



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

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**15th GRUAN Implementation-  
Coordination Meeting (ICM-15)**

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Session 5

Bern

11 March - 15 March 2024

## GRUAN Site Report for Sodankylä

*(Submitted by Rigel Kivi)*

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### **Summary and Purpose of this Document**

Report from the GRUAN site Sodankylä for the period January 2022 to December 2023.

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## Overview

At the Sodankylä GRUAN site both research soundings as well as the automatic radiosonde launches have been performed. Data from the sounding systems have been submitted to the GRUAN archive. The manual sounding dataflow includes Vaisala RS41, Vaisala RS92-SGP, ECC ozonesonde, CFH water vapor soundings and Internet iMet-1 data. The data have been uploaded using the RsLaunch Client software. We have updated the RsLaunch Client software provided by the GRUAN Lead Centre. In addition to the balloon borne measurements, the GNSS dataflow at SODF is operational. Recent research activities include test flight of a new version of the CFH sonde using a new type of cooling system with liquid nitrogen. The Sodankylä GRUAN site was recertified in December 2023.

## Change and change management

No major radiosonde changes have taken place during the reporting period. However, we have frequently upgraded the Vaisala sounding system software to the most recent versions available. The site has installed several radiosonde receiving units, therefore it is possible to perform dual and multiple soundings. For example, we have performed Vaisala RS92/RS41/iMet/CFH flights and parallel flights with manual versus automated sonde system. The results have been reported for example in Madonna et al., (2020) article on automated sonde performance.

## Resourcing

Currently our budget funding is not covering all the research activities. For example, the CFH launches are partially funded by external funding sources. The site has performed project-based Air-Core launches since early September 2013. Additional resources will be needed to increase balloon burst altitude of the regular sonde launches.

## Operations

Winter and springtime sondes have been launched using larger balloons. Therefore, balloon burst point of the cold season autosonde measurements has been relatively high compared to the other sonde launches.

## **Covid-19**

In 2022/2023 the site was less affected by the global Covid-19 pandemic than during the previous year.

## **Site assessment and certification**

Sodankylä site has been recertified in December 2023.

## **GRUAN-related research**

GRUAN- related research includes participating in the Radiosonde task team activities, CFH and ozonesonde related studies, research activities involving balloon borne AirCore and FTIR instrument to measure methane and other greenhouse gases.

FMI Sodankylä site is leading an international research project (WIFVOS) focusing on accurate measurements of water vapor isotopologues. Within the WIFVOS project a novel balloon borne instrument is being developed to measure water vapor isotopologues in the free troposphere. The balloon borne observations are used to improve remote sensing retrievals by ground based and space borne instruments. Currently a second generation WIFVOS sampler is under construction at the FMI.

## **WG-GRUAN interface**

A letter of support to the FMI Administration from the Working Group on GRUAN would be useful.

## **Other archiving centers**

Data have been submitted to NDACC, WOUDC, TCCON, NILU and to project databases.

## **Participation in campaigns**

FMI has performed rig soundings with CFH, RS41, RS92, iMet. We have also participated in Match ozonesonde campaign and in an ATMO-ACCESS AirCore campaign in August 2023, with a focus

on balloon borne stratospheric measurements. FMI hosted NSF-funded campaign in March-April 2023 to perform stratospheric soundings of ozone and particles. Campaign news have been posted for example at the FMI Space and Earth Observation Centre web page.

## **Future plans**

Continuation of GRUAN research activities is foreseen. FMI is able to host research campaigns at the FMI Sodankylä site. Dedicated balloon launches at Sodankylä are possible, for example Vaisala RS41 sondes, CFH sondes, ECC ozonesondes, coordinated with satellite overpass times.



# GRUAN Site Report for Sodankyla (SOD), 2022

Reported time range is Jan 2022 to Dec 2022

Created by the Lead Centre

Version from 2024-03-01

## 1 General GRUAN site information

Object	Value
Station name	Sodankyla
Unique GRUAN ID	SOD
Geographical position	67.3700 °N, 26.6300 °E, 179.0 m
Operated by	FMI   Ilmatieteen laitos
Main contact	Kivi, Rigel
WMO no./name	02836 SODANKYLÄ
Operators	currently 8, changes +0 / -0
Sounding Site	2
GNSS	1

### 1.1 General information about GRUAN measurement systems

System	Name	Type	Setups	Measurements
SOD-GN-01	GNSS Site SODF	GNSS	1	operational
SOD-RS-01	Sodankylä Radiosonde Launch Site	Sounding Site	4	32
SOD-RS-02	Automatic Sodankylä Launch System (AUTOSONDE)	Sounding Site	2	736

### 1.2 General comments from Lead Centre

#### 1.2.1 Request

Please consider comprehensive documentation of equipment and procedure changes in the meta data (e.g. changes of balloon type), and adopt such changes in the configuration of the gtRsl tool. Please contact the Lead Centre in case of any questions regarding this.

## 2 System: GNSS Site SODF (SOD-GN-01)

Object	Value
System name	GNSS Site SODF
Unique GRUAN ID	SOD-GN-01
System type	GNSS (GN - GNSS)
Geographical position	67.4209 °N, 26.3890 °E, 299.7 m
Operated by	FMI   Ilmatieteen laitos
Instrument contact	Kivi, Rigel
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 February 2015. The current dataflow includes manufacturer raw data, converted raw data (RINEX) and instrument logs, containing all equipment changes.

There is no operational processing of GNSS-PW-GDP due to lack of meteorological data.

### 3 System: Sodankylä Radiosonde Launch Site (SOD-RS-01)

Object	Value
System name	Sodankylä Radiosonde Launch Site
Unique GRUAN ID	SOD-RS-01
System type	Sounding Site (RS - Radiosonde)
Geographical position	67.3700 °N, 26.6300 °E, 179.0 m
Operated by	FMI   Ilmatieteen laitos
Instrument contact	Kivi, Rigel
Started at	-
Defined setups	4 (RESEARCH, OZONE, ROUTINE2, OZONE2)
Possible streams	CFH, COBALD, FLASH, RS41, RS80, RS92

#### 3.1 Lead Centre comments

##### 3.1.1 Dataflow

Sonde dataflow to the GRUAN LC is operational since October 2010.

Weekly soundings of ECC Ozone sonde and sporadic soundings of CFH are part of the dataflow. All soundings are submitted using RsLaunchClient.

##### 3.1.2 General

This is the manual launch site, used for ECC ozone sondes, CFH sondes and other manually released research sondes.

