.5 Instrument co-location – what are the key considerations for assessing the location of this measurement system in the context of related measurement systems?
- 2.6 Calibration, validation and maintenance – what procedures need to be implemented to ensure that the calibration, validation and instrument maintenance procedures are fit for GRUAN?

3 *Reference measurements*

- 3.1 Making reference measurements – what are the processes that need to be in place to make reference measurements with this measurement system? (Connect to Section 4.2 for standard operating procedures)
- 3.2 Managing change – what sort of changes might need to be managed and how will that management occur? What are the key steps in managing change events for this measurement system? (This describes the process of ‘managing’ the changes at different sites rather than ‘mandating’ how sites quantify the effects of changes. Align with content of *GRUAN Guide to Operations*.)

4 *Measurement uncertainty*

- 4.1 Evaluating measurement uncertainty – how is this done for this measurement system? Ideally papers in the peer reviewed literature would be cited here.
- 4.2 Reporting measurement uncertainty – how will the measurement uncertainty be reported to users of the data?
- 4.3 Reducing measurement uncertainty – what is the way forward for reducing measurement uncertainty for this measurement system?
- 4.4 Reducing operational uncertainty – how might uncertainties related to instrument set-up, sampling rates and the application of algorithms for data analysis be reduced?
- 4.5 Validating measurements – what is the process for validating the measurements and the measurement uncertainties?

1 Cf. Section 2.1 of the *GRUAN Guide to Operations*

5 *Measurement scheduling*

- 5.1 Guiding principles – what are the key considerations for deciding measurement scheduling for this instrument?
- 5.2 Factors affecting measurement scheduling – likely references here to the peer reviewed literature to justify measurement scheduling needs.
- 5.3 Interplay of science goals and scheduling frequency – discuss how different requirements on measurement scheduling across different user groups might be balanced.
- 5.4 Measurement schedule – what is the GRUAN recommended measurement schedule for this instrument? There are likely to be a number of different schedules tailored for sites at different stages of development e.g. entry-level sites and fully equipped sites.

6 *Data management*

- 6.1 Overview of data flow – describe the different levels of GRUAN data for this instrument. Describe if and how these data might be required for near-real time (NRT) applications and if so, the processing required for NRT data delivery.
- 6.2 Inter-instrument dependence – does the creation of data products from this instrument depend on measurements made by other instruments? If so, how?
- 6.3 Software/analysis packages – describe the different packages/tools that will be implemented to facilitate the collation and processing of the data streams, as well as, to the extent possible, how it is to be implemented and by whom.
- 6.4 Centralized data processing – describe how the centralized data processing for this instrument will occur. If a centralized data processing facility for this GRUAN product has been identified, this can be documented here, including details of its operation.
- 6.5 Data policy – discuss any constraints on the provision of these data to users via the GRUAN data base.
- 6.6 Collation of metadata – provide an in-depth description of the metadata that need to be collated for this measurement system to meet the goals of GRUAN.
- 6.7 Data format – describe the format(s) in which the data will be provided to users.
- 6.8 Data submission – how will the data be distributed to users?
- 6.9 Data archiving – which data (including metadata) need to be archived and where will this archiving occur?
- 6.10 Creation of the GRUAN data product – how will the data from this instrument be used to create GRUAN data products? It may be that it will be used in conjunction with other instruments. Of particular interest is the use of the data in Integrated GRUAN Product Data.

7 *Post-processing analysis and feedback*

What processes will be implemented to allow users to provide feedback on the quality and utility of the data being produced by this measurement system?

8 *Quality management*

What processes will be implemented for quality assurance/quality control for this instrument system?

9 *Site assessment and certification*

- 9.1 Criteria – against what criteria should this measurement programme be assessed at the time of GRUAN site assessment and certification? (I.e.: What are the minimum requirements for that programme to be certified.)
- 9.2 Standard operating procedures – what is the GRUAN recommended standard operating procedure for this instrument? Which aspects of the standard operating procedure are mandatory?
- 9.3 Criteria for assessing added value – when a site using this measurement system applies for GRUAN certification, how should the added value that this measurement system brings to the network be assessed in the context of existing similar measurement systems?
- 9.4 Auditing – what specific aspects of the measurement system must be considered at the time of site auditing (noting that audits will occur some years after the certification or previous audit)?

10 *Appendices*

All material that would be too detailed for the main body text should go here. This might include, for example, instructions on using the data collation/analysis tools (including screen shots), list of acronyms, etc.

