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Session 3

GRUAN Site Report for Potenza

(Submitted by Marco Rosoldi)

Summary and Purpose of this Document

Report from the GRUAN site Potenza for the period January 2024 to December 2024.

Overview

Potenza contributes to the GRUAN data stream with 3 weekly launches of Vaisala RS41 radiosondes, one of which carried out with an automatic launcher nighttime, typically on Monday at 00:00 UTC, and the other two with a manual system both daytime and nighttime, usually on Thursday at 12:00 UTC and between 30 and 120 minutes after sunset. For these manual launches, the standard humidity chamber (SHC) ground check (GC) is routinely performed following the manufacturer GC. Whenever possible, radiosondes were launched within ±3 hours of the GNSS-RO or LEO satellite relevant overpasses provided by the LC. Occasionally, additional radiosonde launches have been performed targeted to the calibration and validation of remote sensing observation systems (e.g. ground-based Raman lidar for water vapour and temperature profiling, MWI and ICI radiometers aboard the Second Generation EUMETSAT Polar Systems within the VICIRS project). Moreover, a long term campaign of monthly dual launches (daytime and nighttime) with Vaisala RS41 and Graw DFM-17 radiosondes is ongoing, with the final aim of contributing to the development of the Graw DFM-17 GDP. In 2024, 97 manual launches (including 6 RS41-DFM17 dual launches) and 70 automatic launches have been performed and the data have been submitted to the GRUAN LC via RsLaunchClient.

About GRUAN future data streams, the dataflow to the GNSS processing centre at GFZ has started in July 2024 and it is currently running. This dataflow includes hourly GNSS RINEX files and co-located meteorological data. The operational processing for GNSS-PW GDP retrieval is expected to be established from the GRUAN processing centre at GFZ. Additionally, in 2025 the Potenza site began the launches of Meisei SKYDEW chilled mirror hygrometers connected to Vaisala RS41 radiosondes, which are expected to contribute to the related GRUAN data stream in the future. Finally, Potenza ground-based remote sensing systems (Raman lidar, Doppler lidar and microwave radiometer) and a GRAW manual radiosounding system for the atmospheric profiling of temperature, water vapor and horizontal wind, will allow to extend the number of GRUAN data streams, once the related GDPs have been defined.

Change and change management

During the reporting period, there was no change in GRUAN measurement programs and related operating procedures, operators, instruments or expendables, data processing algorithms, data acquisition software, as well as in location of instruments and their operating environments.

Resourcing

Although the site of Potenza does not have financial and personnel resources specifically dedicated to GRUAN activities, resources from natioNa0and international projects will allow to suppoRtsurrent and planned GRUAN measurement programs and related activities, as outlined in the overview section, for at least the next two years, as well as to keep hosting the file-safe backup for the full GRUAN data archive in its data center.

Operations

There are no operational challenges or deviations from GRUAN procedures to be reported. With the exception of one manual launch, GDP for all launches performed during the reporting period is available in the GRUAN data archive and the performance in terms of burst point pressure is generally good, being the burst point pressure for manual launches between 100 and 10 hPa for 5 launches (5%) and below 10 hPa for all the others (95%), while for automatic launches slightly higher than 100 hPa for 3 launches (4%), between 100 and 10 hPa for 5 launches (7%) and below 10 hPa for all the others (89%). The lower performance for automatic launches is presumably due to lighter balloons used (typi-cally 600g) compared to manual launches, where 800g balloons are typically used.

Site assessment and certification

Potenza was GRUAN-certified for the first time in April 2015, then recertified in May 2019 and Feb-ruary 2024.

GRUAN-related research

The site team is involved in a new Copernicus C3S contract, where an updated version of harmonized GRUAN dataset, including the processing of Vaisala RS41 radiosondes, will be released. Moreover, the version 2 of RHARM (Radiosonde HARMonization) dataset, based on a novel algorithm designed and implemented by the site team using the GRUAN GPDs and the related algorithms, has been released in September 2025.