#### 3.2 GRUAN data products

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

CFH		3	3	
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##### 3.2.2 Stream: ECC

ECC		32	32	
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##### 3.2.3 Stream: IMET-1

IMET-1		3	3	
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##### 3.2.4 Stream: RS41

RS41		31	31	
RS41-RAW	001		31	
RS41-EDT	001		31	
RS41-GDP	001		31	



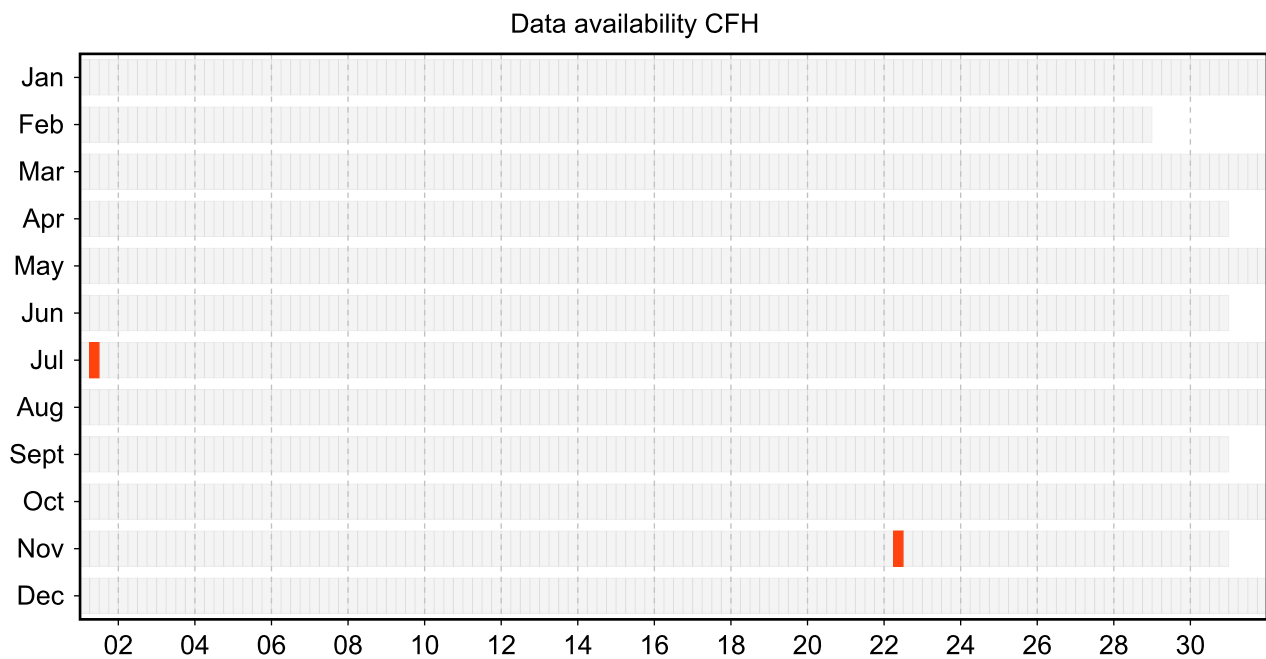
### 3.3 Availability of data products

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).

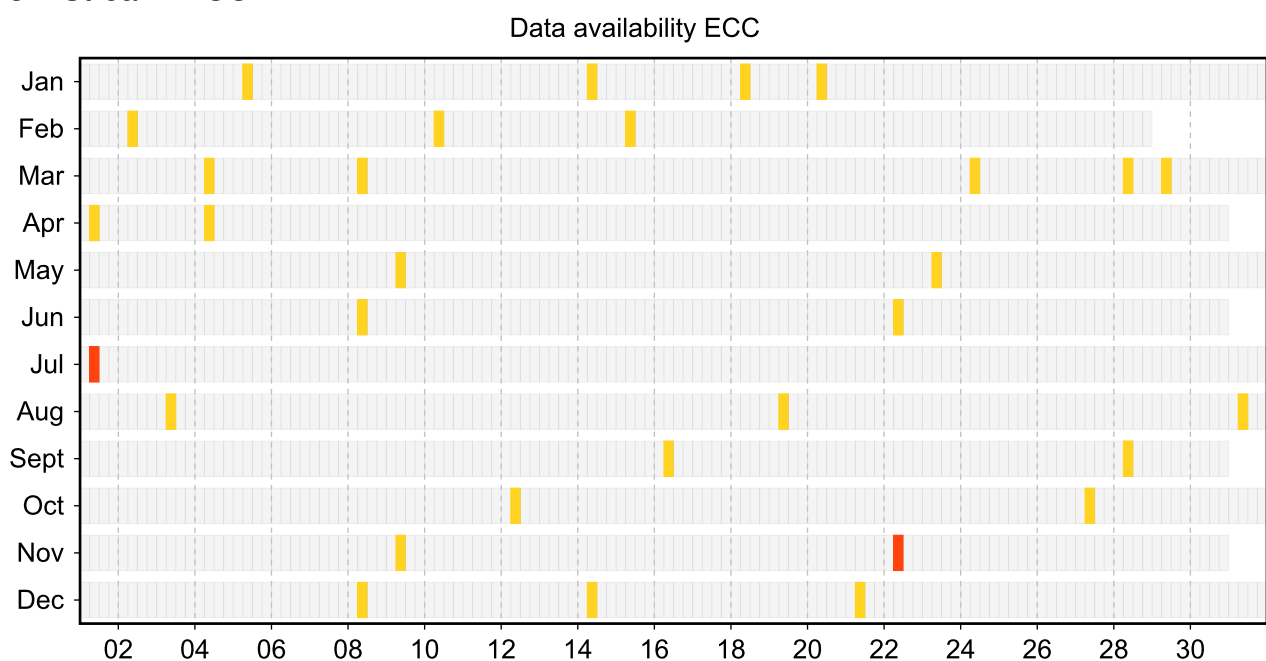
Unprocessed (yellow): The manufacturer-produced file with raw measurement data has been successfully converted into a GRUAN-standardized raw data format (NetCDF). The GRUAN data processing has not been performed or was aborted. Reasons for this may be a still missing GRUAN data processor or a processing-software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

