



WMO/IOC/UNEP/ICSU
GLOBAL CLIMATE OBSERVING
SYSTEM (GCOS)

Doc. 5.20
(22.VI.2022)

**14th GRUAN Implementation-
Coordination Meeting (ICM-14)**

Session 5

La Réunion

28 November - 02 December 2022

GRUAN Site Report for Potenza

(Submitted by Fabio Madonna)

Summary and Purpose of this Document

Report from the GRUAN site Potenza for the period January to December 2021.

Overview

Currently, the Potenza site is contributing to GRUAN data streams only with radiosoundings, routinely performed twice per week. RS41 radiosondes are manually launched, typically on Monday and Thursday between 30 and 120 minutes after sunset. A manufacturer-independent pre-launch ground check is regularly performed using the standard humidity chamber SPRH100. When not too demanding for the Potenza site team, radiosondes launches in correspondence of the GNSS-RO or LEO satellite overpasses (provided by the LC) have been performed. Only relevant overpasses occurring during the week (no Saturday and Sunday) and within ± 2 hours of the sunset are considered. From January to December 2021, 49 radiosoundings were performed: this is smaller than the typical number for the Potenza site because of a failure of the radiosounding PC and of the restrictions imposed by the Italian government due to the pandemic, which caused an gap in the measurements for the period from October 2021 to January 2022. About GRUAN future data streams, the automatic radiosonde launcher (ARL), operational from 2004 to 2016, has been upgraded and made operational. Since May 2022, launches with the ARL re-started successfully. As a consequence, the total number of sounding at Potenza site is expected to increase from 2 to 3 weekly radiosoundings: one with the automatic launcher (on Monday at 00:00 UTC) and two with the manual system (on Thursday at 12:00 UTC and after sunset). The GNSS data processing for Potenza was successfully tested. Unfortunately, this cannot be performed on a routine basis yet, because of the replacement of the automatic weather station providing near surface data. Now the station is in place and the data shall be submitted on a regular by the next Sept-Oct 2022. Finally, the facility at Potenza is being upgraded with the acquisition of new instruments, including a portable GNSS antenna, a portable radiosounding system, a total-sky imager, remote sensing instruments for atmospheric profiling of temperature and humidity (Raman lidar and microwave profiler), trace gases (Fourier-transform infrared radiometer), wind fields (Doppler lidar), aerosol (multiwavelength polarization/Raman lidar), clouds and precipitation (Doppler radar and microwave radiometer). However, the installation and operation of most of these instruments has been delayed, also because of the pandemic, and most of them will become operational by the end of 2022.

Change and change management

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

Resourcing

The site of Potenza carries out GRUAN activities using not dedicated funds. As part of a national project aimed at strengthening the Italian research infrastructures, it was possible to upgrade the automatic radiosonde launcher, as well as to acquire a manual portable launch system, along with several other instruments of interest for next GRUAN phase and for the priority two products (see also the “Overview section”). Moreover, funds are available to ensure at least 3 weekly launches (two manual and one automatic) and possible additional resources to perform field measurement campaigns and/or laboratory experiments relevant for GRUAN. Finally, the site of Potenza will continue to host in its data center the filesafe backup for the full GRUAN data archive.

Operations

There were no operational challenges or deviations from GRUAN procedures to be reported. For 94% of launches performed during the reporting period the burst point pressure was below 10 hPa, while for the remaining launches the burst point pressure was between 10 and 20 hPa. No critical issues are expected in coming years for the supply of helium, currently in use at the Potenza station to inflate balloons. However, it is technically possible to use hydrogen instead of helium in the future, if needed.

Covid-19

In order to deal with the Covid-19 pandemic emergency, the Italian government enforced restrictions to access the facility for unvaccinated personnel. This contributed to the interruption of radiosoundings from October 2021 to January 2022, partly to their reduction in March 2022 and to the installation and new instruments, of interest for GRUAN, in the frame of a large site upgrade.

Site assessment and certification

The site of Potenza was first certified in April 2015 and then recertified in May 2019.

