Flash update on:

The GRUAN Task Team on Ground-Based Remote Sensing Measurements (TT-GB)

Co-chairs:

Thierry Leblanc

Nico Cimini

TT-GB in 2 slides (1/2)

Aims: Facilitate the production of ground-based remote sensing techniques in compliance with GRUAN measurement practices

Co-chairs: Thierry Leblanc, JPL-Caltech, USA
Nico Cimini, CNR-IMMA, Italy

"Kick-off": November 30, 2020

Members	Institution	Country	Expertise	Site
Arnoud Apitouley	KNMI	Netherlands	Lidar	Cabauw
Maria Cadeddu	ANL	USA	MWR	ARM SGP
Jonathan Gero	Univ. Wisconsin	USA	AERI	ARM SGP
Jim Hannigan	NCAR	USA	FTIR	Boulder
Christine Knist	DWD	Germany	MWR	Lindenberg
Fabio Madonna	CNR-IMAA	Italy	Lidar, MWR	Potenza
Gianni Martucci	Meteoswiss	Switzerland	Lidar, MWR	Payerne
Christoph Ritter	AWI	Germany	Lidar, MWR	Ny-Alesund
Matthias Schneider	KIT	Germany	FTIR	Tenerife
Michael Sommer	DWD	Germany	GRUAN LC	Lindenberg
Bernhard Pospichal	U. Cologne	Germany	MWR	ACTRIS sites
Tim Wagner	U. Wisconsin	USA	AERI	ARM SGP

TT-GB in 2 slides (2/2)

Terms of reference

- Interface with **other expert** teams (e.g., NDACC, ARM, ACTRIS)
- Develop **guidance** on data and associated metadata
- **Evaluate** data products (uncertainty budget); bring in missing knowledge
- **Inventory** instruments worldwide for potential inclusion in GRUAN
- Draw conclusions on the **suitability** of the deployed equipment
- Establish **validation campaign** rationales (includ. multiple platforms)
- Establish a system for the **routine collection and display** of data
- **Report** to WG-GRUAN on all above duties

Updates on instrument activities

Considered instruments (so far):

- **LIDAR**: Light Detection And Ranging
- **MWR**: Microwave Radiometer
- **FTIR**: Fourier Transform InfraRed spectrometer
- **AERI**: Atmospheric Emitted Radiance Interferometer

To be GRUAN-compliant, a data product should be:

- Traceable to SI standards (or other internationally accepted standard)
- Provided with comprehensive uncertainty analysis
- Documented in accessible literature
- Validated against other measurement systems (e.g., inter-comparison)
- Included with complete metadata description

Updates on MWR activities

Ref: Nico Cimini, CNR-IMAA

Most of the activities on MWR uncertainty characterization & quality assessment are carried within ACTRIS (EU) and ARM (USA)

- **ACTRIS**: Long-term EU distributed research infrastructure
  - Cooperation with GRUAN & E-PROFILE within the **PROBE** COST Action
    - e.g.: common format (ncdf CF compliant)

- **ARM**: Long-term US programme

- **Two presentations:**
  - **Tobias Marke** (U. Cologne): ACTRIS MWR development
  - **Maria Cadeddu** (ANL): Microwave radiometers in the ARM program

GRUAN MWR Product: 2024 expectations in 1 slide

A1: Assess the viability of using existing data products (e.g., from ACTRIS and/or ARM) as a GRUAN data product (GDP):

- **Scientific**:
  - Do these products meet GDP requirements?

- **Technical & administrative**:
  - Technical feasibility: e.g., data life cycle
  - Formal agreement(s): e.g., GRUAN-ACTRIS and/or GRUAN-ARM

Updates on LIDAR activities as of 2024

Ref: Thierry Leblanc, NASA-JPL
Presentation at 16:15

- ✓ In 2020, data processor (GLASS) went from development to production stage
- ✓ In 2020, raw data automatically transferred from Payerne to processing center (JPL-TMF)
- ⚠ In 2021, automated transfer from Payerne to JPL-TMF interrupted due to transfer protocol changes on Payerne's end (suspected firewall issues) ➔ Change of strategy!