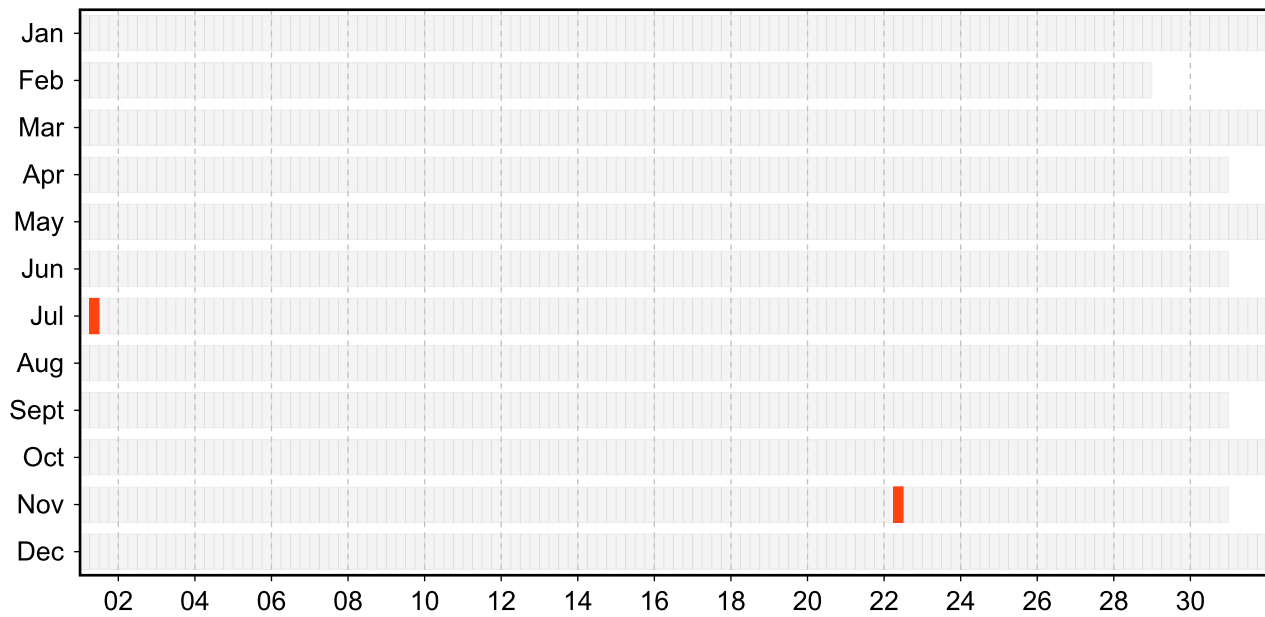


#### 3.3.2 Stream: ECC



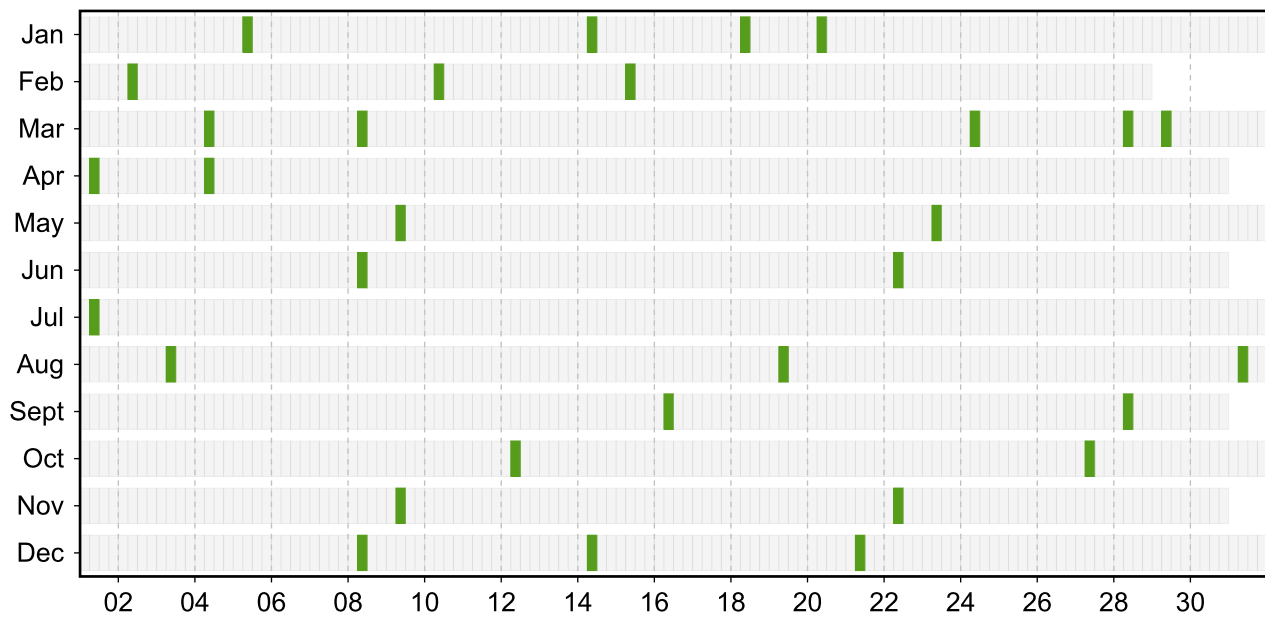
### 3.3.3 Stream: IMET-1

Data availability IMET-1



### 3.3.4 Stream: RS41

Data availability RS41



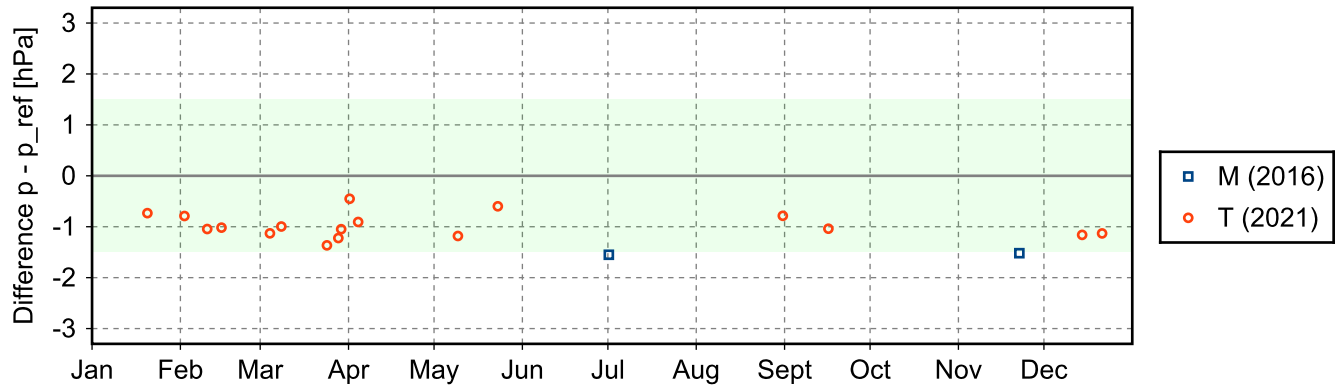
### 3.4 Instrument combinations of SOD-RS-01

