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Session 1

GRUAN Site Report for Payerne

(Submitted by Giovanni Martucci)

Summary and Purpose of this Document

Report from the GRUAN site Payerne for the period January to December 2020.

Overview

The consolidated measurement programme of multi-payload flights counted few dozens of flight in 2019, while in 2020 this programme has been interrupted in February after only four flights. A new GRUAN strategy for MeteoSwiss will be defined in 2021. The strategy will define the main operational GRUAN programme at Payerne, the PI involved and the new measurements.

Consolidated measurement programmes:

- The multi-payload comparison programme (RS41, RS92, SRS-C34, SRS-C50) has been performed only until February 2020. Three multi-payload flights with RS41-RS92-SRSC50-SRSC34 and 1 RS41+O3+PCFH have been performed.

- *PAY-RS-01/02:* The Vaisala RS41 is the official operational sonde at Payerne. It is launched twice per day at 11 and 23 UTC. Automatic flights from the AS15 Autosonde system are launched every midnight, weekend (noon and midnight) and official holidays (noon and midnight). An operator launches manual flights every working day at noon or (independent-ly of the time of launch) in combination with an ozone sonde (three times per week). In 2020, 82 manual flights and 277 automatic flights have been performed and the data been sent to the LC.

GRUAN new product:

- *PAY-GN-01*
  GNSS data at Payerne (PAYE) are owned by SwissTopo as part of the AGNES network. SwissTopo streams the Zenith Delay (ZD) data to the GFZ at Potsdam in a daily 5-minute resolution RINEX file. GFZ puts the ZD data obtained from SwissTopo on an ftp server ftp://ftp.gfz-potsdam.de/GNSS/products/nrttrop/sinex_trop_GRUAN_EPOS8/wnnnn
  What is still missing in 2020? The Integrated Water Vapour (IWV) along the atmosphere was not calculated at GFZ in 2020 be-cause the meteorological data (pressure, Temperature and humidity) were not yet streamed to the GFZ. Consequently, no GNSS GPD has been generated in 2020. At the time when this report is written (April 2021) a new data stream of meteorological data from PAYE to GFZ has been put in place. A daily RINEX-M file is transferred every day to GFZ allowing the creation of a GNSS GPD.

- *PAY-LI-01*
  The PAY-LI-01 is an operational all-day measurement of water vapour by the Raman lidar RALMO installed at Payerne. RALMO has suffered a main failure of the laser in July 2020 and due to the travel restrictions in place in Europe in relation to the pandemic has not been solved until April 2021. The only data available in 2020 are then during the period January-July. *Data streaming to LC:* to the best of our knowledge, no official automatic procedure are in

place at GRUAN to ingest automatically the WV data from RALMO. However, RALMO raw data are automatically transferred as daily files to the JPL Table Mountain Facility under the responsibility of Dr. Thierry Leblanc. These data can be used for WV retrieval by the GLASS algorithm.

Change and change management

- The number of operational radiosounding has been doubled (from 2 to 4 per day) during the period 15-April to 15-June 2020 to compensate the gap of measurements of AMDAR (air-lines grounding due to COVID-19).

- Descent flight data have been started recording since April 2020.

Resourcing

Resourcing challenges

- No changes in the staff composition during the year 2019.

- Instrumentation and staff units have not undergone any cut during 2019.

Funding:
The funding are of governmental origin and stable.

