

# 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 ???



Achievement for the 3rd IP



Priority for next IP

# OBJECTIVES OF GRUAN IP 2017-2021

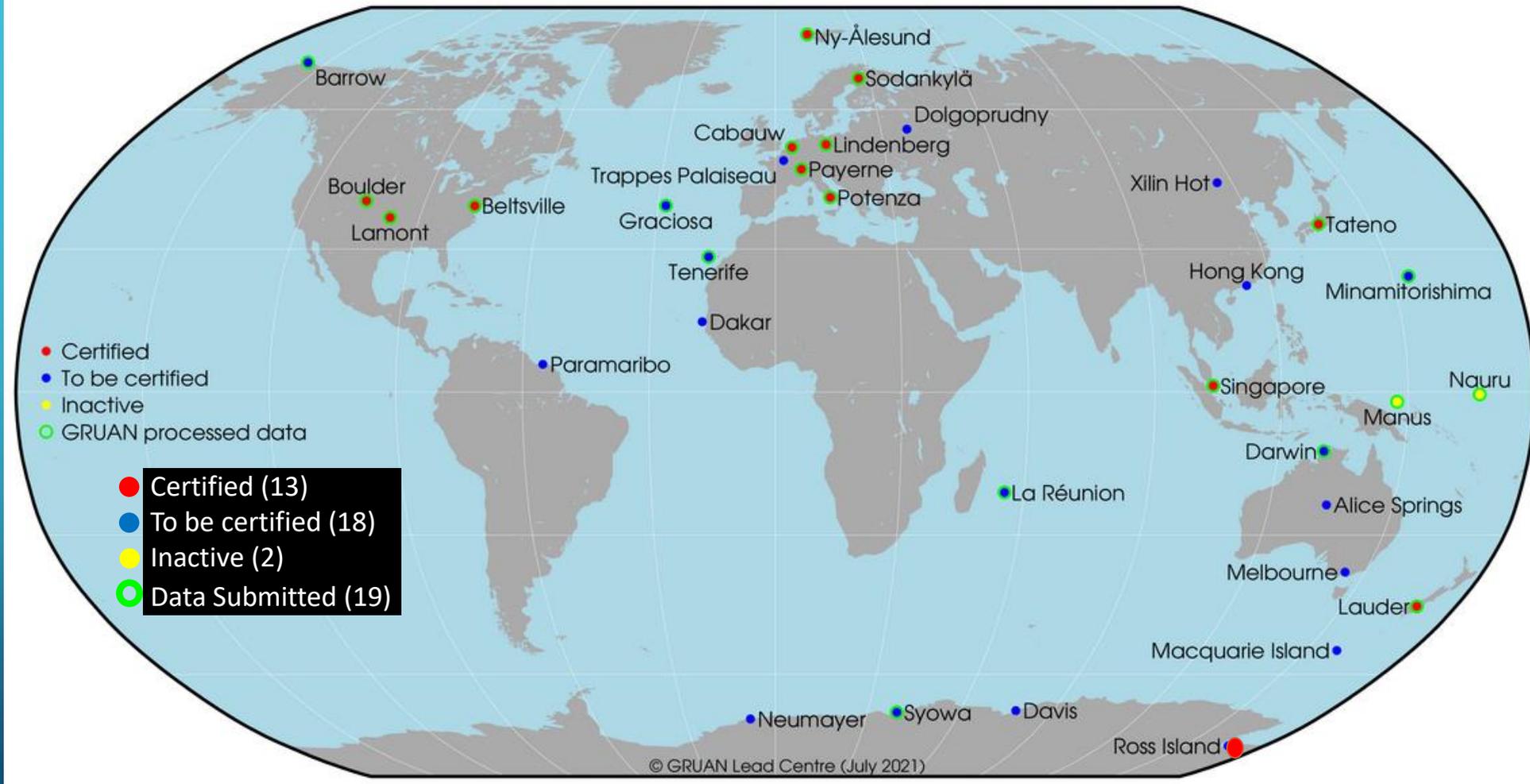


By the end of the period of this IP (through 2021), if it is successfully implemented, GRUAN shall consist of:

1. A network of approximately **30 to 40 sites** (at least 25 of which shall have been certified with subsequent regular auditing) and will be more globally equitably located. The location of new sites will be chosen pro-actively to meet documented stakeholder requirements.
2. A network serving reference quality measurements of vertical profiles from the surface through the lower stratosphere (and higher where feasible) of **temperature, pressure, water vapour, wind speed and direction, and ozone** . To the extent possible, these measurements will be made using complementary measurement systems including sondes and in-situ remote sensing equipment. Measurements will be made to documented GRUAN standards with each data stream processed centrally, and backed up by substantive metadata.
3. A set of sustainable long-term measurements being used by recognized **target stakeholders** (climate change monitoring and detection, satellite-based measurements, NWP, process studies), as demonstrated in the peer-reviewed literature, to improve our collective scientific understanding.
4. A network with operational and research functions, embedded within the overarching WIGOS framework and leading to **improved capabilities and practices in other broader components of the Global Observing System and its applications.**