The site team is also involved in the EUMETSAT project VICIRS (Development of vicarious calibration tools for MWI and ICI using radiosoundings) led by CNR-IMAA and devoted to the design of the calibration and validation phase of ICI and MWI satellite sensors, using the most recent data from GRUAN and RHARM.

Since 15th October 2025, the site team is leading the EUMETSAT scientific contract EUMETRAVES (EUMETSAT Radiosondes Validation Support for Earth-Observing Satellites), aimed at setting up a globally coordinated service for providing radiosoundings reference measurements (GDPs) targeted to support EUMETSAT's satellite calibration/validation (Cal/Val) and monitoring activities.

The site team is contributing to the following GRUAN-related research activities:

- GRUAN Action GA2 ”Graw GDP Progression“, performing systematic RS41/DFM-17 dual launches.
- GRUAN Action TT4 ”GC for the autolauncher“, aimed at providing a procedure and recommendations for implementing a manufacturer independent GC with the SHC in the autolaunchers. For this purpose, laboratory tests with the SHC are carried out in the autolauncher at Po-tenza site in synergy with other GRUAN sites equipped with autolaunchers.
- GRUAN Action CC1 ”Frostpoint Hygrometer GDP progression“, performing SKYDEW-RS41 launches for reference water vapour measurements in the UTLS

Finally, the site team is co-chairing the GRUAN TT Ground-based and member of GRUAN TT sites.

GRUAN-related publications

- Cimini, D., Barlakas, V., Carminati, F. et al. Anatomy of the uncertainty of satellite vicarious calibration using radiosondes: concepts and preliminary results for microwave radiometric ob-servations. Bull. of Atmos. Sci.& Technol. 5, 9 (2024). `https://doi.org/10.1007/s42865-024-00073-y`.
- Fujiwara, M., Sun, B., Reale, A., Cimini, D., Larosa, S., Borg, L., von Rohden, C., Sommer, M., Dirksen, R., Maturilli, M., Vmel, H., Kivi, R., Ingleby, B., Kramer, R. J., Demoz, B., Ladonna, F., Carminati, F., Lewis, O., Candy, B., Thomas, C., Edwards, D., Noersomadi, Shimizu, K., and Thorne, P.: Justification for high-ascent attainment for balloon radiosonde soundings at GRUAN and other sites, Atmos. Meas. Tech., 18, 2919-2955, `https://doi.org/10.5194/amt-18-2919-2025`, 2025.
- D'Amico, G., Arienzo, A., Vivone, G., Amodeo, A., Cardellicchio, F., Gumà-Claramunt, P., De Rosa, B., Di Girolamo, P., Gandolfi, I., Giunta, A., Laurita, T., Marra, F., Mona, L., Mytilinaios, M., Papagiannopoulos, N., Rosoldi, M., and Summa, D.: Atmospheric Boundary Layer Height

Estimation from Lidar Observations: Assessment and Validation of MIPA Algorithm, Remote Sensing, 17(16), 2748, https://doi.org/10.3390/rs17162748, 2025.

WG-GRUAN interface

No action from the WG-GRUAN is currently required for assisting and supporting uh site operations.

Other archiving centers

As for GRUAN relevant datasets, GNSS data collected at Potenza site are also archived on the GPS Italian Integrated Network (RING, https://webring.gm.ingv.it).

Participation in campaigns

In Spring 2024, a measurement campaign was organized and performed at Potenza, where different types of lidar systems were operating continuously, together with frequent RS41 launches (up to 8 launches per day). The main goal of the campaign was to assess the performance of the innovative algorithm MIPA (Morphological Image Processing Approach) for the retrieval of Atmospheric Boundary Layer Height (ABLH) from lidar-derived aerosol backscatter coefficient profiles time series. This assessment was performed using the ABLH estimates from radiosoundings data as a reference. From the GRUAN perspective, including the ABLH with related uncertainty among radiosoundings GDPs would be of great interest to the scientific community for the validation of a huge quantity and variety of existing algorithms and instruments for the measurement of this essential climate variable.