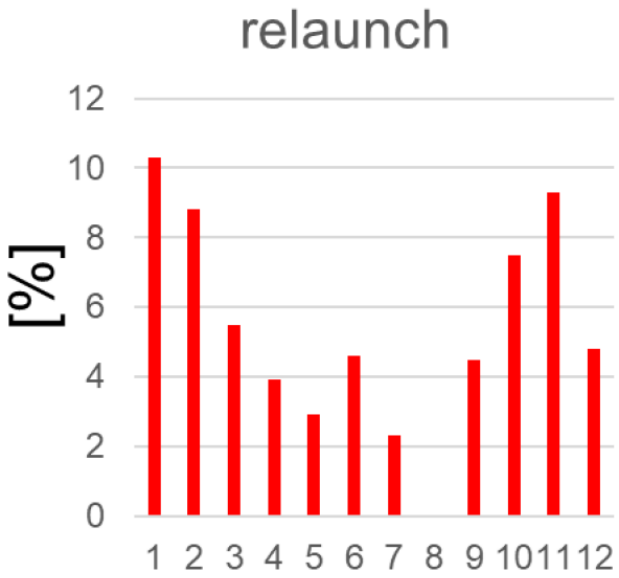
Operations

The data availability and the target achievement at the levels 100-30-10 hPa in 2020 has been globally (year performance) very good. However, the bursting levels at 30 hPa and 10 hPa have not been reached satisfactorily in the winter months of 2020 (Jan-Feb-Dec). Monthly statistics are provided in the table below.

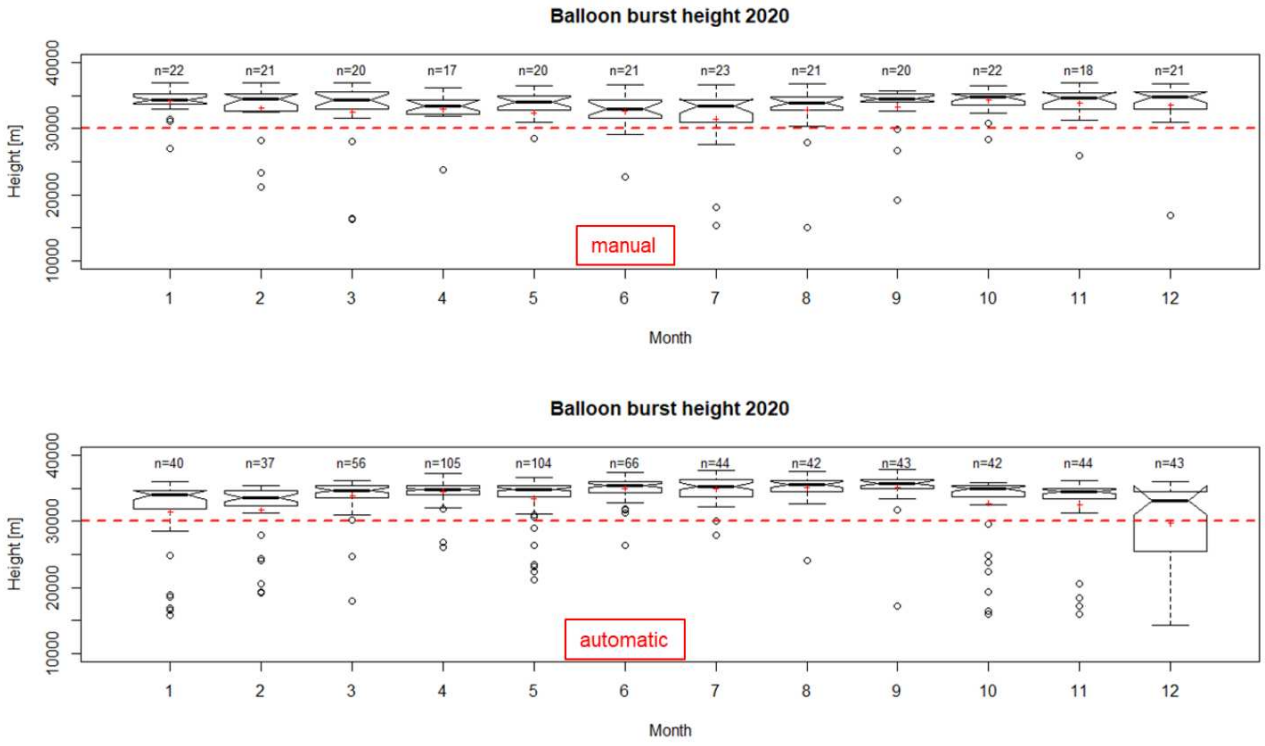
Mois	P< 100 hPa [>95%]	P< 30 hPa [>90%]	P< 10 hPa [>80%]	Avg Burst [manual]	Avg Burst [auto]
01	96%	90%	83%	34.173 m	31.394 m
02	100%	89%	82%	33.069 m	31.587 m
03	98%	95%	90%	32.510 m	34.043 m
04	100%	98%	98%	32.781 m	34.784 m
05	98%	91%	85%	32.404 m	33.278 m
06	100%	98%	98%	32.615 m	34.912 m
07	98%	96%	85%	31.420 m	34.966 m
08	98%	96%	93%	32.865 m	35.126 m
09	100%	96%	93%	33.260 m	35.229 m
10	98%	93%	88%	34.273 m	32.873 m
11	98%	91%	90%	33.808 m	32.378 m
12	98%	83%	77%	34.377m	29.579 m
all	**98%**	**93%**	**88%**	**33.123 m**	**33.359 m**

