The GRUAN Radiosonde Technical Document

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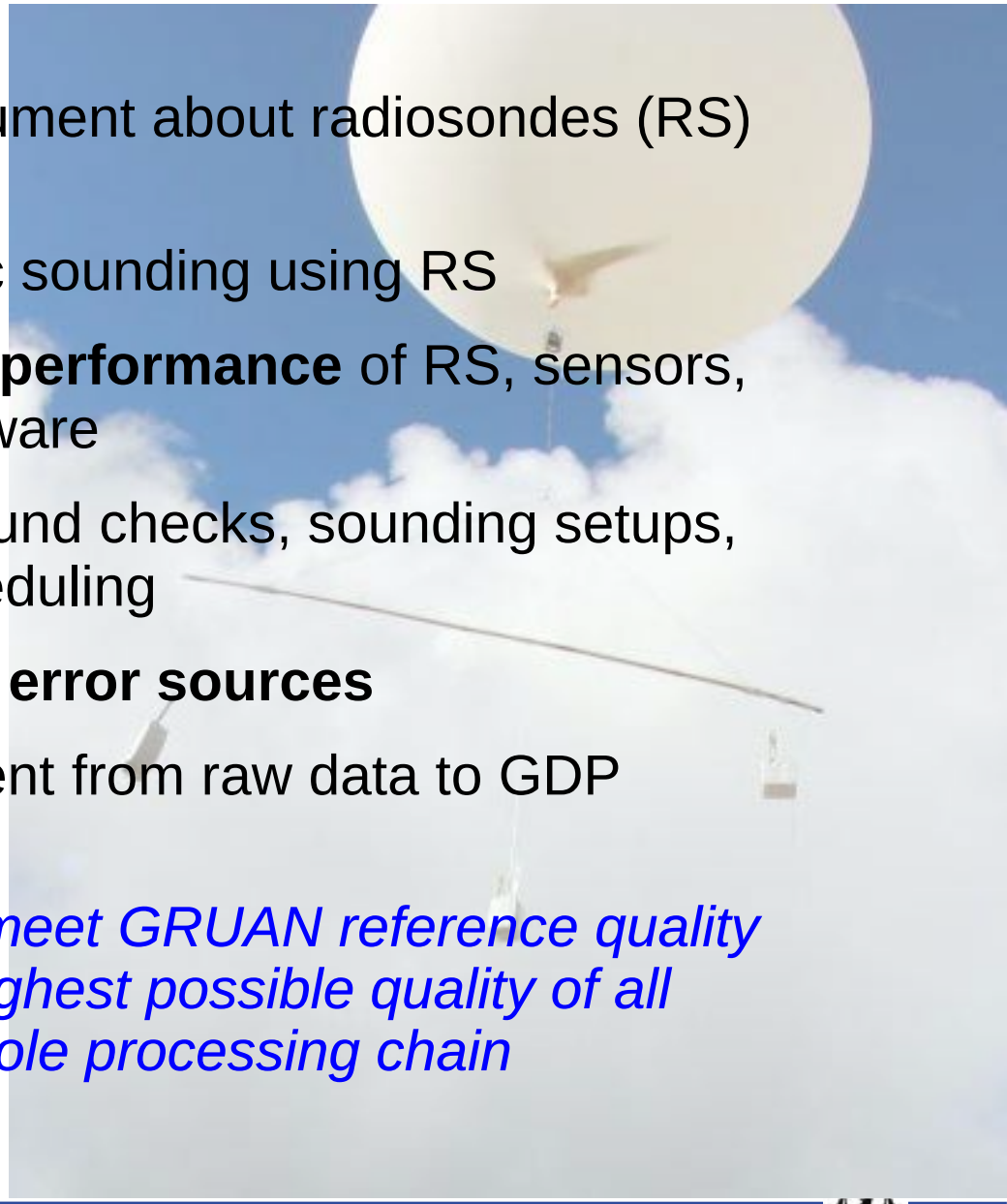
Motivation



Comprehensive (overarching) document about radiosondes (RS)

- **Background** on atmospheric sounding using RS
- General implementation and **performance** of RS, sensors, ground station systems, software
- **Practice**: RS calibration, ground checks, sounding setups, sounding, comparisons, scheduling
- Identification and handling of **error sources**
- **Data** formats and management from raw data to GDP

…with strong orientation to meet GRUAN reference quality requirements by ensuring highest possible quality of all parts of the whole processing chain

Motivation

Who is the document addressed to?