Future plans

For the coming year (2026), the Potenza site's perspectives are to maintain the current GRUAN data flow, interact with the GFZ processing centre to extend the data flow to GNSS data, while continuing and consolidating the GRUAN-related research activities described above. Moreover, the data flow of water vapour Raman lidar measurements performed at Potenza to the GRUAN LC might start for the retrieval of the related GDP. Finally, the site will lead the EUMETSAT EUMETRAVES contract, acting as a single contact point for EUMETSAT, the involved stations (GRUAN and GRUAN-compliant) and the GRUAN LC for the purpose of project execution.

GRUAN Site Report for Potenza (POT), 2024

Reported time range is Jan 2024 to Dec 2024
Created by the Lead Centre
Version from 2025-11-07

1 General GRUAN site information

Object	Value
Station name	Potenza
Unique GRUAN ID	POT
Geographical position	40.6000 °N, 15.7200 °E, 760.0 m
Operated by	IMAA | Istituto di Metodologie per l'Analisi Ambientale, part of: CNR | Consiglio Nazionale delle Ricerche
Main contact	Rosoldi, Marco
WMO no./name	0-20008-0-POT null
Operators	currently 4, changes +0 / -0
Sounding Site	2
GNSS	1

1.1 General information about GRUAN measurement systems

System	Name	Type	Setups	Measurements
POT-GN-01	GNSS Site TITO	GNSS	0	not operational
POT-RS-01	Potenza Radiosonde Launch Site	Sounding Site	6	97
POT-RS-02	Automatic Potenza Launch System (Autosonde AS15)	Sounding Site	1	70

1.2 General comments from Lead Centre

No comments from Lead Centre.

2 System: GNSS Site TITO (POT-GN-01)

Object	Value
System name	GNSS Site TITO
Unique GRUAN ID	POT-GN-01
System type	GNSS (GN - GNSS)
Geographical position	40.6013 °N, 15.7237 °E, 770.0 m
Operated by	IMAA | Istituto di Metodologie per l'Analisi Ambientale, part of: CNR | Consiglio Nazionale delle Ricerche
Instrument contact	Rosoldi, Marco
Started at	-
Defined setups	-
Possible streams	-

2.1 Lead Centre comments

2.1.1 Dataflow

No GNSS dataflow to LC has been established yet.

3 System: Potenza Radiosonde Launch Site (POT-RS-01)

Object	Value
System name	Potenza Radiosonde Launch Site
Unique GRUAN ID	POT-RS-01
System type	Sounding Site (RS - Radiosonde)
Geographical position	40.6010 °N, 15.7237 °E, 760.0 m
Operated by	IMAA | Istituto di Metodologie per l'Analisi Ambientale, part of: CNR | Consiglio Nazionale delle Ricerche
Instrument contact	Rosoldi, Marco
Started at	-
Defined setups	6 (OZONE, ROUTINE, ROUTINE3, RESEARCH, ROUTINE2, DUAL)
Possible streams	DFM-17, ECC, RS41, RS92, SKYDEW

3.1 Lead Centre comments

3.1.1 Data quality

The SHC groundcheck RH differences are a bit on the large side, although this has been observed for other sites as well.

3.1.2 General

This is the manual launching site.

The current operational radiosonde is the Vaisala RS41.

There is good performance in terms of burst altitude which is regularly 10 hPa and higher.