NEW FROM LAST REPORT…

- ✓ In 2023, Automated transfer from Payerne to GRUAN LC: Routine mode
- ✓ In 2023, Automated transfer from GRUAN LC to JPL-TMF: Routine mode
- ✓ In 2023, GLASS can now run in IDL Virtual Machine (VM) mode => no license required
- ✓ In 2024, new (unix-based) cloud server set up at GLASS LC for future GLASS operation
- ✓ In 2024, GLASS successfully tested on GRUAN LC PC/Windows

WHAT' NEXT ON THE AGENDA…

- ⚠ Auto data transfer set up to GRUAN LC from Ny-Aalesund, Cabauw, other sites?
- ⚠ Design/finalization of GRUAN Lidar Data Product content and format (NetCDF?)
- ⚠ Migrate GLASS from PC/Win to new (unix-based) GRUAN LC cloud server
- ⚠ Finalization of Lidar GDP Technical docs
- ✖ Unlikely to happen soon: raw data conversion to NetCDF (LC-suggested)
- ✖ Unlikely to happen soon: Homogenization of meta data through LidarRunClient

Updates on FTIR/AERI activities

No updates since ICM-14

- **Action:** identify new members
  - **AERI**: Tim Wagner (U. Winsconsin, USA)
  - **FTIR**: No name yet
    - action to reach out to Martine De Maziere for suggestions

Introduction to the session

- **Tobias Marke** (U. Cologne): ACTRIS MWR development 15’
- **Maria Cadeddu** (ANL): Microwave radiometers in the ARM program 15’
- **Thierry Leblanc** (NASA): Update on the GRUAN Lidar Product 15’
- **Discussion** 30’

Discussion

Discussion on MWR data products

GDP requirement	ACTRIS	ARM
Traceable		
Uncertainty		
Documented OA		
Validated		
Metadata		
Raw data for reproces.		
Techn feasible		
Formal feasible		

Discussion

Discussion on LiDAR data products

- Specific content required by GRUAN?
  - e.g., WV MR & RH, metadata, …
- Should LIDAR GDP follow standardized format (e.g., matching GNSS, RS)?
- Type of products (clim, hires, cal/val)?
- Any other GRUAN LIDAR beyond PAY/NYA/CAB?
- Some GRUAN sites have other lidars (e.g., O3, stratospheric T). Should these be part of GRUAN LIDAR GDP?

Actions Items

CODE	ACTION	RESPONSIBLE	TIMING	Update (10 Mar 24)
TTGB10	Start procedure to establish ACTRIS-GRUAN formal agreement for MWR data product	Nico	ICM-16	Ongoing.
TTGB11	Porting GLASS on Linux	Thierry, Michael	May-June	Micheal successfully run GLASS on his pc (Windows). Will be adapted for other OS (Unix).
TTGB12	Finalising 2 lidar-related documents (GLASS user manual; OA paper on NDACC product validation)	Thierry	6 months	Ongoing.
TTGB13	Ask Ruud to send link to ICM-15 to all TTGB members	TTGB chairs	ICM-15	Done. Closed.
TTGB14	Reach out to Martine De Maziere for adding FTIR members	Thierry, Fabio	2 months	Ongoing.

New Actions Items

CODE	ACTION	RESPONSIBLE	TIMING	Update (10 Mar 24)
TTGB15				
TTGB16				
TTGB17				
TTGB18				
TTGB19				

Back-up slides

- **From ICM-14**

UAII2022: Upper Air Instrument Intercomparison 2022

- **Lindenberg, Germany (16 Aug to 9 Sep 2022)**

UAII2022: Upper Air Instrument Intercomparison 2022

Ref: Gianni Martucci, Meteoswiss

- 78 multi-payload flights
- Ground-based remote sensing
- **Aim:** validate GB-RS products wrt GRUAN sondes

Variables of interest

- Temperature [T]
- Humidity [q]
- Wind speed [ws]
- Wind direction [wd]

Instrument available on site

- Raman LIDAR [T,q]
- Microwave radiometer [T,q]
- Wind lidar [ws,wd]
- Wind Profiler [ws,wd]

Ancillary measurements

- Cloud RADAR
- Ceilometer

RS data will be processed by the Data Visualisation and Analysis Software (DVAS) and included in the data evaluation final report in 2023.

UAII2022: Upper Air Instrument Intercomparison 2022

Ref: Gianni Martucci, Meteoswiss

	RAW TIME RESOLUTION	INTEGRATION TIME
• Raman LIDAR [T,q]	1 min	[0, +30] min
• Microwave radiometer [T,q]	5 min	[0, +05] min
• Wind lidar [ws,wd]	15 sec	[0, +10] min
• Wind Profiler [ws,wd]	20 min	[0, +20] min