Count	Instrument combination
1	CFH, ECC, IMET-1
2	CFH, ECC, IMET-1, RS41
29	ECC, RS41

### 3.5 Instrument ground check

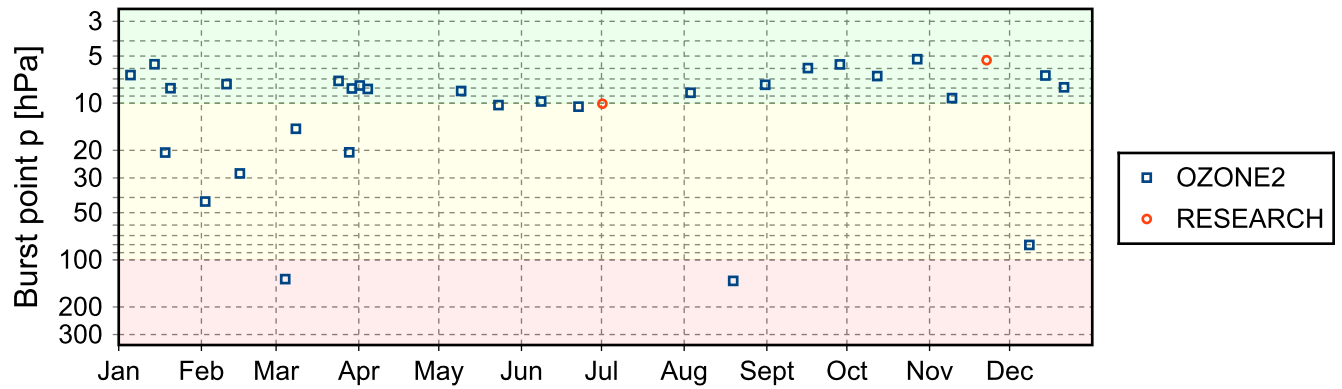
#### 3.5.1 Stream: RS41

(1) GroundCheck: GC-RI41



(2) GroundCheck: GC-SHC

#### 3.6 Measurement events



## 4 System: Automatic Sodankylä Launch System (AUTOSONDE) (SOD-RS-02)

Object	Value
System name	Automatic Sodankylä Launch System (AUTOSONDE)
Unique GRUAN ID	SOD-RS-02
System type	Sounding Site (RS - Radiosonde)
Geographical position	67.3663 °N, 26.6313 °E, 179.0 m
Operated by	FMI   Ilmatieteen laitos
Instrument contact	Kivi, Rigel
Started at	2008-01-01
Defined setups	2 (ROUTINE, ROUTINE3)
Possible streams	RS41, RS92

### 4.1 Lead Centre comments

#### 4.1.1 Dataflow

Dataflow to GRUAN LC is operational since January 2011. The dataflow includes radiosoundings with Vaisala RS41-SG. All data are transmitted using the GRUAN tool gtRsl.

#### 4.1.2 General

This is the autolauncher system.

Recommended burst altitude of 10 hPa is not reached in summer for the operational radiosoundings. Burst point data suggest a change in balloon type before winter and summer, which is not updated in the documentation (metadata).

### 4.2 GRUAN data products

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

RS41		736	736	
RS41-RAW	001		734	
RS41-EDT	001		730	
RS41-GDP	001		723	

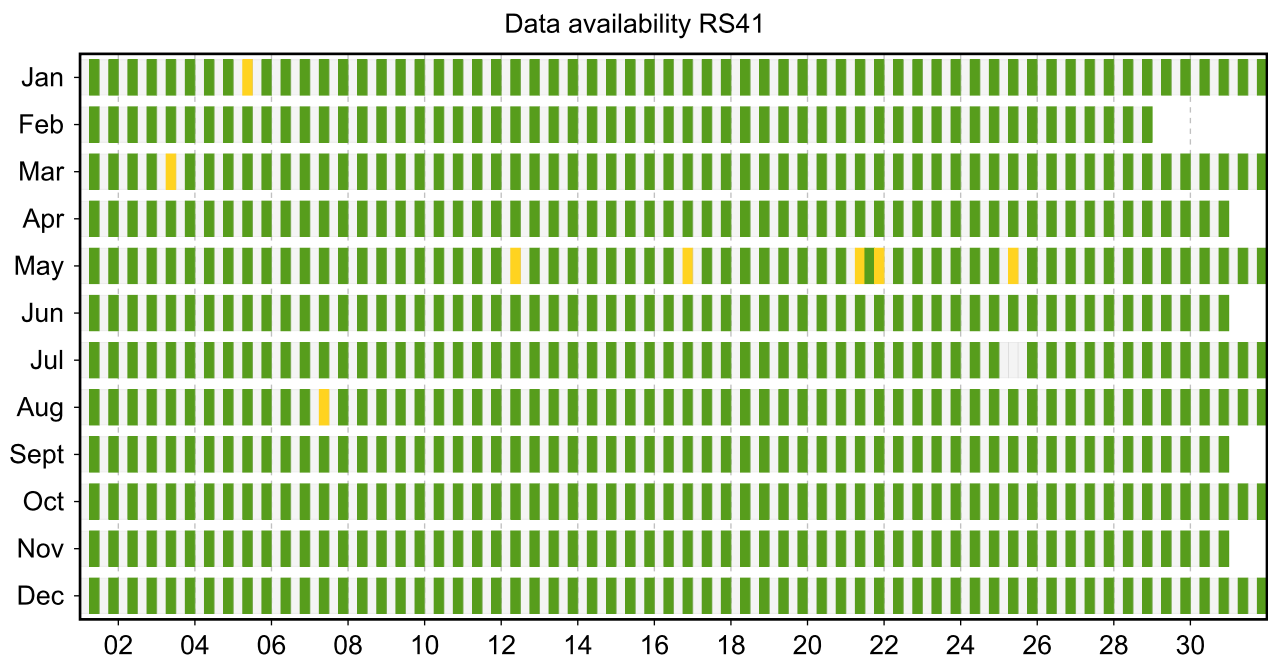
### 4.3 Availability of data products

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).