3.2 GRUAN data products

Product	Version	Soundings received	Available at LC	Distributed by NCEI

3.2.1 Stream: DFM-17

DFM-17		6	6	
DFM-17-RAW	001		6	

3.2.2 Stream: RS41

RS41		97	97	
RS41-RAW	001		97	
RS41-EDT	001		97	
RS41-GDP	001		96	

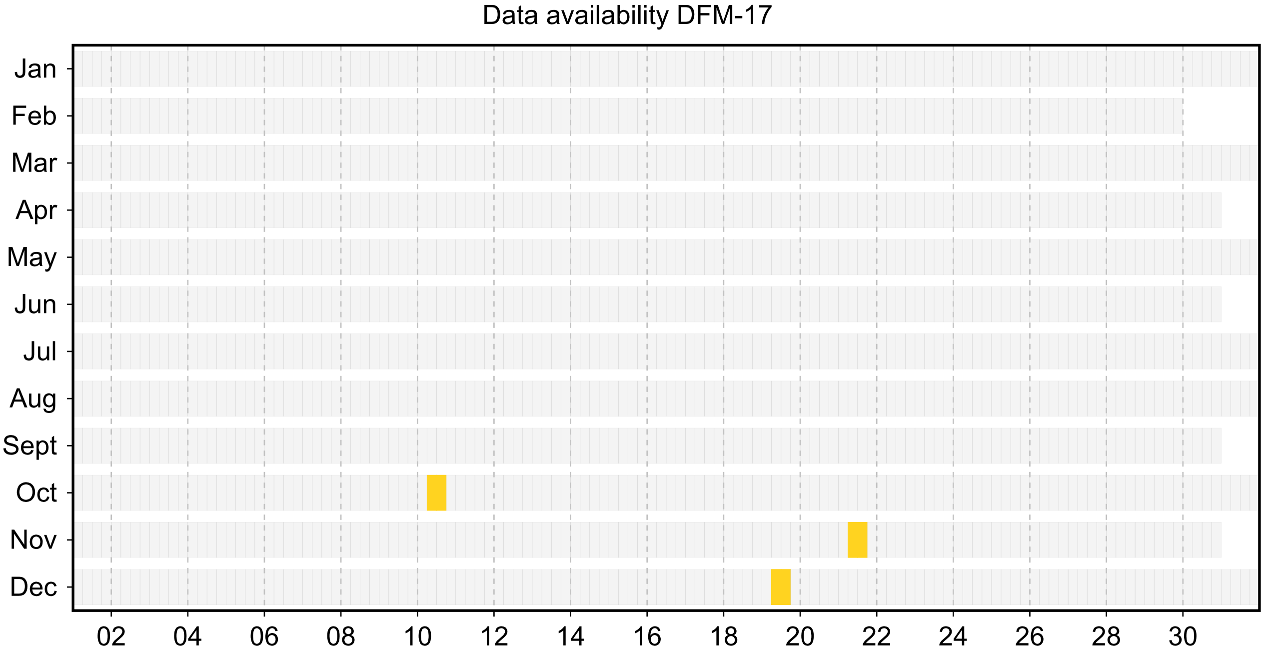
3.3 Availability of data products

Available (green): All steps of data processing have been successfully completed. The data product file is available at LC (e.g. files that didn't pass QA/QC or uncertified GRUAN data products) and/or at NCEI (a certified GRUAN data product file that did pass QA/QC).