The unsatisfactory performances at 10 hPa and 30 hPa are related mostly with the automatic launches as shown in the monthly relaunch statistics of the Vaisala AS15 in the table below. The Relaunch histograms shows the percentage of flights that failed and had to be relaunched by the AS15.

Mois	Relaunch AS15a
01	10.3% (4/39)
02	8.8% (3/34)
03	5.5% (3/55)
04	3.9% (4/103)
05	2.9% (3/102)
06	4.6% (3/65)
07	2.3% (1/43)
08	0% (0/41)
09	4.5% (2/44)
10	7.5% (3/40)
11	9.3% (4/43)
12	4.8% (2/42)
all	4.8% (32/668)



Below the box-plots show the statistics of bursting heights per month and for the manual and automatic system. Currently the reasons why the performances with the automatic system have dropped in 2020 are under investigation by Vaisala.



Covid-19

- COVID-19 pandemic has not affected the over quality or data availability of operational *PAY-RS-01/02* GRUAN measurements at Payerne. The radiosounding programme *PAY-RS-01/02* has been enhanced during the period April-June 2020 to help filling the gap of AMDAR measurements.

- COVID-19 pandemic has not affected the over quality or data availability of operational *PAY-GN-01* GRUAN measurements at Payerne

- The LIDAR *PAY-LI-01* has been affected significantly by the pandemic situation as explained in the sections above. *PAY-LI-01* data suffered a disruption during 08/20-04/21 due to the impossibility of the maintenance company Litron (Rugby, UK) to travel to the Payerne site and repair the Lidar.

Site assessment and certification

Payerne has been recertified as GRUAN site on September 2019.

GRUAN-related research

Task Team participation:

- Gonzague Romanens and Christian Felix, MeteoSwiss, are members of the GRUAN *TT Radiosondes* with the task to report on auto-launcher performances and GRUAN-compatibility.

- Giovanni Martucci is member of the GRUAN *TT Ancillary* under the specific task of LIDAR activities.

List of published GRUAN-related scientific publications:

- Martucci, G., Navas-Guzmán, F., Renaud, L., Romanens, G., Gamage, S. M., Hervo, M., Jeannet, P., and Haefele, A.: Validation of pure rotational Raman temperature data from the Raman Lidar for Meteorological Observations (RALMO) at Payerne, Atmos. Meas. Tech., 14, 13331353, https://doi.org/10.5194/amt-14-1333-2021, 2021.

- Shayamila Mahagammulla Gamage; Robert J Sica; Giovanni Martucci; Alexander Haefele., A 1D Var retrieval of relative humidity using the ERA5 dataset for the assimilation of Raman lidar measure-ments, Journal of Atmospheric and Oceanic Technology , in print, 2020

- Hicks-Jalali, S., Sica, R. J., Martucci, G., Maillard Barras, E., Voirin, J., and Haefele, A.: A Raman lidar tropospheric water vapour climatology and height-resolved trend analysis over Payerne, Switzerland, Atmos. Chem. Phys., 20, 96199640, https://doi.org/10.5194/acp-20-9619-2020, 2020.

- Brunamonti, S., Martucci, G., Romanens, G., Poltera, Y., Wienhold, F. G., Haefele, A., and Navas-Guzmán, F.: Validation of aerosol backscatter profiles from Raman lidar and ceilometer using balloon-borne measurements, Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2020-294, in review, 2020.