# STATUS OF SITES

## GCOS Reference Upper-Air Network



- Milestone: 31 sites
- Certified: 13 (Target: 25)
- New sites to target: Tahiti, Barbados, Brazil, Argentina

## GRUAN DATA PRODUCTS

### ➤ Certified GRUAN data products

Vaisala RS92 v2

Meisei RS-11G v1

GNSS-PW

Vaisala RS41

### ➤ Certification in progress

Meisei IMS-100

Modem M10

### ➤ GDP in development

Graw DFM-09 & 17

Ozone sonde

Lidar

MWR

### ➤ Path to GDP Certification

- GRUAN Technical Document
- Peer-reviewed paper
- Central data processing facility identified
- Trial run of data stream (beta)
- Data review

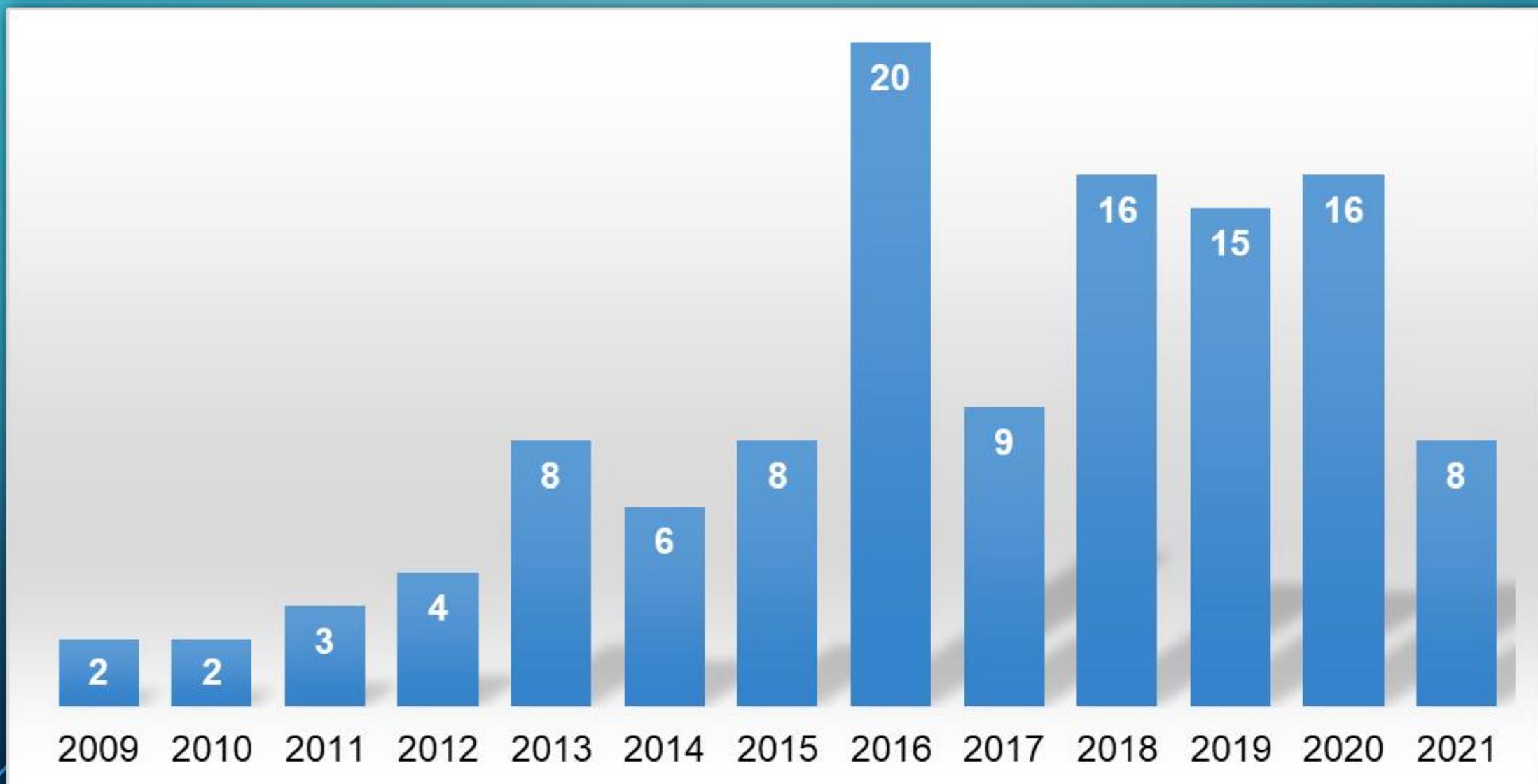
# Applications: GRUAN journal articles (2009-2021)

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.