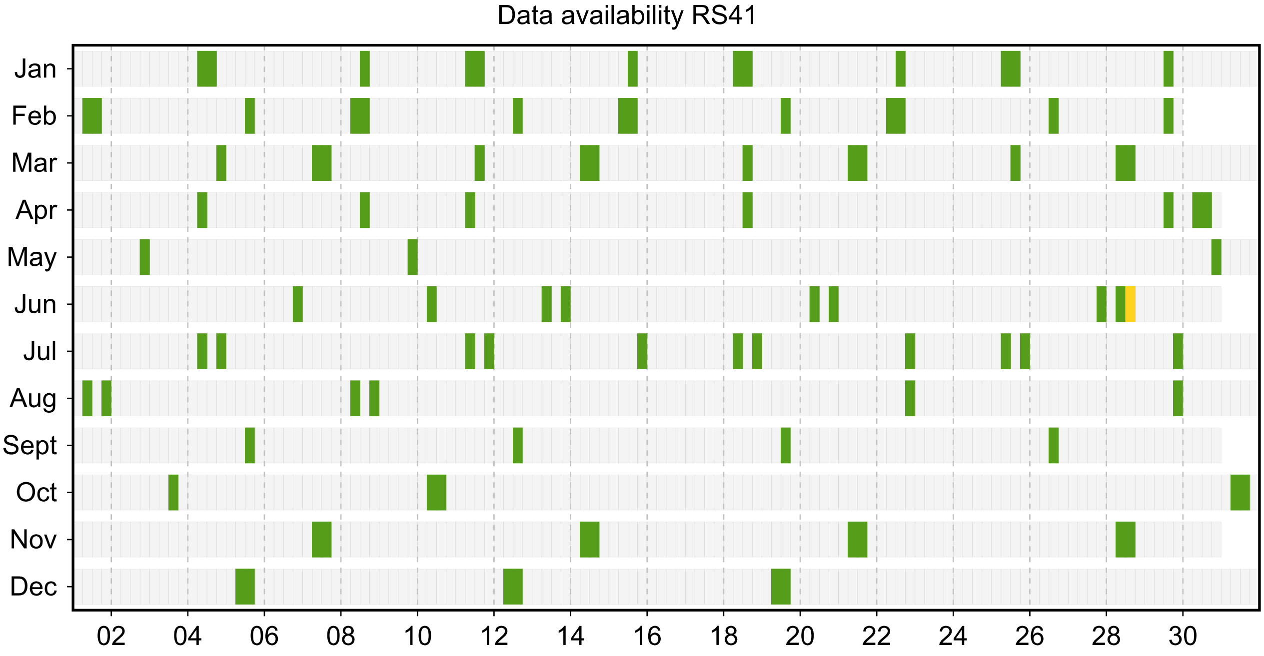
Unprocessed (yellow): The manufacturer-produced file with raw measurement data has been successfully converted into a GRUAN-standardized raw data format (NetCDF). The GRUAN data processing has not been performed or was aborted. Reasons for this may be a still missing GRUAN data processor or a processing-software error.

Original (red): The original, manufacturer-produced, raw data file is available (e.g. MWX data file) but was not converted into a GRUAN-standardized raw data format (NetCDF). Reasons for this may be missing data conversion software, a software error, or a corrupt data file.

3.3.1 Stream: DFM-17



3.3.2 Stream: RS41



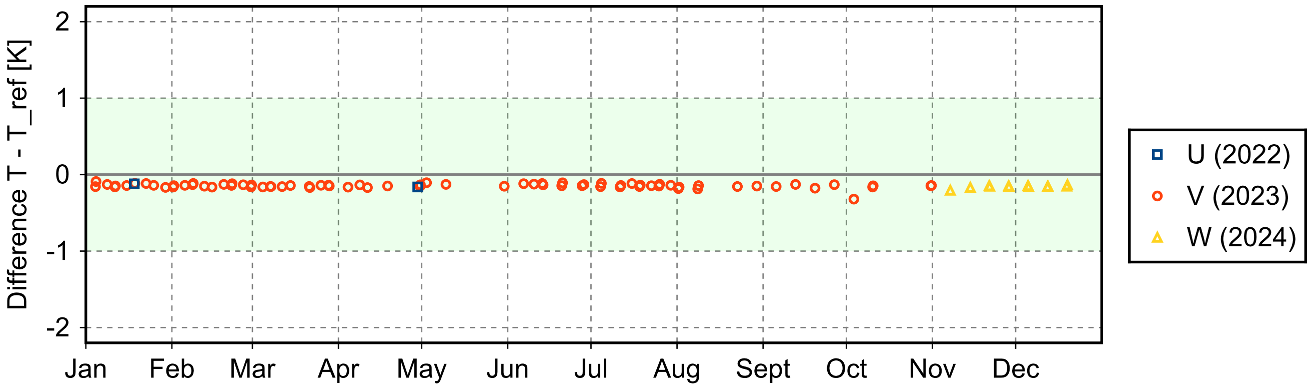
3.4 Instrument combinations of POT-RS-01

