GRUAN

Flash update on:

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

Co-chairs:

Thierry Leblanc

Nico Cimini

TT-GB in 1 slide

Aims: Facilitate the production of ground-based remote sensing techniques (e.g., lidar, MWR, FTIR) in compliance with GRUAN measurement practices

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

Member	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

"Kick-off" meeting on November 30, 2020:
Review current actions and define new ones

TT-GB in 1 slide (…cont)

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 lidar activities

Ref: Thierry Leblanc, NASA-JPL

- **(Almost) No new activitiy in 2022**
  - Waiting for LC to set up raw lidar data server and ingest data from GRUAN lidar sites
  - Some recent email exchanges with Cabauw Team (Arnoud Apituley et al.) to provide access to raw data and start processing
  - Recent study (Chouza et al., AMT, 2022) shows water vapor UV-lidar products in the UTLS have recently suffered impact from higher biogenic aerosol loading from wildfires

➔ Correction method possible and demonstrated; However, it impacts total uncertainty and impairs trend detection ability in LS

➔ High-power systems transmitting in the visible (e.g., green) could possibly be a replacement solution to traditional UV-based systems (yet to be demonstrated, testing ongoing…)

Updates on MWR activities

Ref: Nico Cimini, CNR-IMAA

- **Most of the activities are carried on within ACTRIS & E-PROFILE**
  - **ACTRIS**: Eu (distributed) research infrastructure – long term
  - **E-PROFILE**: Profiling programme of EUMETNET – NWP oriented
  - Cooperation within the **PROBE** COST Action

Updates on MWR activities

- **ACTRIS:**
  - MWR quality assessment (2021-2023)
  - MWR uncertainty characterization
  - Calibration uncertainty

Ref: Bernhard Pospichal, U. Koeln

- **E-PROFILE**
  - MWR networking (2021-2023)
    - L1 and L2 data format (agreed with ACTRIS)
    - Data flow and online monitoring

Ref: Rolf Rüfenacht, Meteoswiss

More within MWR GDP update

- **WMO UAII2022 campaign**
  - 4 RS operational + extra RS
  - Two MWR (same type)
  - MWR product validation

Ref: Christine Knist, DWD Gianni Martucci, Meteoswiss

- **ARM**
  - Tested new calibration procedure

Ref: Maria Cadeddu, ANL-ARM

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

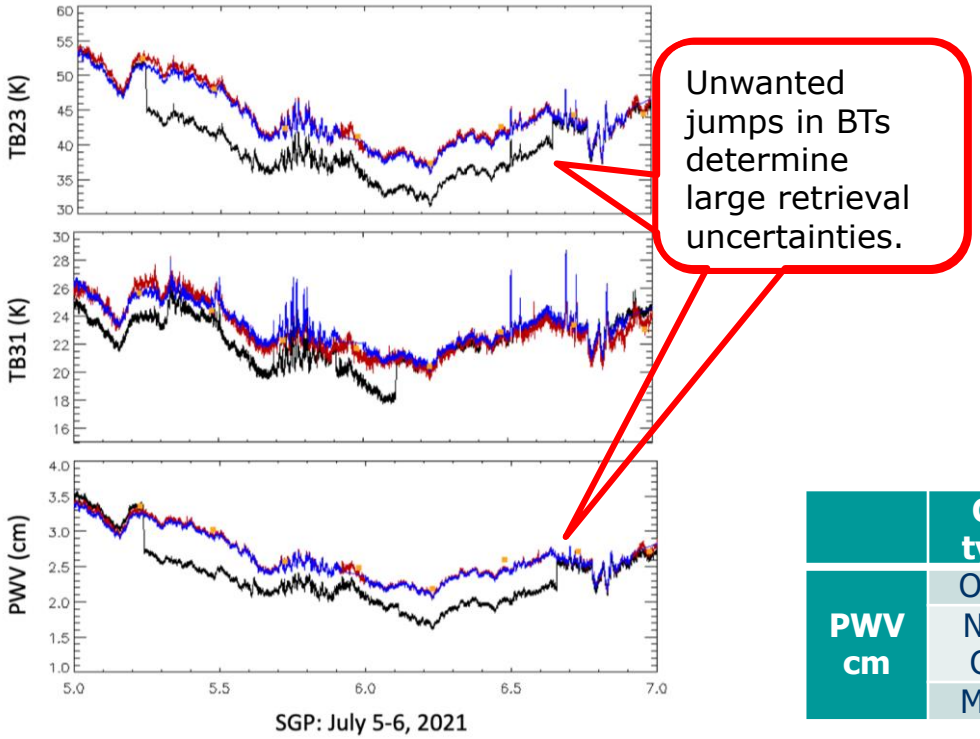
Range of interest based on instrument performance

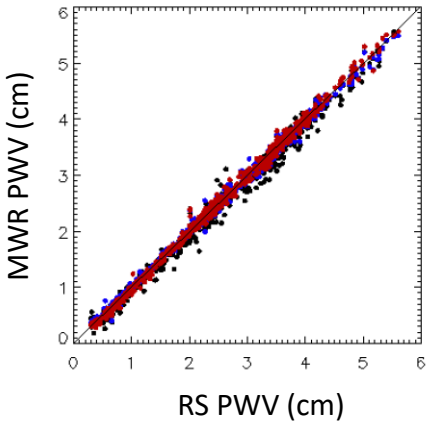
instrument	T	q	ws	wd	Sonde ascent rate	
Raman LIDAR	7 km day 12 km night	3 km day 12 km night	NaN	NaN	→ 5 m/s →	~20 min ~40 min
MWR	**2.5 km day** **2.5 km night**	**2.5 km day** **2.5 km night**	**NaN**	**NaN**	→ 5 m/s →	~8 min ~8 min
Wind lidar	NaN	NaN	2.5 km	2.5 km	→ 5 m/s →	~8 min
Wind profiler	NaN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

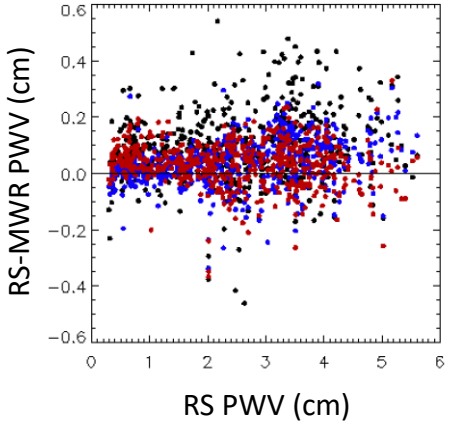
Updates on MWR activities

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)

TT-GB summary

- **LIDAR:**
  - Ready to go. Waiting for a raw lidar data server.
- **FTIR**
  - No update yet.
- **MWR**
  - MWR calibration uncertainty characterization
  - MWR data and metadata (L1 & L2)
  - UAII2022 dataset useful to characterise retrieval uncertainty
  - Re-calibration developed and tested to improve continuity