- Domenico Cimini, Martial Haeffelin, Simone Kotthaus, Ulrich Löhnert, Pauline Martinet, Ewan OConnor, Christopher Walden, Martine Collaud Coen, Jana Preissler: Towards the profiling of the atmospheric boundary layer at European scale Introducing the COST Action PROBE, Bulletin of Atmospheric Science and Technology, https://doi.org/10.1007/s42865-020-00003-8, 2020.

- Maillard Barras, E., Haefele, A., Nguyen, L., Tummon, F., Ball, W. T., Rozanov, E. V., Rüfenacht, R., Hocke, K., Bernet, L., Kämpfer, N., Nedoluha, G., and Boyd, I.: Study of the dependence of long-term stratospheric ozone trends on local solar time, Atmos. Chem. Phys., 20, 84538471, https://doi.org/10.5194/acp-20-8453-2020, 2020

- Parrish, D. D., Derwent, R. G., Steinbrecht, W., Stübi, R., Van Malderen, R., Steinbacher, M., et al. (2020). Zonal similarity of longterm changes and seasonal cycles of baseline ozone at northern midlatitudes. Journal of Geophysical Research: Atmospheres,125, e2019JD031908. https://doi.org/10.1029/2019JD031908

- Holger Vömel, Herman G. J. Smit, David Tarasick, Bryan Johnson, Samuel J. Oltmans, Henry Selkirk, Anne M. Thompson , Ryan M. Stauffer , Jacquelyn C. Witte, Jonathan Davies, Roeland van Malderen, Gary A. Morris, Tatsumi Nakano, Rene Stübi, A new method to correct the ECC ozone sonde time response and its implications for "background current" and pump efficiency, Atmos. Meas. Tech., 13, 56675680, 2020, https://doi.org/10.5194/amt-13-5667-2020

- Collaud Coen, M., Andrews, E., Bigi, A., Martucci, G., Romanens, G., Vogt, F. P. A., and Vuilleumier, L. (2020). Effects of the prewhitening method, the time granularity, and the time segmentation on the MannKendall trend detection and the associated Sen's slope. Atmos. Meas. Tech., 13, 69456964, https://doi.org/10.5194/amt-13-6945-2020.

WG-GRUAN interface

No requests

Other archiving centers

- ACTRIS/EARLINET: Lidar
- NDACC: Ozone Radiosounding + Lidar

Participation in campaigns

Nothing to be reported for the year 2020.

Future plans

Payerne has acquired 45 COBALD sondes to be flown based on mothy schedule during the period 2020-2022 (15 flights per year). One of the objective of this programme is to study the vertical profile of the hygroscopicity through the lower troposphere and its validation with the lidar. The UAII field campaign for intercomparison of radiosounding systems and remote sensing instruments has been postponed to 2022 due to the pandemic.

GRUAN Site Report for Payerne (PAY), 2020

Reported time range is Jan 2020 to Dec 2020
Created by the Lead Centre
Version from 2021-04-27

1 General GRUAN site information

Object	Value
Station name	Payerne
Unique GRUAN ID	PAY
Geographical position	46.8100 °N, 6.9500 °E, 491.0 m
Operated by	MSWISS | Office fédéral de météorologie et climatologie MeteoSuisse
Main contact	Martucci, Giovanni
WMO no./name	06610 PAYERNE
Operators	currently 20, changes +0 / -0
Sounding Site	2
Lidar	1
GNSS	1

1.1 General information about GRUAN measurement systems

System	Name	Type	Setups	Measurements
PAY-GN-01	GNSS Site PAYE	GNSS	1	operational
PAY-LI-01	Payerne Raman WV Lidar (RALMO)	Lidar	1	0
PAY-RS-01	Payerne Radiosonde Launch Site	Sounding Site	8	81
PAY-RS-02	Automatic Payerne Launch System (Autosonde)	Sounding Site	1	559

1.2 General comments from Lead Centre

No comments from Lead Centre.