GRUAN-related research

In the frame of the C3S 311a Lot3 contract of the Copernicus Climate Change Service (C3S), led by CNR-IMAA, both GRUAN and IGRA radiosounding historical data archives have been made available. Harmonized data version for both GRUAN and IGRA are currently publicly available through the C3S Climate Data Store (CDS). A bias-adjusted version of IGRA data, called RHARM

(Radiosonde HARMonization) and based on a novel algorithm designed and implemented by the CNR-IMAA, is also publicly available through the CDS. A peer-reviewed paper has been recently published, which describes the RHARM homogenization algorithm, the quality of the RHARM data for temperature, relative humidity and wind, as well as the comparison with other reanalysis data. The dataset includes also the uncertainty estimation for the historical data.

Since November 2021, CNR is leading the C3S2 311 Lot2 contract, where an updated version of harmonized GRUAN dataset, including the processing of the most recent Vaisala RS41 radiosondes, will be released to C3S. Within the same contract, improvements of RHARM algorithm performances, as well as updates of RHARM and IGRA datasets are also planned.

Recently, a peer-reviewed paper has been published, presenting the methodology and results of laboratory tests aimed at characterizing the performances and differences of Vaisala RS92 and RS41 radiosondes in terms of noise, calibration accuracy, as well as bias in temperature measurements. The experiment was drafted and carried out by CNR-IMAA in cooperation with the Italian NMI (INRiM). Moreover, a study was carried by CNR to assess trends and uncertainties in the atmospheric boundary layer height estimated using low and high resolution radiosounding temperature profiles. The results and methodology of this study have also been published in a peer-reviewed paper.

Finally, the site of Potenza is co-chairing the GRUAN Task Team “Measurement scheduling and combination”.

GRUAN-related publications:

- Madonna, F., Tramutola, E., SY, S., Serva, F., Proto, M., Rosoldi, M., Gagliardi, S., Amato, F., Marra, F., Fass, A., Gardiner, T., and Thorne, P.W., The new Radiosounding HARMonization (RHARM) data set of homogenized radiosounding temperature, humidity, and wind profiles with uncertainties. *Journal of Geophysical Research: Atmospheres*, 127, e2021JD035220. <https://doi.org/10.1029/2021JD035220> 2022.
- Rosoldi, M.; Coppa, G.; Merlone, A.; Musacchio, C.; Madonna, F. Intercomparison of Vaisala RS92 and RS41 Radiosonde Temperature Sensors under Controlled Laboratory Conditions. *Atmosphere*, 13, 773. <https://doi.org/10.3390/atmos13050773>, 2022.
- Madonna, F.; Summa, D.; Di Girolamo, P.; Marra, F.; Wang, Y.; Rosoldi, M. Assessment of Trends and Uncertainties in the Atmospheric Boundary Layer Height Estimated Using Radiosounding Observations over Europe. *Atmosphere*, 12, 301. <https://doi.org/10.3390/atmos12030301>, 2021.

WG-GRUAN interface

A WIGOS ID has been officially assigned to the Potenza station, although, For unknown reasons, we continue not be allowed by the IT MetService transmitting the radiosounding data through the WIS.

Other archiving centers

Referring strictly to datasets relevant for GRUAN, GNSS data are also archived on the RING (Italian Integrated GPS network), while the datasets for aerosols and clouds are available via ACTRIS data portal (actris.nilu.no) and through the AERONET data archive (<https://aeronet.gsfc.nasa.gov>).

Participation in campaigns

During the reporting period, the site of Potenza was not involved in campaigns relevant for GRUAN research activities.

Future plans

The site of Potenza is one of the most relevant Italian facilities of the ACTRIS Research Infrastructure (RI), which is part of the ESFRI roadmap, and one of the most advanced atmospheric observatory in Europe. Thus, resources are available to ensure the continuity and consolidation of the current GRUAN measurement programs, as well as the participation in field measurements campaigns or laboratory experiments interesting for GRUAN.

Furthermore, a major upgrade is currently being implemented at the facility, with the installation and operation of several new instruments (see “Overview section”), which will be likely finalized by the end of 2022. The measurements from all these instruments may contribute to current and future GRUAN measurement programs.