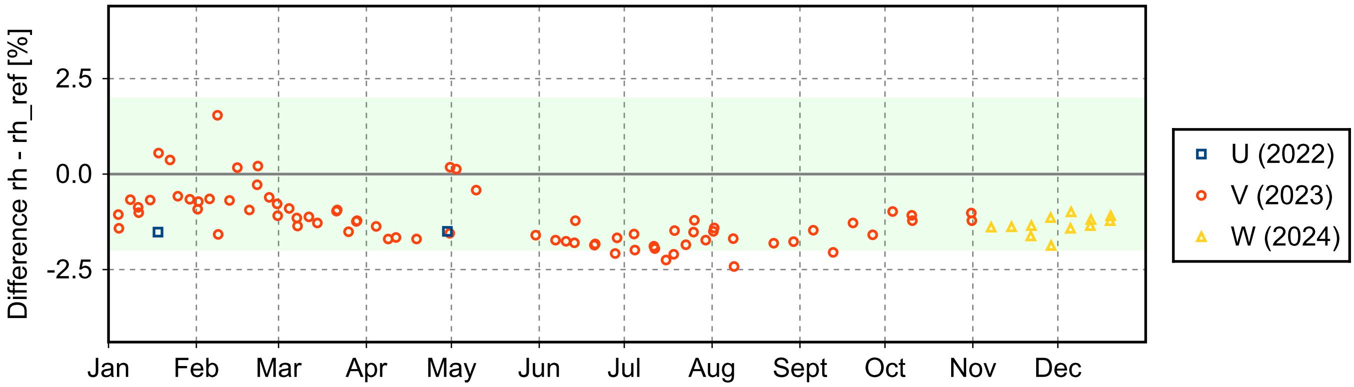
Count	Instrument combination
6	DFM-17, RS41
91	RS41

3.5 Instrument ground check

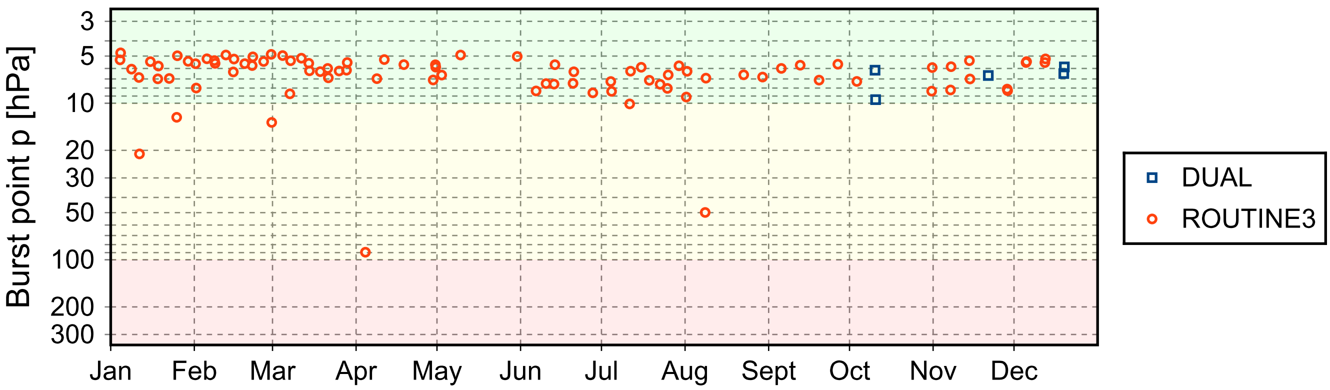
3.5.1 Stream: RS41

(1) GroundCheck: GC-SHC





3.6 Measurement events



4 System: Automatic Potenza Launch System (Autosonde AS15) (POT-RS-02)

Object	Value
System name	Automatic Potenza Launch System (Autosonde AS15)
Unique GRUAN ID	POT-RS-02
System type	Sounding Site (RS - Radiosonde)
Geographical position	40.6000 °N, 15.7200 °E, 760.0 m
Operated by	IMAA | Istituto di Metodologie per l'Analisi Ambientale, part of: CNR | Consiglio Nazionale delle Ricerche
Instrument contact	Rosoldi, Marco
Started at	2022-03-01
Defined setups	1 (AUTO1)
Possible streams	RS41

4.1 Lead Centre comments

4.1.1 General

This is the autolauncher system.

The current operational radiosonde is the Vaisala RS41.