2 System: GNSS Site PAYE (PAY-GN-01)

Object	Value
System name	GNSS Site PAYE
Unique GRUAN ID	PAY-GN-01
System type	GNSS (GN - GNSS)
Geographical position	46.8121 °N, 6.9439 °E, 548.7 m
Operated by	MSWISS | Office fédéral de météorologie et climatologie MeteoSuisse
Instrument contact	Martucci, Giovanni
Started at	-
Defined setups	1 (HOURLY)
Possible streams	-

2.1 Lead Centre comments

2.1.1 Dataflow

Dataflow of GNSS data to GRUAN LC and the GRUAN GNSS processing centre at GFZ has started in October 2018. The current dataflow includes converted raw data (RINEX) and instrument logs, containing all equipment changes.

Meteorological data are missing, therefore the operational processing as GNSS-PW-GDP cannot be performed at moment.

3 System: Payerne Raman WV Lidar (RALMO) (PAY-LI-01)

Object	Value
System name	Payerne Raman WV Lidar (RALMO)
Unique GRUAN ID	PAY-LI-01
System type	Lidar (LI - Lidar)
Geographical position	46.8100 °N, 6.9500 °E, 491.0 m
Operated by	MSWISS | Office fédéral de météorologie et climatologie MeteoSuisse
Instrument contact	Martucci, Giovanni
Started at	2013-09-01
Defined setups	1 (TEST-1)
Possible streams	-

3.1 Lead Centre comments

3.1.1 Dataflow

No dataflow of lidar measurements to LC has been established yet.

4 System: Payerne Radiosonde Launch Site (PAY-RS-01)

Object	Value
System name	Payerne Radiosonde Launch Site
Unique GRUAN ID	PAY-RS-01
System type	Sounding Site (RS - Radiosonde)
Geographical position	46.8133 °N, 6.9434 °E, 491.0 m
Operated by	MSWISS | Office fédéral de météorologie et climatologie MeteoSuisse
Instrument contact	Romanens, Gonzague
Started at	-
Defined setups	8 (ROUTINE, OZONE, RESEARCH, SRS-TEST, DUAL, ROUTINE2, ROUTINE3, OZONE2)
Possible streams	COBALD, ECC, M10, RS41, RS92, SRS-C34, SRS-C50

4.1 Lead Centre comments

4.1.1 Dataflow

Dataflow to GRUAN LC was running intermittently since September 2011. This dataflow included streams of the Meteolabor SRS-C34, Meteolabor SRS-C50, Vaisala RS92-SGP, Vaisala RS41-SG, and ECC ozone sonde.

Operational data flow of manual routine launches is working well. This dataflow includes stream of the operational sonde Vaisala RS41-SG. All launches are promptly recorded using the GruanToolRsLaunch (gtRsl). Change to use of RsLaunchClient is planned for February 2021.

Data flow of all manual research and ozone flights was interrupted since January 2018. The restart is planned using of RsLaunchClient in spring 2021.

4.2 GRUAN data products

Product	Version	Soundings received	Available at LC	Distributed by NCEI
4.2.1 Stream: RS41				
RS41		81	81	
RS41-GCA	001		80	
RS41-RAW	001		81	
RS41-EDT	001		80	
RS41-GDP-ALPHA	003		24	
RS41-GDP-ALPHA	004		16	
RS41-GDP-BETA	001		81	
RS41-GDP-BETA	002		16	