GRUAN Site Report for Potenza (POT), 2021

Reported time range is Jan 2021 to Dec 2021

Created by the Lead Centre

Version from 2022-11-15

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	Madonna, Fabio
WMO no./name	0-20008-0-POT null
Operators	currently 4, changes +0 / -0
Sounding Site	1
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	5	49

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	Madonna, Fabio
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	Madonna, Fabio
Started at	-
Defined setups	5 (OZONE, ROUTINE, ROUTINE2, RESEARCH, ROUTINE3)
Possible streams	ECC, RS41, RS92

3.1 Lead Centre comments

3.1.1 Dataflow

Sonde dataflow to GRUAN LC is operational since February 2011.

Currently, the dataflow is interrupted. No sounding data has been sent to the LC since October 2021.

3.1.2 General

Routine soundings are performed up to twice per week employing the Vaisala RS41-SG.

3.2 GRUAN data products

Product	Version	Soundings received	Available at LC	Distributed by NCEI
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3.2.1 Stream: RS41

RS41		49	49	
RS41-RAW	001		49	
RS41-EDT	001		49	
RS41-GDP	001		49	
RS41-GDP-BETA	002		36	
RS41-GDP-BETA	003		49	

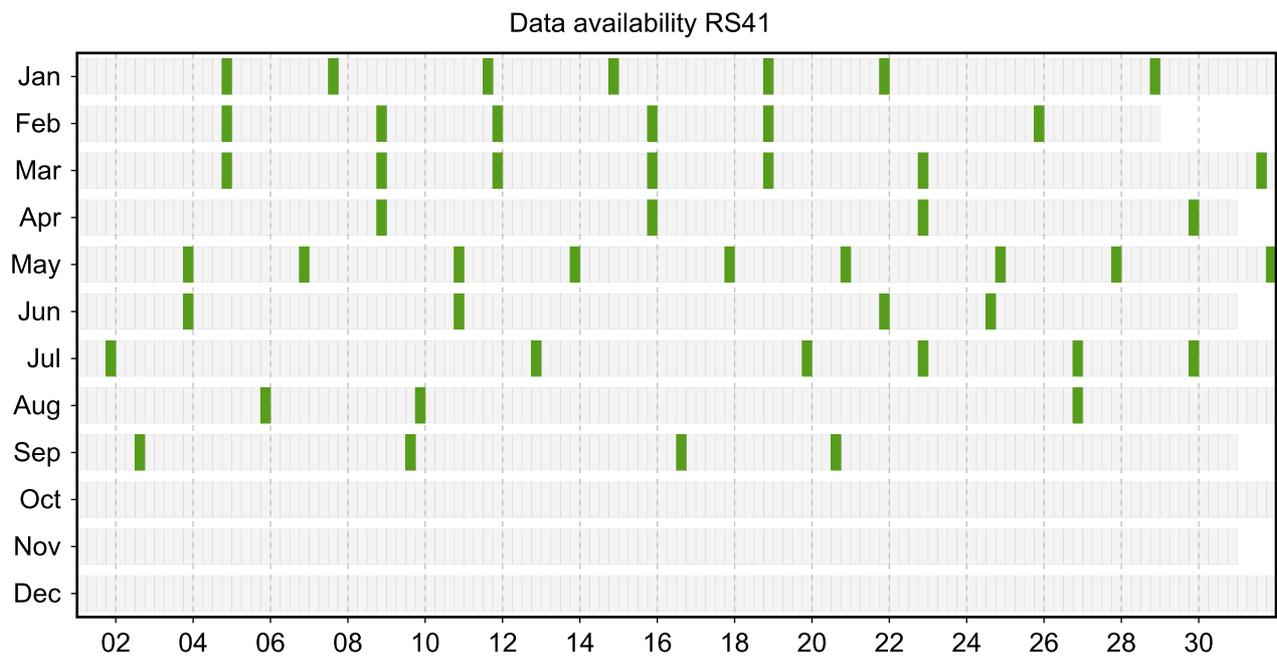
3.3 Availability of data products

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: RS41



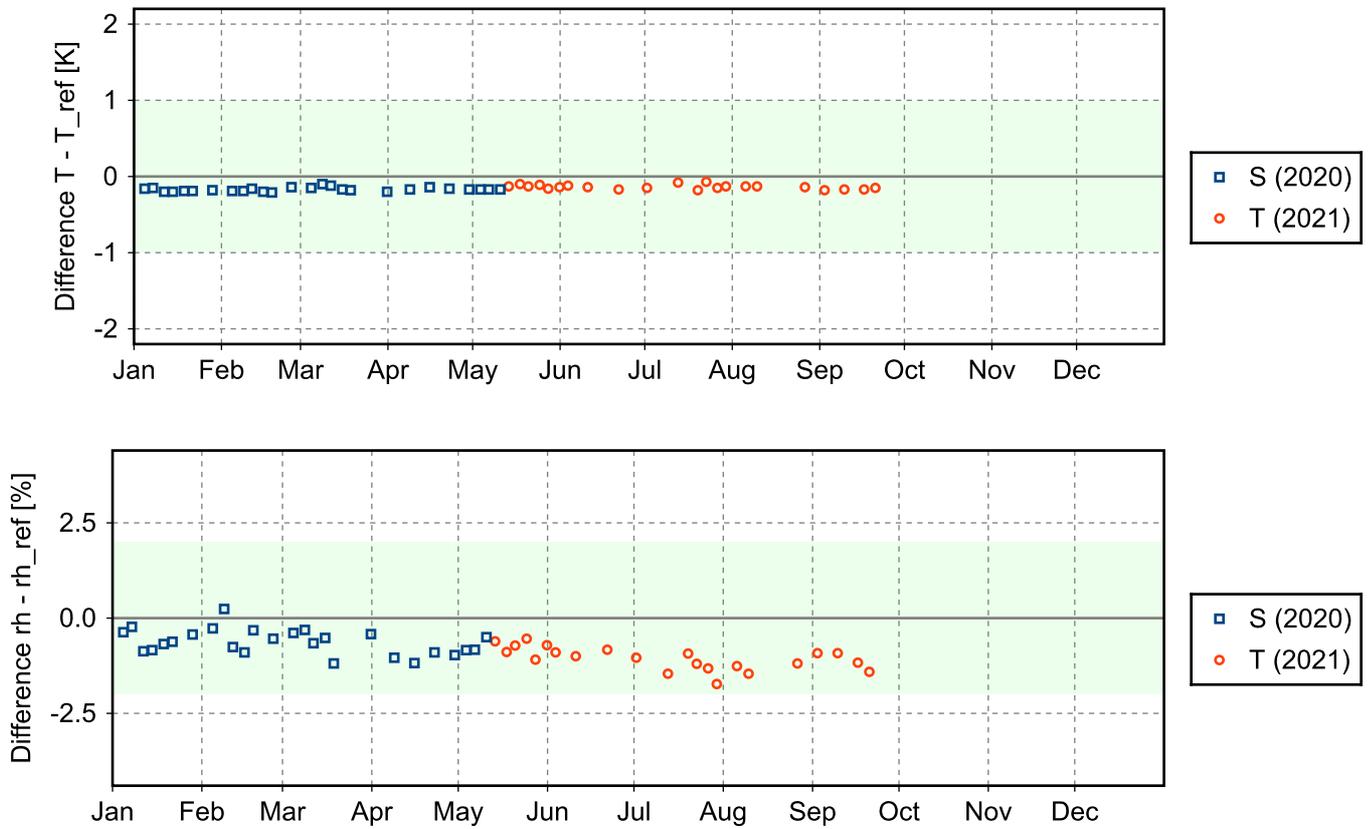
3.4 Instrument combinations of POT-RS-01

Count	Instrument combination
49	RS41

3.5 Instrument ground check

3.5.1 Stream: RS41

(1) GroundCheck: GC-SHC



3.6 Measurement events