11 *References*

To the extent possible, the material above should cite the peer reviewed literature. This will ensure that GRUAN measurement protocols achieve world-class standards.

Document change management

Change management must be applied to GRUAN Technical Documents with the same level of rigour that is applied to change management in measurement programmes within GRUAN. Over the lifetime of a GRUAN Technical Document, a number of reviews may need to be made to the content of the Technical Document, ranging from minor to major amendments. Every time a Technical Document is modified, this must be considered a new version and published as a new version, even if only a very small amendment has been made. In this way, each version of a Technical Document must become a single, traceable document, which can be referred back to at any time point in time.

1 *Document numbering*

To ensure the traceability of any GRUAN Technical Document, every version of a Technical Document must be allocated a unique version number. The following numbering system must be adhered to for all Technical Documents:

GRUAN-TD-N.x

N The Technical Document Number

This number will be assigned by the GRUAN Lead Centre, and once it is allocated to a Technical Document, it must not change.

x The Version Number²

The first published document will be Version 1. Any future updates will be reflected by a different version number, which will increase sequentially from 1.

2 Document change record

To enable the reader to understand the level and type of revisions made to a document over time, any changes made to a Technical Document must be recorded in a Document Change Record, which is located prior to the Table of Contents.

Date	Document Number	Description of changes	Review level	Author	Sign-off
yyyy-mm-dd This is the date of publication of the revised document. Please always use the date format as shown above.	TD-N.x 'x' will increase sequentially with every revision.	A brief narrative of the changes made and to which chapters / sections.	1, 2 or 3 (see below)	The name of the person(s) who made the changes.	Sign-off by the GRUAN Document Curator, WG co-chair(s), or Lead Centre. This section may include the names of the reviewers unless they have asked to be anonymous.

3 Document review

The first official version of a Technical Document will be sent for review to at least three reviewers. The selection of the reviewers will be made by the WG co-chairs in consultation with the document authors and members of the WG as required. The review process will be managed by the GRUAN Document Curator (currently Emma Scarlet³) who will complete the review by signing-off in the Document Change Record.

4 Review of revised Technical Documents

Revisions to an existing Technical Document should preferably be marked up using the MS Word revision tools (enable Track Changes) or, alternatively, marked up on printed sections of the document so that the extent of the changes can be easily assessed. The Word document, or scanned marked up sections, must then be sent to the GRUAN Document Curator who will, in consultation with the Lead Centre and WG co-chairs, decide on a case-by-case basis what level of review is required for that revision (depending on the extent of the modifications made), and ensure that the appropriate level of review is undertaken.

It is recognised that some sections of a Technical Document may have a shorter lifespan than the overall document and therefore require more frequent revision. This will mean that specific sections or sub-sections of a Technical Document may be updated without affecting the overall content of the Technical Document. Therefore, not every update to a Technical Document will require a full review.

Potential levels of review, to be confirmed on a case-by-case basis as outlined above, are:

1. Changes made to the entire Technical Document will require a full re-review. This review process will be coordinated by the GRUAN Document Curator in consultation with the co-chairs, and will follow the same process as outlined under 'Document Review' above.

² When developing these document management guidelines, the use of multiple version fields to reflect the level of the revision was considered. However, it was deemed that this did not add to the traceability of the document in any way.

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2. Changes made to a whole section, or the addition of a new section will require sign-off by the Lead Centre and at least one co-chair. It may also require independent review by an additional member/expert. Review and sign-off will only pertain to the section that has been changed. The sign-off will be noted in the Document Change Record.
3. Minor changes made to a section will require sign off by the Lead Centre and at least one co-chair. As above, review and sign off will only be required for the parts that have actually been changed.

Regardless of the level of review required, the new version of the Technical Document will always need to be published on the GRUAN website with a new version number. Only the most recent version of a GRUAN Technical Document will be made available on the GRUAN web page. All previous versions will be archived at the Lead Centre and will be made available on request.

No Technical Document will go more than 5 years without being reviewed in its entirety.

5 *Document file name*

When publishing the Technical Document, the following file-naming convention must be followed:

GRUAN-TD-N.x_DescriptiveText.pdf

The Descriptive Text can be up to 20 characters, and should include key words that give a clear indication of what the Technical Document relates to. This text will be set by the original authors, with approval by the Lead Centre, and must not be changed in subsequent versions of the Technical Document. Therefore, the only text that will ever be changed in the file name will be the value of 'x'.