- GRUAN measurement sites
- Developers of GRUAN data products (potential Processing Centres)
- Scientific community dealing with GRUAN data
- Potential broader radiosounding user community
- Radiosonde manufacturers

Motivation

The radiosonde document should:

- … summarize in one document the available knowledge about radiosondes on a general level of details applicable to devices of diverse manufacturers
- … serve as compendium and work of reference
- … provide comprehensive insight, rules and guidelines for objectives, practice, procedures, data evaluation and management, development with regard to radiosounding in compliance with GRUAN reference quality requirements

  → *not only documentation but also manual and inspiration*

- … clear links to subsequent documents (Appendices) with more detailed aspects on specific radiosonde types

Document structure

Deutscher Wetterdienst
Wetter und Klima aus einer Hand

1 Introduction

2 Terminology (terms, notations and definitions conform to metrological standards (GUM): uncertainties, SI, traceability, …)

3 Measurement practice with radiosondes

3.1 Construction and functional principle of radiosondes
3.2 Sensor properties (*T*, RH, *p*, GPS, long-term stability, …)
3.3 Preparation of soundings (description of ground checks, calibration, …)
3.4 Operating procedures (e.g. balloon preparation adapted to particular instrument configuration, …)
3.5 Optional extensions (combine RS with additional sensors or modules, …)
3.6 Launch setups ((dis)advantages of specific setups, …)
3.7 Launch scheduling

4 Assurance of reference quality for measurement results

4.1 Manufacturer independent calibration
4.2 Systematic errors and biases (solar radiation, time lag, …)
4.3 Measurement uncertainty (uncertainty estimation and error corrections, …)

Document structure

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5 GRUAN data products for radiosondes
(Rules and guidelines for preparation of GDP's)

5.1 Purpose of data products
5.2 Laboratory work and field experiments
5.3 Correction models

6 Data management

6.1 Raw data (both the physically measured quantities (*f*, *R*) and derived variable of interest (*T*, RH, …)
6.2 Metadata (exact definitions of all metadata, tables, …)
6.3 Standardization of data formats (raw data, GRUAN product data)
6.4 Data flow (detailed diagram of data flow, definitions of interfaces, …)

7 Quality management, postprocessing analysis
(data verification, data assessment, comparison with independent data,
criteria for assessment of product data:
E.g.: large u, missing data, RH>100%, differences RH1-RH2, detected contamination)

General aspects to consider throughout the document

- Definition of rules, guidelines; instructions
- Provide examples where appropriate, discuss specific user experiences

E.g.: What metadata should be saved for a combined RS and ozone sounding (radiative interference!)? To what extend can it be used for data interpretation and processing?

- Adhere metrological standards:
  disclose traceability of all measurements, detailed uncertainty budgets, notation, discuss why to pay attention to this

E.g.: Comparison radiosoundings not intended to *correct* measurement results, but to *evaluate* data and identify or quantify systematic effects

- Illustration or discussion of deficiencies, definition of open questions
- Disclose problems with instruments
- Guidance: GRUAN-TN-2, GRUAN Manual and Guide, CIMO-Guide
- Rely on actual peer reviewed literature

Points which should *not* be included (→ Appendices)

- Hardware and software **details**,
  technical specifications and configurations of **specific ground systems**
- Detailed description of **specific radiosonde types**,
  implementation and performance of sensors
- Discussion of any RS specific or **manufacturer dependent operating procedures**
- S**pecific quantitative results** (calibrations, biases, systematic effects, results of experiments, …)

Document generation

- Coordination and editorial work: C. von Rohden (LC)
- Draft of document structure: under construction (LC, C.v.R.)
- At ICM-8:
  - assemble team of authors or contributors (LC, Task team Radiosondes, …)
  - assign themes
  - define links to RS-specific TD's (appendices)
- Timeline: reviewable version end of 2016