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Task Team Progress Report for March 2024 – Ground-Based

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Summary and Purpose of this Document

Progress report from the task team on Ground-Based Remote Sensing Measurements.

Introduction

The GRUAN Task Team on Ground-Based Remote Sensing Measurements (TT-GB) oversees the integration and production of ground-based measurements from lidar, microwave, and infrared remote sensing techniques, in compliance with GRUAN best measurement practices.

The TT-GB was initiated in 2020 from the former Task Team on Ancillary Measurements (TT-AM), which was split into two separate Task Teams: TT-GB and the Task Team on Satellite-Based Remote Sensing Measurements (TT-SAT). The Term of Reference (ToR) for TT-GB were then reviewed as listed below (available online at: <https://www.gruan.org/network/task-teams/tt-ground-based>).

Summary of Activity Progress and Perspectives

As of Fall 2022, the standardized lidar data processor GLASS has been producing test water vapor retrievals for the prospective GRUAN lidars at the sites of Ny-Ålesund, Payerne and Cabauw. Pending a fully-automated raw data transfer between the sites and the GRUAN Lead Center, a more systematic processing of the data is anticipated. A peer-reviewed manuscript describing GLASS is near completion, and a draft version of Best Measurement Practice Guide for GRUAN Lidars is already available.

Given the limited resources allocated for this activity, important advances have been made in 2023 and early 2024 towards a long-due GRUAN Lidar Product. On the GRUAN sites end, the automatic dataflow of the RALMO raw lidar data from Payerne to the GRUAN LC has started on October 8, 2023. Every day, a daily folder of raw data of the 5 Raman and 1 elastic RALMO channels are streamed to the LC. To date (14 Feb 2024), a total of 110 daily measurements have been streamed from Payerne to the LC. As for the GRUAN site of Cabauw, the web interface for CAELI data upload and a manual stp data stream has been tested. A preliminary file name, folder and subfolder structure has been defined. The subset of lidar data is compressed in a .zip file with the start and stop datetimes included in the name ('caeliRaw_subset.zip'), containing the raw (nighttime) Raman measurements (./datadir) and the related dark measurements (./dark_measuremts). Due to the lack of recent nighttime measurements (bad weather and laser issues) a near real-time upload has not been tested yet. The suitability of the current folder/subfolder structure and standardization of metadata information still needs to be discussed. KNMI is planning to resume this as soon as possible so we can test the retrieval with GLASS. On the lidar data processing end, the GLASS software developed at JPL has been tested to run successfully using the IDL Virtual Machine environment (free) on several non-GRUAN PC-Windows machines (TOLNet, NDACC collaborations), opening the door for additional

IDL VM-based processing of raw lidar data from GRUAN sites. In parallel to these tests, the GRUAN LC has made available a new UNIX-based data and processing server where GLASS can be centrally-run in the future. Because OS-compatibility purposes, GLASS cannot yet run on this server, but it is anticipated that a UNIX-compatible version will run before the end of 2024.

Regarding microwave radiometer (MWR) instruments, TT-GB has continued to interface with other expert teams and networks. During ICM-14, it was agreed that the development of the MWR GRUAN Data Product (GDP) shall build on the activities towards the implementation of the MWR program within ACTRIS (Aerosol, Clouds and Trace Gases Research Infrastructure - <https://www.actris.eu/>), a European long-term research infrastructure dedicated to atmospheric monitoring. In particular, the mission of the ACTRIS Centre for Cloud Remote Sensing (CCRES) is to offer operational support to ACTRIS National Facilities operating cloud remote sensing instrumentation, including MWR. The MWR uncertainty characterization is performed in the framework of the ACTRIS MWR quality assessment (2021-2023) at the ACTRIS Centre for Cloud Remote Sensing (Jülich, Germany), in order to provide the total uncertainty (including calibration repeatability, drifts, noise) and draft instructions for operating a MWR network. A recent paper on measurement uncertainty was published (Böck et al., 2024). The point of contact with the ACTRIS MWR programme is Bernhard Pospichal (University of Cologne, Germany), who has been invited to join TT-GB. In parallel, developments towards MWR networking, including design of data format and metadata, routine data collection and display from multiple platforms, were addressed in the E-PROFILE 2nd phase (2021-2023, contact: Rolf Rüfenacht, Meteoswiss). The status of ACTRIS MWR data flow will be presented at ICM-15, with the intention to assess whether it meets it meets GDP requirements (Action A1 from ICM-14). The update of the MWR GDP technical document (TD) is postponed to when the MWR GDP will be more established.

There is currently no activity to report for the infrared instruments (FTIR and AERI). Coordinated efforts will be undergone in 2024, following guidance provided by the TT-GB IR experts.

References: Böck, T., Pospichal, B., and Löhnert, U.: Measurement uncertainties of scanning microwave radiometers and their influence on temperature profiling, *Atmos. Meas. Tech.*, 17, 219233, <https://doi.org/10.5194/amt-17-219-2024>, 2024.

TT-GB Terms of Reference

- Interface with other expert teams and networks (e.g., NDACC, ARM, ACTRIS)
- Develop guidance on the type and number of data and associated metadata needed to be stored from the instruments, as needed

- Evaluate the data products (uncertainty budget etc.) and bring in missing knowledge
- Inventory instruments worldwide for potential inclusion in GRUAN
- Draw conclusions on the suitability of the deployed equipment and advise accordingly the GRUAN Task Team on Sites
- Establish campaign rationales for the validation of data from multiple platforms
- Establish a system for the routine collection and display of data from multiple platforms
- Report to WG-GRUAN on all above duties

Members

Member	Institution	Country	Expertise	Site
Co-chairs				
Thierry Leblanc	JPL-Caltech	USA	Lidar	–
Domenico Cimini	CNR-IMAA	Italy	MWR	Potenza
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Jonathan Gero	Univ. Wisconsin	USA	AERI	ARM SGP
Jim Hannigan	NCAR	USA	FTIR	Boulder
Christine Knist	DWD	Germany	MWR	Lindenberg
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Gianni Martucci	Meteoswiss	Switzerland	Lidar, MWR	Payerne
Christoph Ritter	AWI	Germany	Lidar, MWR	Ny-Ålesund
Matthias Schneider	KIT	Germany	FTIR	Tenerife
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Proposed new Members				
Bernhard Pospichal	U. Cologne	Germany	MWR	–
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