GRUAN IMPLEMENTATION PLAN

- **1st:** GCOS-134, GRUAN Implementation Plan 2009-2013 *(detailed plan about GRUAN)*
- **2nd:** GCOS-165, GRUAN Implementation Plan 2013-2017 (*long, detailed tasks*)
- **3rd:** GCOS-205, GRUAN Implementation Plan 2017-2021 *(to reach the goal of establishing a fully operational reference upper-air network for climate)*
- **4th:** 2021-2025 ???

- ❑ **First draft 3/30/2022**
- ❑ **Comments by WG until May**
- ❑ **New version available**
- ❑ **Unresolved issues**

The goals of GRUAN

The purpose of GRUAN is to:

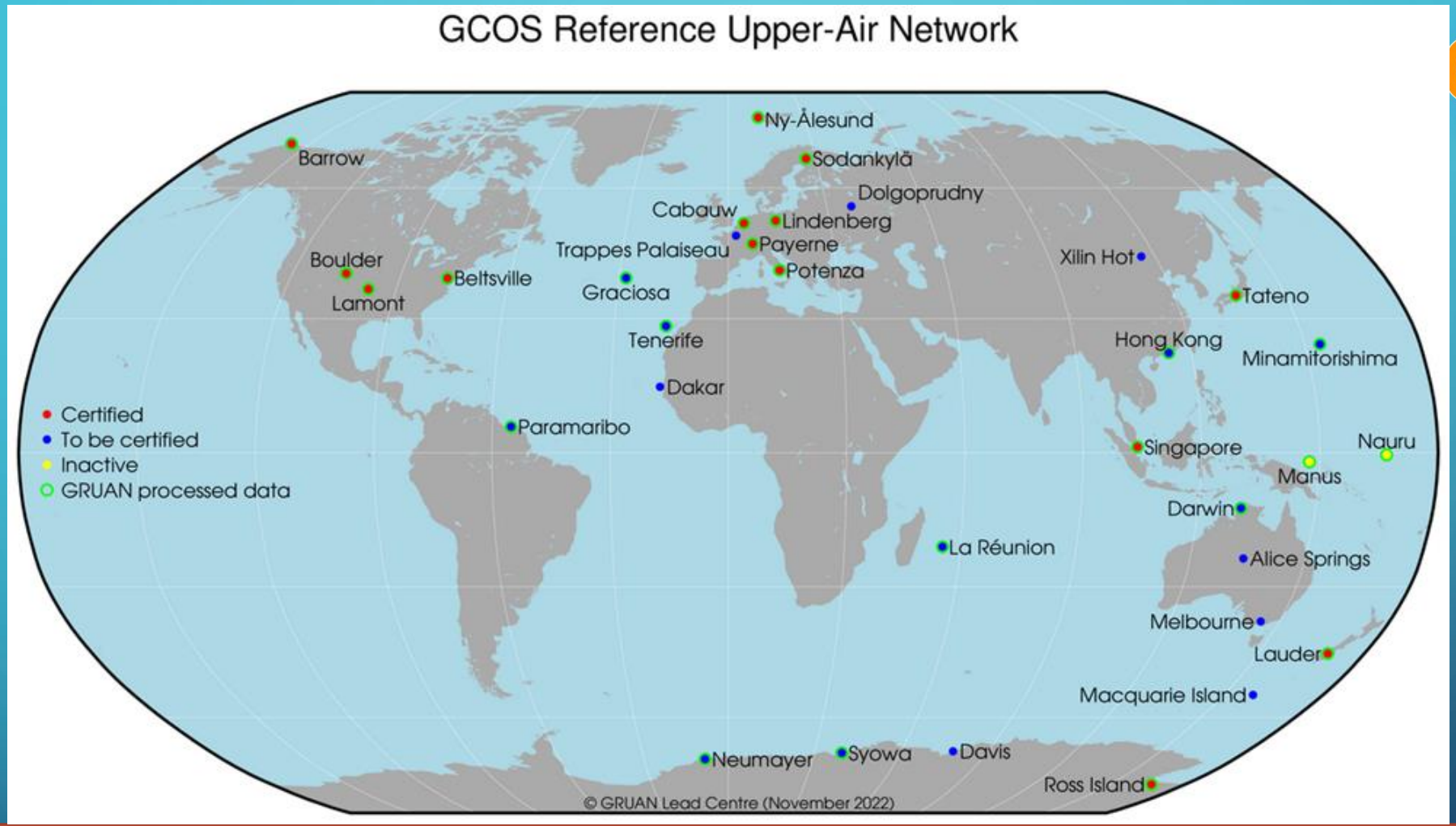
- Provide long-term high quality climate records;
- Constrain and calibrate data from more spatially-comprehensive global observing systems (including satellites and current radiosonde networks); and
- Fully characterize the properties of the atmospheric column.