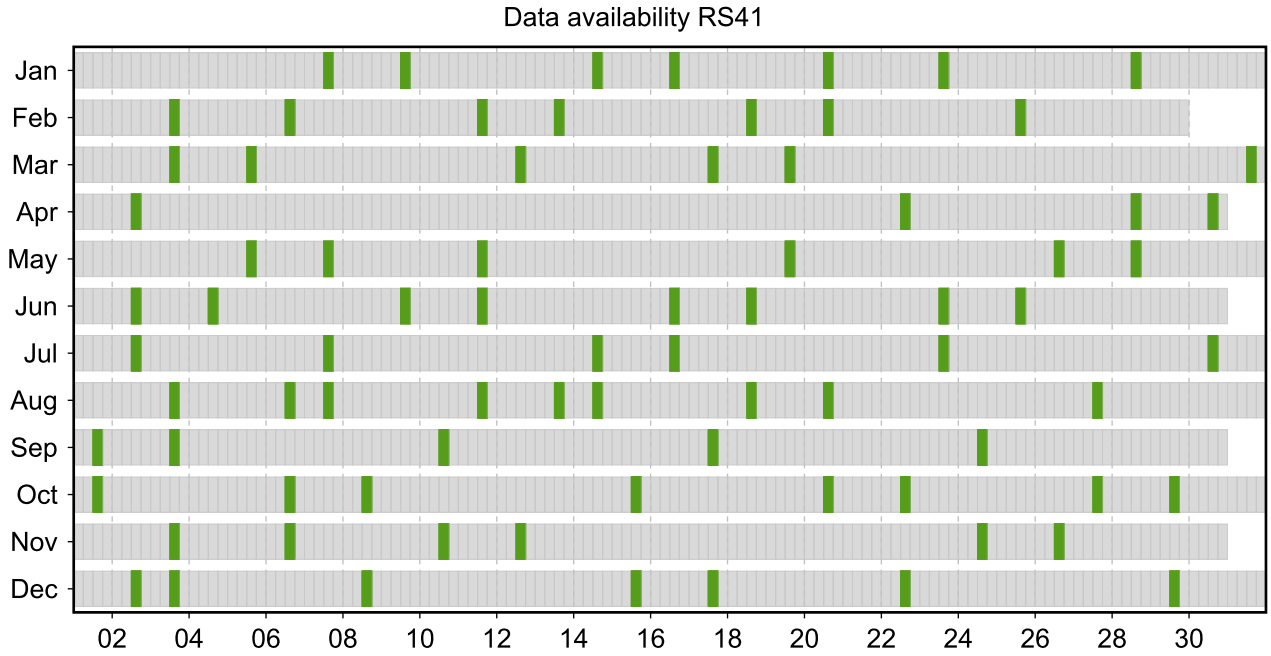
4.3 Availability of data products

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.

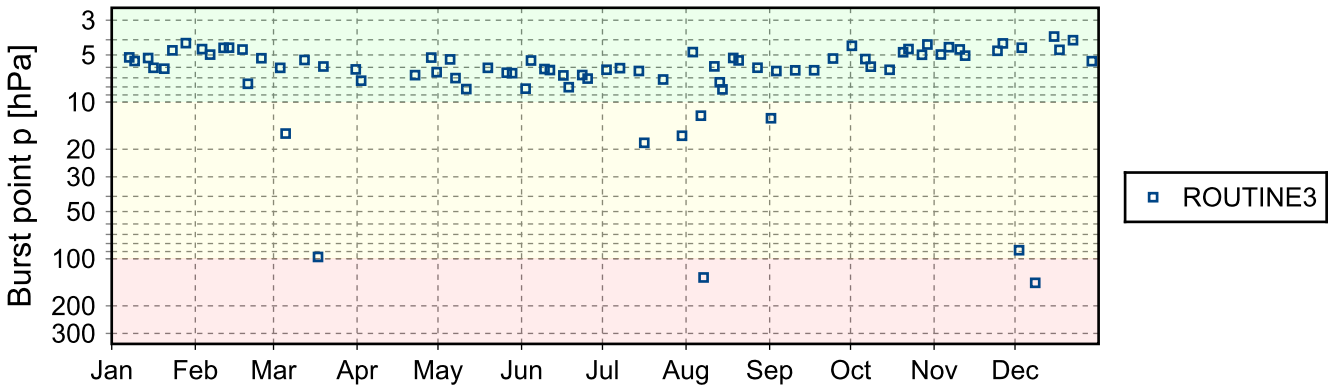
4.3.1 Stream: RS41



4.4 Instrument combinations of PAY-RS-01

Count	Instrument combination
81	RS41

4.6 Measurement events



5 System: Automatic Payerne Launch System (Autosonde) (PAY-RS-02)

Object	Value
System name	Automatic Payerne Launch System (Autosonde)
Unique GRUAN ID	PAY-RS-02
System type	Sounding Site (RS - Radiosonde)
Geographical position	46.8133 °N, 6.9434 °E, 490.0 m
Operated by	MSWISS | Office fédéral de météorologie et climatologie MeteoSuisse
Instrument contact	Romanens, Gonzague
Started at	2018-03-19
Defined setups	1 (AUTO1)
Possible streams	RS41