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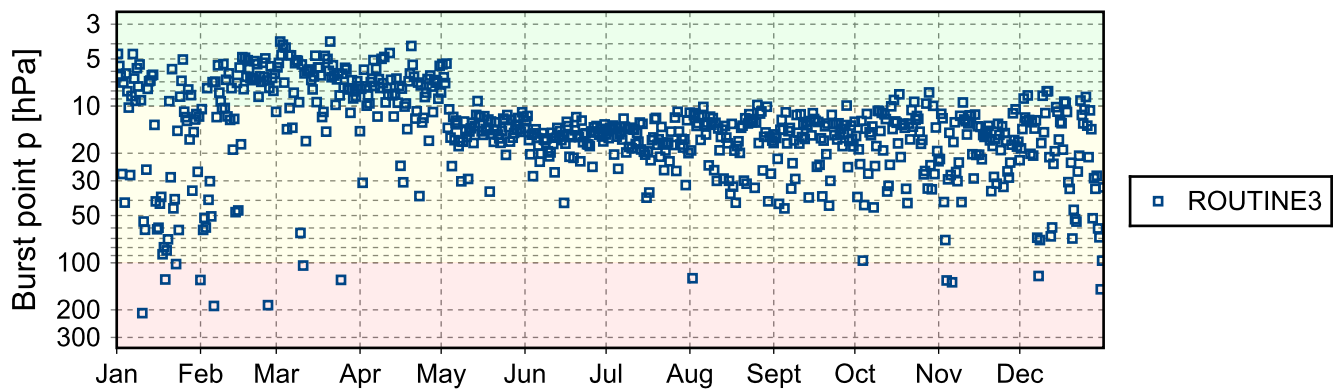
#### 4.3.1 Stream: RS41



### 4.4 Instrument combinations of SOD-RS-02

Count	Instrument combination
736	RS41

### 4.6 Measurement events





# GRUAN Site Report for Sodankyla (SOD), 2023

Reported time range is Jan 2023 to Dec 2023

Created by the Lead Centre

Version from 2024-03-01

## 1 General GRUAN site information

Object	Value
Station name	Sodankyla
Unique GRUAN ID	SOD
Geographical position	67.3700 °N, 26.6300 °E, 179.0 m
Operated by	FMI   Ilmatieteen laitos
Main contact	Kivi, Rigel
WMO no./name	02836 SODANKYLÄ
Operators	currently 8, changes +0 / -0
Sounding Site	2
GNSS	1

### 1.1 General information about GRUAN measurement systems

System	Name	Type	Setups	Measurements
SOD-GN-01	GNSS Site SODF	GNSS	1	operational
SOD-RS-01	Sodankylä Radiosonde Launch Site	Sounding Site	4	38
SOD-RS-02	Automatic Sodankylä Launch System (AUTOSONDE)	Sounding Site	2	733

### 1.2 General comments from Lead Centre

#### 1.2.1 Request

Please consider comprehensive documentation of equipment and procedure changes in the meta data (e.g. changes of balloon type), and adopt such changes in the configuration of the gtRsl tool. Please contact the Lead Centre in case of any questions regarding this.

## 2 System: GNSS Site SODF (SOD-GN-01)

Object	Value
System name	GNSS Site SODF
Unique GRUAN ID	SOD-GN-01
System type	GNSS (GN - GNSS)
Geographical position	67.4209 °N, 26.3890 °E, 299.7 m
Operated by	FMI   Ilmatieteen laitos
Instrument contact	Kivi, Rigel
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 February 2015. The current dataflow includes manufacturer raw data, converted raw data (RINEX) and instrument logs, containing all equipment changes.

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System type	Sounding Site (RS - Radiosonde)
Geographical position	67.3700 °N, 26.6300 °E, 179.0 m
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Instrument contact	Kivi, Rigel
Started at	-
Defined setups	4 (RESEARCH, OZONE, ROUTINE2, OZONE2)
Possible streams	CFH, COBALD, FLASH, RS41, RS80, RS92

#### 3.1 Lead Centre comments

##### 3.1.1 Dataflow

Sonde dataflow to the GRUAN LC is operational since October 2010.

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##### 3.1.2 General

This is the manual launch site, used for ECC ozone sondes, CFH sondes and other manually released research sondes.



## 3.2 GRUAN data products

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

CFH		1	1	
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### 3.2.2 Stream: ECC

ECC		26	26	
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### 3.2.3 Stream: IMET-1

IMET-1		2	2	
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### 3.2.4 Stream: RS41