Four key user groups of GRUAN data products are identified:

- The climate detection and attribution community.
- The satellite community.
- The atmospheric process studies community.
- The numerical weather prediction (NWP) community.

PRIORITIES FOR 2021-2025

1. Priorities from GCOS IP 2022
2. Silent sites, more certifications of sites, needs from sites?
3. Recruit candidate sites in the tropics, South America and Africa (Tahiti, Barbados, Brazil, Argentina)
4. Develop other radiosondes, CFH/FPH, ozone sonde, Lidar and MWR data products
5. R23 replacement options for UT/LS water vapor sondes & new sensors (Skydew, PCFH, QCLAS, FLASH-B, …)
6. Expand to Priority 2 variables and beyond
7. More applications: climate process, detection and attribution studies & NWP



By the end of the period of this IP (through 2026), if it is successfully implemented, GRUAN shall consist of:

A network of approximately 35 to 40 sites (at least 25 of which shall have been certified with subsequent regular auditing) that are more globally equitably located. The location of new sites will be chosen pro-actively to meet documented stakeholder requirements.

System	data processor	centralized processing facility	GRUAN documentation	Peer reviewed paper	GRUAN certification	Target date
Vaisala RS92 v2	yes	LC	GRUAN-TD-4	Dirksen et al. 2014 (AMT)	???	
Meisei RS-11G v1	yes	JMA, Tateno	GRUAN-TD-5	Kobayashi et al. 2019 (AMT)	2019	
GNSS-PW	yes	GFZ	GRUAN-TD-6	Ning et al. 2016 (AMT), other in preparation	2021	
Vaisala RS41 v1	yes	LC	under review	von Rohden et al. 2022 (AMT), other in prep.	2022	
Meisei IMS-100	yes	JMA, Tateno	Update TD5 in progress	submitted: Hoshino et al. 2022 (AMTD)		2/28/2022???
Meisei RS-11G v2	yes	JMA, Tateno	Update TD5 in progress	???		2/28/2022???
Modem M10 & M20?	beta version	IPSL	under review	Dupont et al. 2020 (JAOT)		2/28/2022
Graw DFM09/DFM17	in preparation	LC	in preparation			12/31/2022
lidar	yes		in progress	Leblanc et al. 2016 (AMT)		12/31/2022
Ozone	?	no	Under review/update	ASOPOS		12/31/2023
MWR	in progress	in progress	in progress			12/31/2023
CFH/FPH		no		e.g. Vömel et al 2016 (AMT)		12/31/2023

3. THE BROADER CONTEXT OF THE FOURTH GCOS IMPLEMENTATION PLAN

Could GCOS Secretariat revise this part based on the newest GCOS IP?

Action B1: Development of reference networks (in situ and satellite Fiducial Reference Measurement (FRM) programs)

1. **Continue development of GRUAN.**
2. **Efforts should be made to better integrate GRUAN into WIGOS operations.**
3. **Although GRUAN has been successfully implemented since 2005, it remains far from being globally well distributed.**

Action 8: Undertake research to understand the effects of scheduling for different instruments and end-uses and provide quantitatively based advice on scheduling.

Who: Task Team on scheduling, Lead Centre, WG-GRUAN

Time-frame: Continuous

Status & relevance???

Performance indicator: Publications and evidence for progress in annual ICM reports, advice dispensed to sites and taken up.

Benefits: Optimal use of observational assets to meet stakeholder needs.