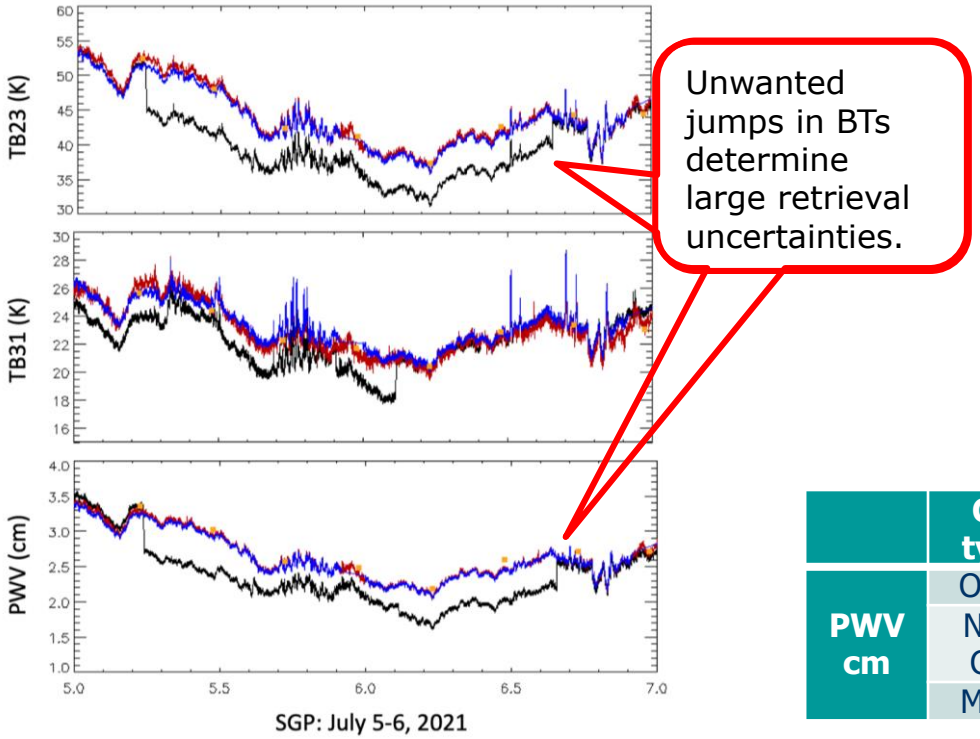
Range of interest based on instrument performance

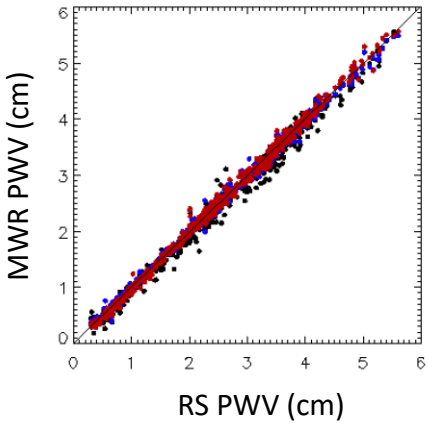
instrument	T	q	ws	wd	Sonde ascent rate	
Raman LIDAR	7 km day 12 km night	3 km day 12 km night	NaN	NaN	→ 5 m/s →	~20 min ~40 min
MWR	**2.5 km day** **2.5 km night**	**2.5 km day** **2.5 km night**	**NaN**	**NaN**	→ 5 m/s →	~8 min ~8 min
Wind lidar	NaN	NaN	2.5 km	2.5 km	→ 5 m/s →	~8 min
Wind profiler	NaN	NaN	8 km	8 km	→ 5 m/s →	~25 min

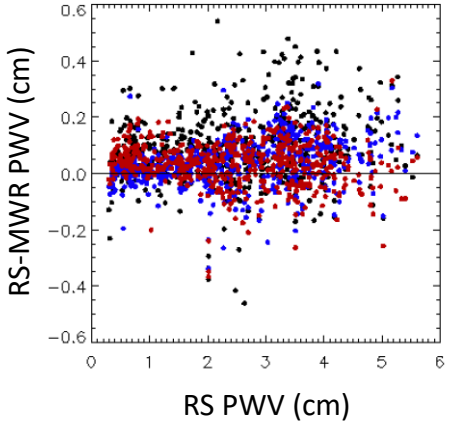
Updates on MWR activities

Ref: Maria Cadeddu, ANL-ARM

- **MWR calibration of new DOE-ARM radiometers** (RPG-LWP-G5-23-31-90)







	Cal type	Intercept	Slope	Corr	$X-X_{RS}$ av	$X-X_{RS}$ stdev
PWV cm	ORIG	-0.036	0.978	0.995	0.089	0.126
	NEW CAL	0.021	0.979	0.998	0.033	0.084
	MWR	-0.051	1.008	0.998	0.033	0.078

Black: Original
Blue: New cal
Red: 2-channel MWR
Yellow: RS

The **re-calibration** reduces scatter in water vapor retrievals by eliminating unwanted jumps in the BT and it **makes the new measurements consistent with the old 2-channel MWR measurements ensuring good continuity of the dataset despite the change of instrument.** The new PWV (blue) has improved bias and standard deviation compared to the original PWV (black)