RS41		29	29	
RS41-RAW	001		29	
RS41-EDT	001		29	
RS41-GDP	001		29	

### 3.2.5 Stream: RS92

RS92		9	9	
RS92-RAW	001		9	
RS92-RAW	002		9	
RS92-EDT	001		9	
RS92-GDP	002		9	

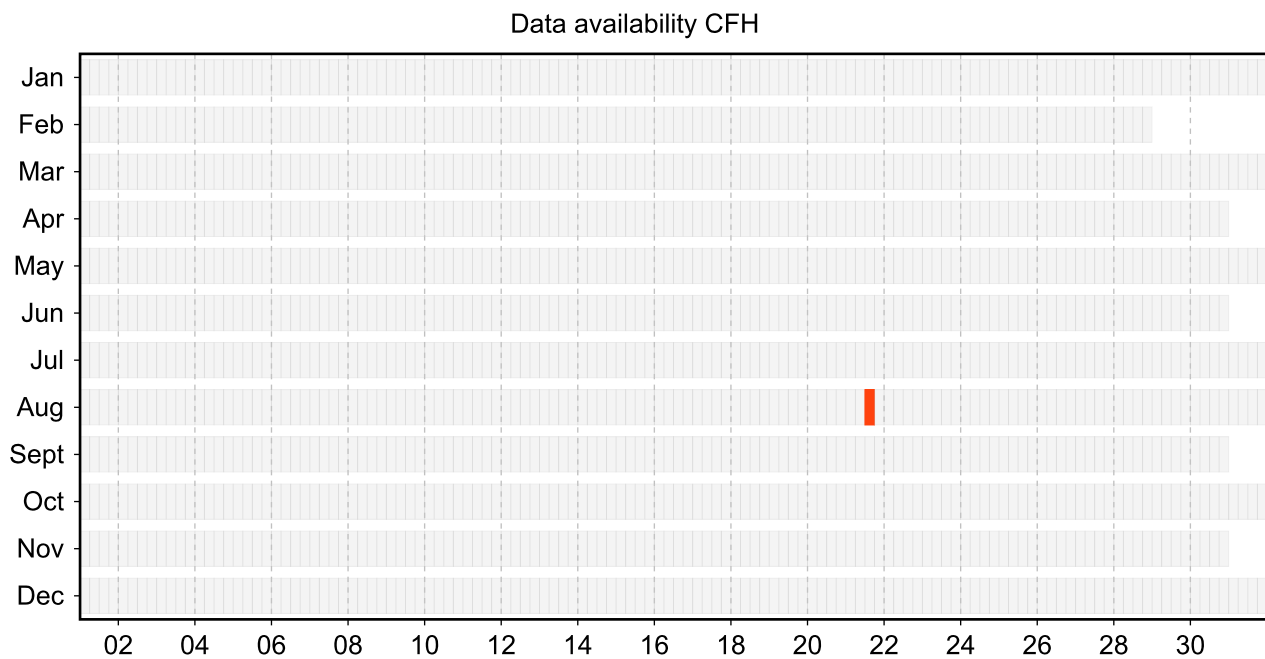
### 3.3 Availability of data products

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).

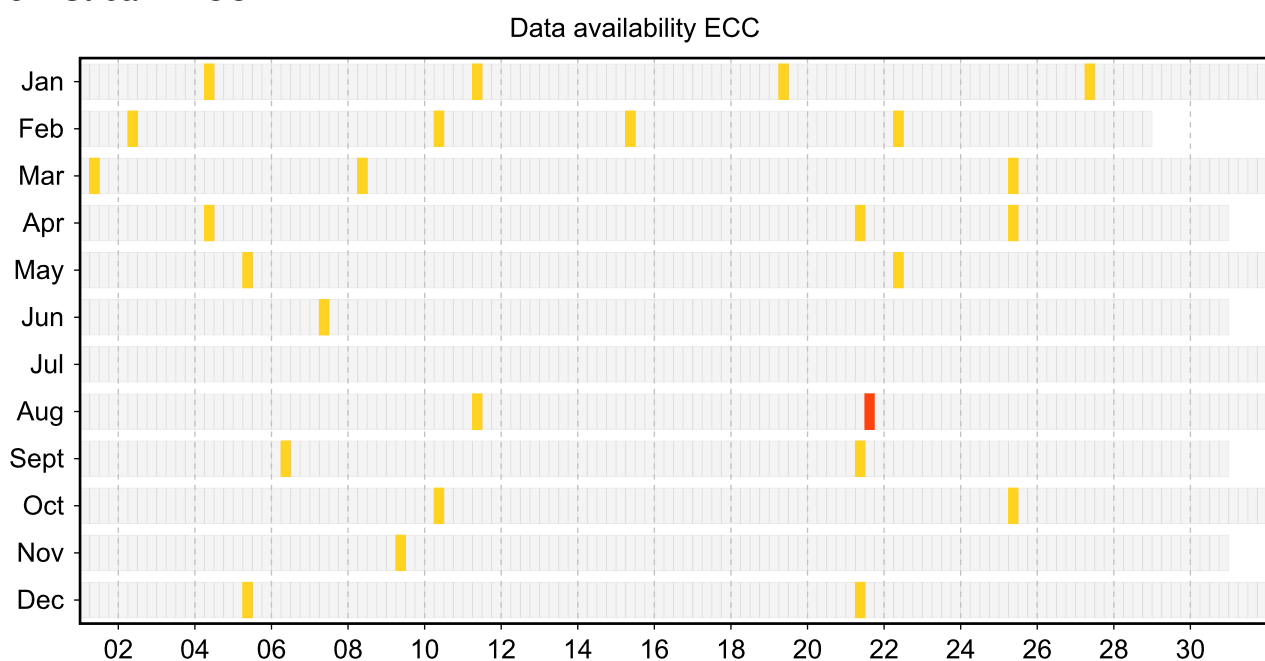
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#### 3.3.1 Stream: CFH