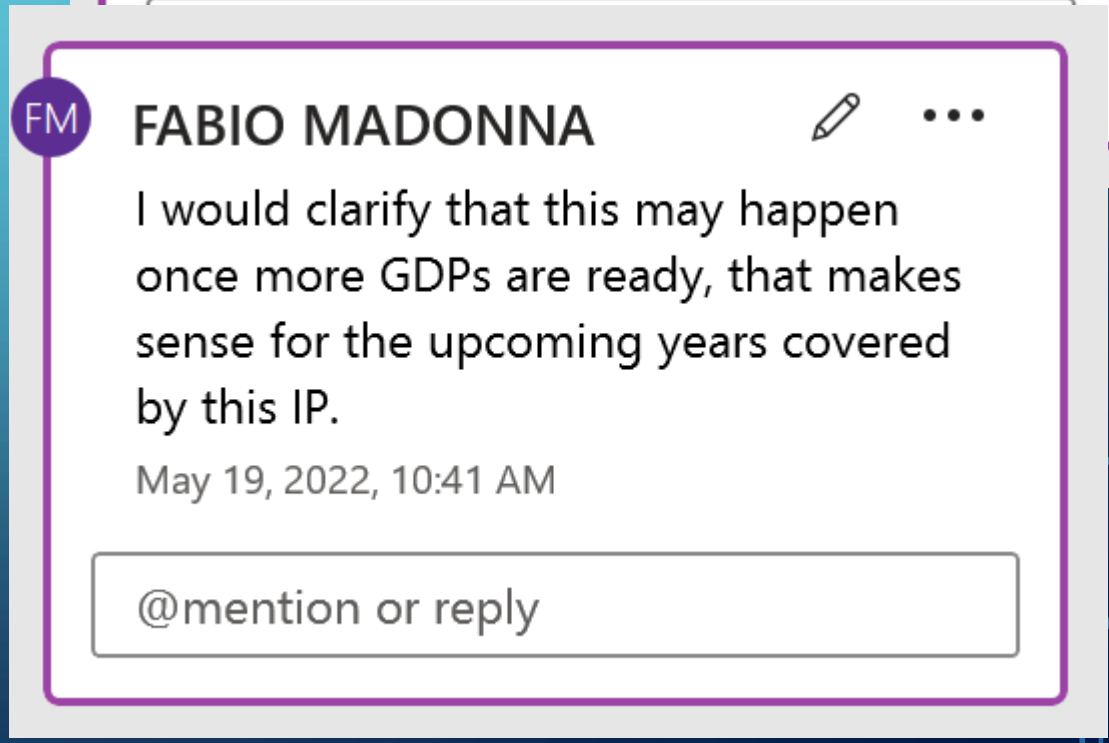
Action: Create through appropriate value added product generation approaches optimal estimates of the column ECV properties by combining multiple complementary instrument data streams building upon their respective strengths.

Who: Task Team on ground-based Measurements, WG-GRUAN, Lead Centre

Time-frame: 2019 for first products, 2021 for more mature set of products

Performance indicator: Papers published and such estimators being produced and made available for data arising from GRUAN stations on a sustained basis.

Benefits: Better characterization than possible by any single instrument, better understanding of the instruments at GRUAN sites and their performance.



We had a TT SAT telecon yesterday, where we discussed a possible action to be added to the Science Issues section (we discussed this when going through the IP, whether all TT should aim to have an associated action). The TT SAT agreed to propose the following action to the IP:

Action 11

Action: Strengthen the use of satellite and GRUAN products for validation and calibration activities of both data sets, leading to improved uncertainty estimates.

Who: Task Team on Satellite, Lead Centre, WG GRUAN

Time-frame: Continuous

Performance indicator: Publications and evidence for progress in annual ICM reports.

Benefits: Better characterization of measurement uncertainties, optimal use of observational assets to meet stakeholder needs.

IP 2013-2017: Bringing in other GRUAN target priority 2 variables and beyond

What	Deliverables	By whom	By when
G1: In collaboration with partner networks, assess the relevance and tractability of the full suite of remaining GRUAN target variables defined in GCOS-112 in the context of measurement capabilities and measurement programmes underway in partner networks.	GRUAN report identifying potential target data streams and partners.	WG-GRUAN, Lead Centre, TT ancillary, TT sites	September 2014
G2: Determine how best to collaborate with BSRN to bring surface radiation measurements into GRUAN. **Radiation**	GRUAN report summarizing the strategy for consideration by GRUAN stakeholders.	WG-GRUAN Co-chairs, TT ancillary	January 2015
G3: Determine how best to collaborate with NDACC and GAW to bring in measurements of aerosol properties into GRUAN. **Aerosol & Trace gases (COBALD, AirCore, FTIR …)**	GRUAN report summarizing strategy options for consideration by GRUAN stakeholders.	WG-GRUAN Co-chairs, TT ancillary	January 2016
G4: Identify appropriate partner experts / networks to scope options to bring in cloud property measurements into GRUAN. **Clouds (Ceilometer…)**	GRUAN report summarizing strategy options for consideration by GRUAN stakeholders.	WG-GRUAN Co-chairs, TT ancillary	December 2017