Category	Number
Field and intercomparison campaigns	★ 27
Satellite Validation & Algorithm Development	★ 21
GRUAN product development	16
Operational developments	13
Assessment of the measurement record	12
Validation for ground-based instruments	10
Network design	8
Modelling; model evaluation and calibration	6
Others (mainly science)	4
Total	117

# Applications: GRUAN journal articles (2009-2021)



# BENEFITS TO OTHER NETWORKS & OBS SYSTEMS GRUAN

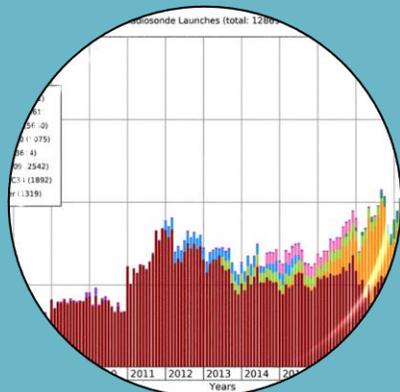
- Pioneer in defining and making reference observations
- Improving operational radiosondes
- Assisting operational radiosonde transitions, such as RS92 to RS41
- “On the quality of RS41 radiosonde descent data” Ingleby et al. (AMT)
- “Use of automatic radiosonde launchers to measure temperature and humidity profiles from the GRUAN perspective” Madonna et al. (2020) (AMT)
- “Review of Multiple-payload Radiosonde Sounding Configurations for Determining Best-Practice Guidance for GRUAN Sites” Jauhiainen et al. (2019) (GRUAN TD-7)
- Important roles in Satellite Cal & Val

# PRIORITIES (ROADMAP) FOR 2021-2025



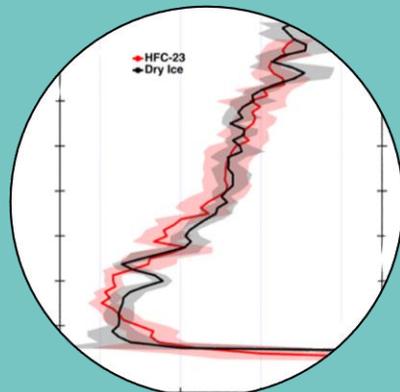
## Network

- Certification
- New sites
- Silent sites
- Other needs



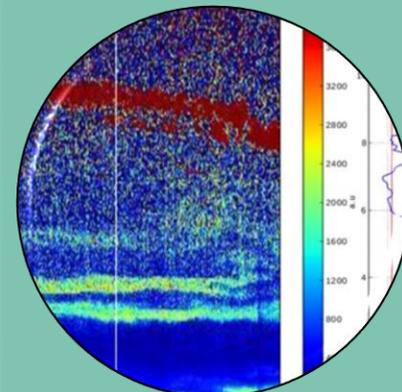
## GDPs

- Other radiosondes
- Ozone
- CFH/FPH
- Lidar
- MWR



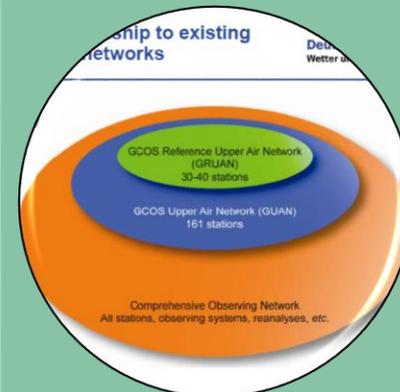
## UTLS WV

- R23 replacement
- New sensors (Skydew, PCFH, QCLAS, FLASH-B, ...)



## Priority 2 variables & beyond

1. Clouds
2. Radiation
3. Aerosol
4. Trace gases ...



Benefits to other networks, measurement systems and sciences

**Timeline: Draft by 3/31/2022; Final version by ICM14?**

# GDP development status



System	data processor	centralized processing facility	GRUAN documentation	Peer reviewed paper	GRUAN certification	Target Date???
Meisei IMS-100	yes	yes	Update TD5 in progress	submitted		2/28/2022
Meisei RS-11G V2	yes	yes	Update TD5 in progress	???		2/28/2022
Modem M10 & M20?	beta version	yes	in preparation/under review	Dupont et al. 2020 (JAOT)		2/28/2022
Graw DFM09/DFM17	in preparation	yes	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



**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.  <b>Radiation</b>	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.  <b>Aerosol &amp; Trace gases (AirCore, FTIR ...)</b>	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.  <b>Clouds (Ceilometer...)</b>	GRUAN report summarizing strategy options for consideration by GRUAN stakeholders.	WG-GRUAN Co-chairs, TT ancillary	December 2017