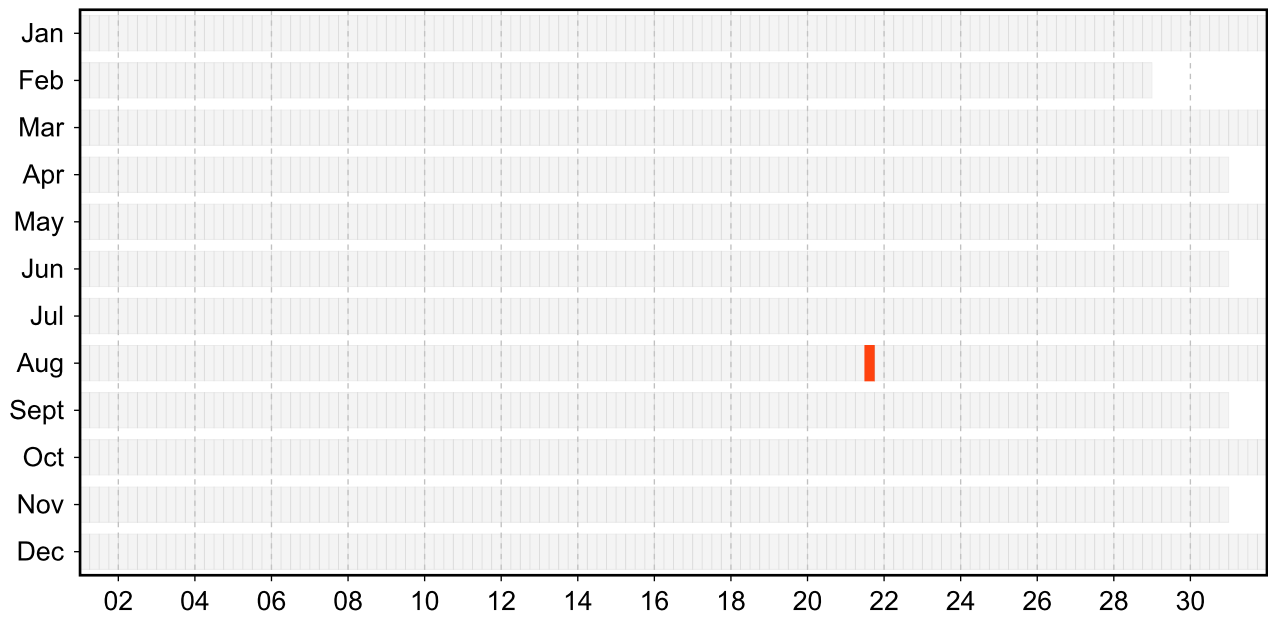


#### 3.3.2 Stream: ECC



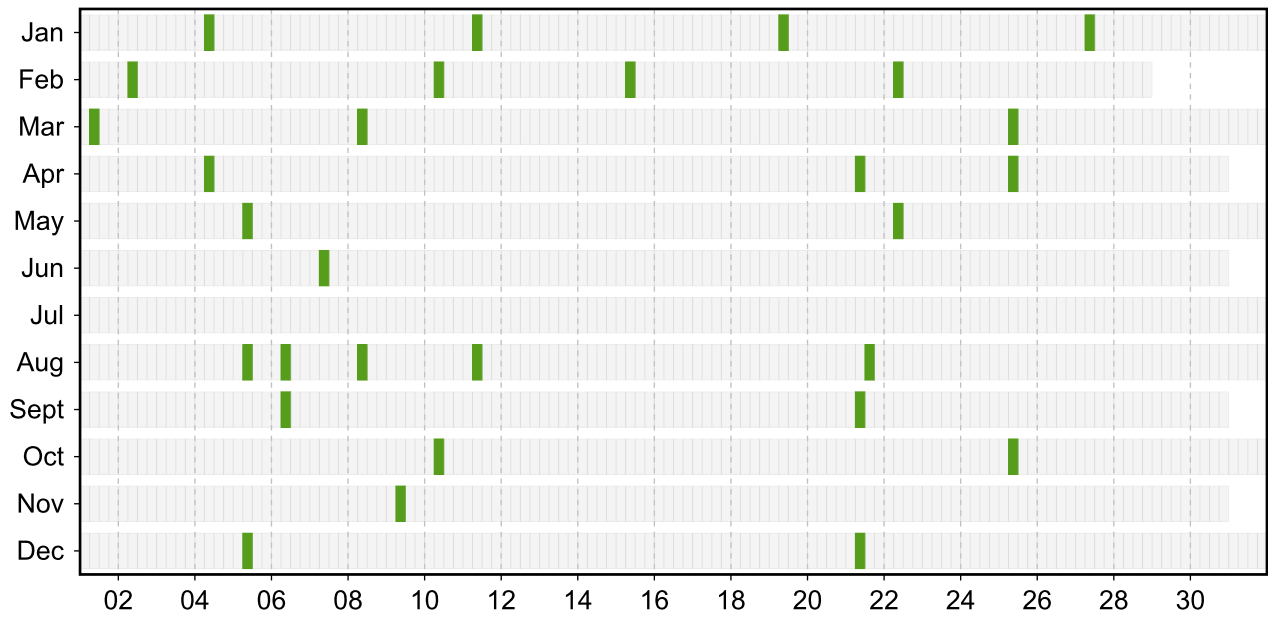
### 3.3.3 Stream: IMET-1

Data availability IMET-1

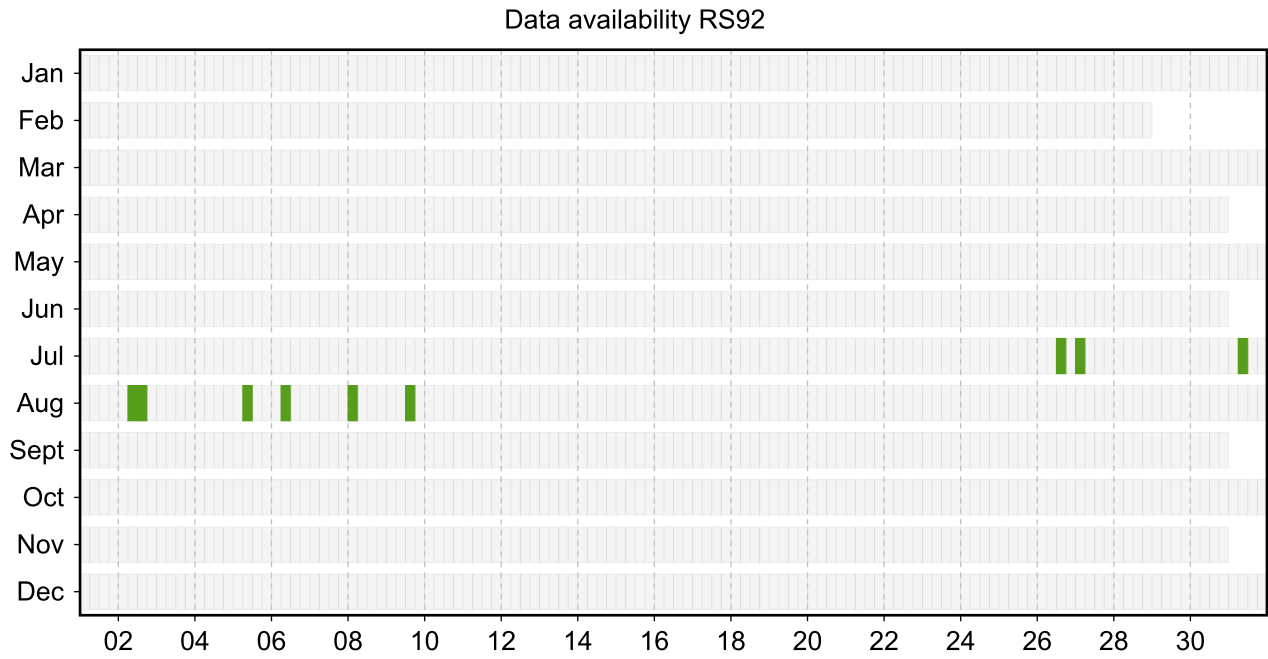


### 3.3.4 Stream: RS41

Data availability RS41



### 3.3.5 Stream: RS92



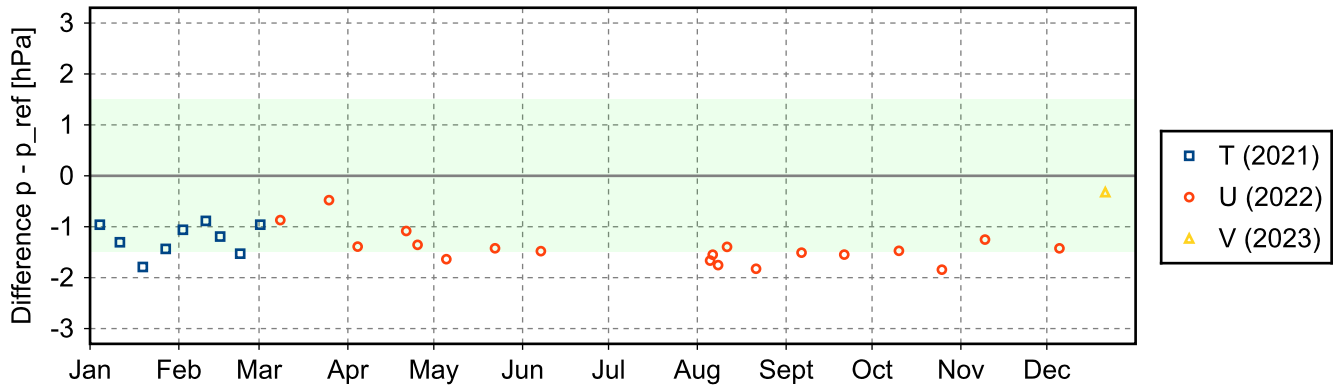