5.1 Lead Centre comments

5.1.1 Dataflow

Dataflow of auto launcher system to GRUAN LC is running since October 2018. This dataflow includes stream of the operational sonde Vaisala RS41-SG (since March 2018). All launches are promptly recorded using the GruanToolRsLaunch (gtRsl).

5.1.2 General

This auto launcher system was established in March 2018.

5.2 GRUAN data products

Product	Version	Soundings received	Available at LC	Distributed by NCEI
5.2.1 Stream: RS41				
RS41		559	559	
RS41-GCA	001		553	
RS41-RAW	001		559	
RS41-EDT	001		558	
RS41-GDP-ALPHA	003		188	
RS41-GDP-ALPHA	004		199	
RS41-GDP-BETA	001		557	
RS41-GDP-BETA	002		93	

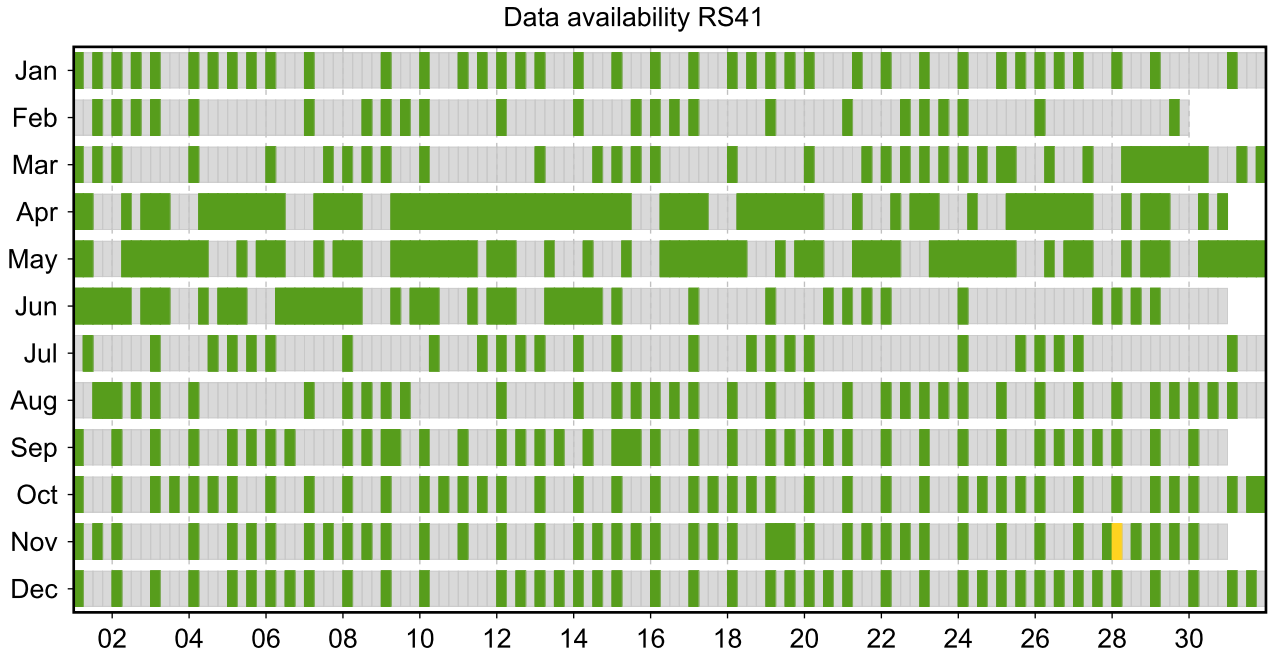
5.3 Availability of data products

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.

5.3.1 Stream: RS41



5.4 Instrument combinations of PAY-RS-02

Count	Instrument combination
559	RS41

5.6 Measurement events