There is good performance in terms of burst altitude which is regularly 10 hPa and higher.

4.2 GRUAN data products

4.2.1 Stream: RS41

Product	Version	Soundings received	Available at LC	Distributed by NCEI
RS41		70	70	
RS41-RAW	001		70	
RS41-EDT	001		70	
RS41-GDP	001		70	

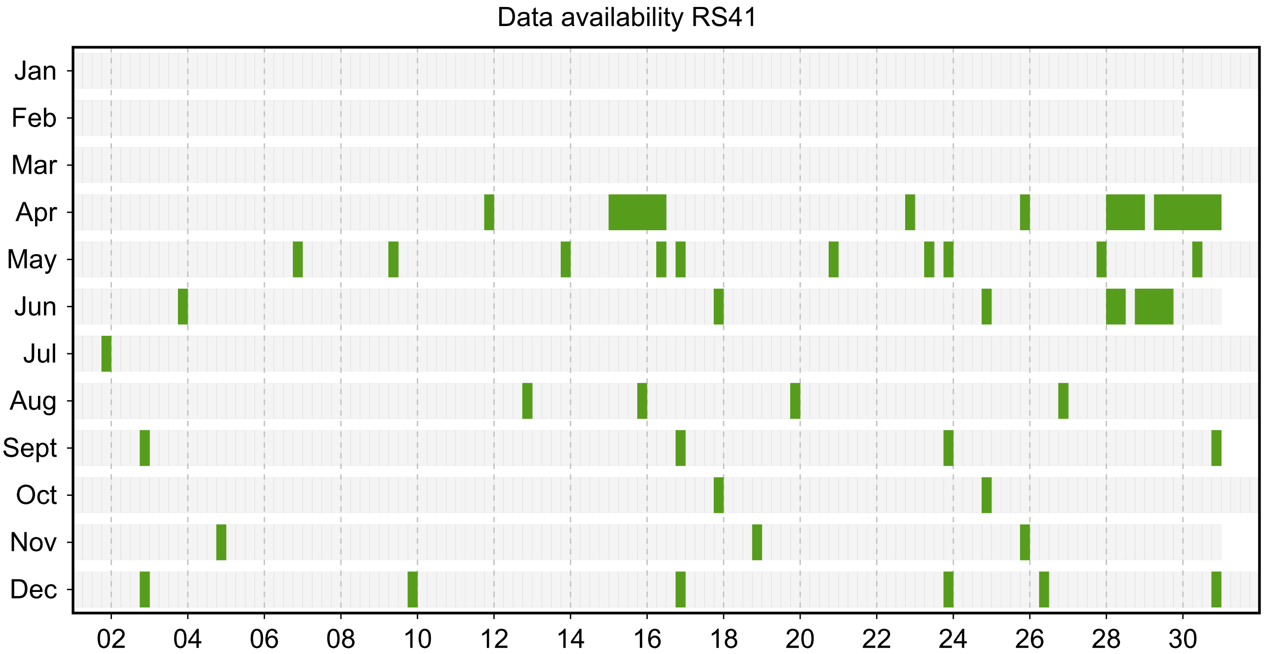
4.3 Availability of data products

Available (green): All steps of data processing have been successfully completed. The data product file is available at LC (e.g. files that didn't pass QA/QC or uncertified GRUAN data products) and/or at NCEI (a certified GRUAN data product file that did pass QA/QC).

Unprocessed (yellow): The manufacturer-produced file with raw measurement data has been successfully converted into a GRUAN-standardized raw data format (NetCDF). The GRUAN data processing has not been performed or was aborted. Reasons for this may be a still missing GRUAN data processor or a processing-software error.

Original (red): The original, manufacturer-produced, raw data file is available (e.g. MWX data file) but was not converted into a GRUAN-standardized raw data format (NetCDF). Reasons for this may be missing data conversion software, a software error, or a corrupt data file.

4.3.1 Stream: RS41



4.4 Instrument combinations of POT-RS-02

Count	Instrument combination
70	RS41

4.6 Measurement events