### 3.4 Instrument combinations of SOD-RS-01

Count	Instrument combination
1	CFH, ECC, IMET-1, RS41
25	ECC, RS41
1	IMET-1, RS92
3	RS41
8	RS92

### 3.5 Instrument ground check

#### 3.5.1 Stream: RS41

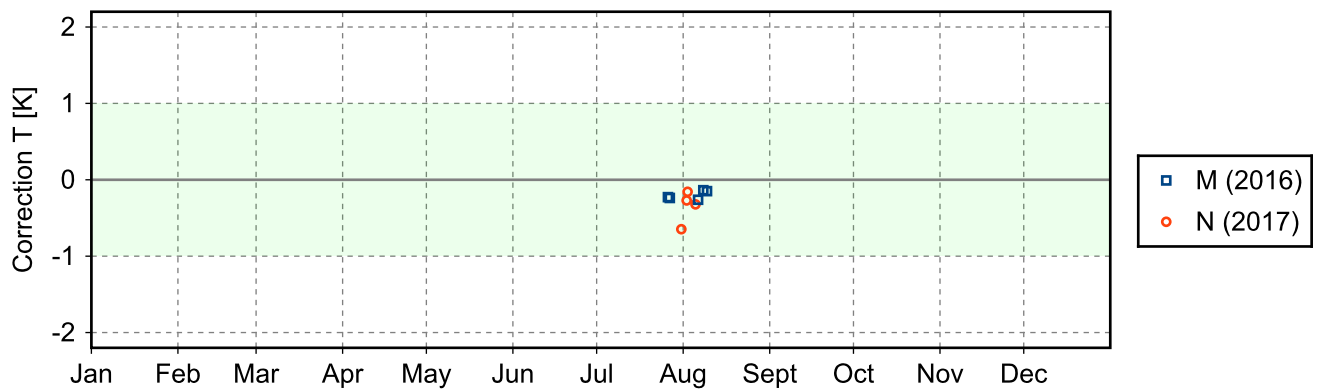
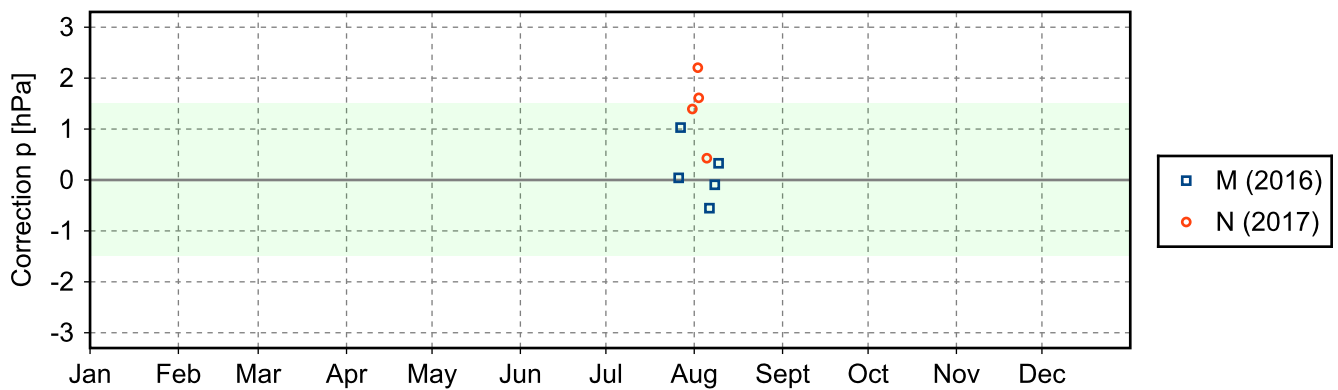
(1) GroundCheck: GC-RI41

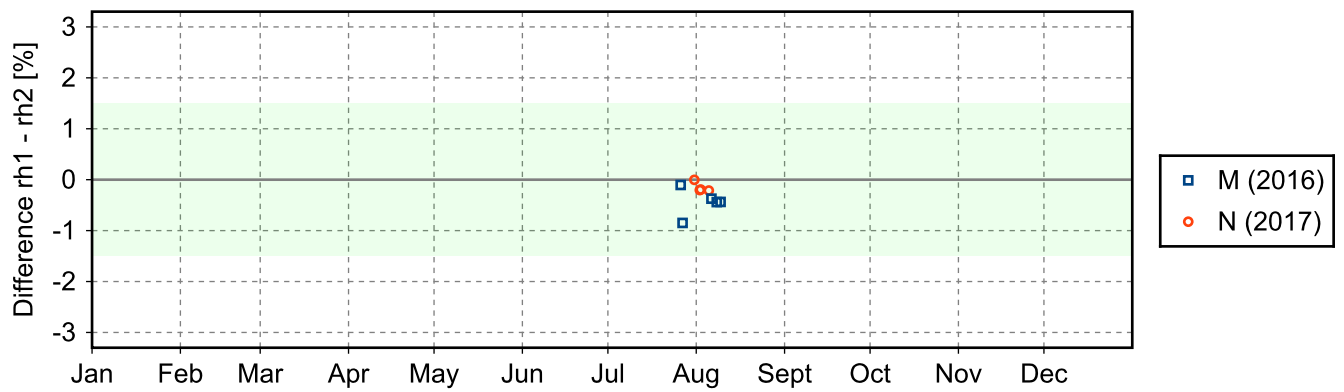
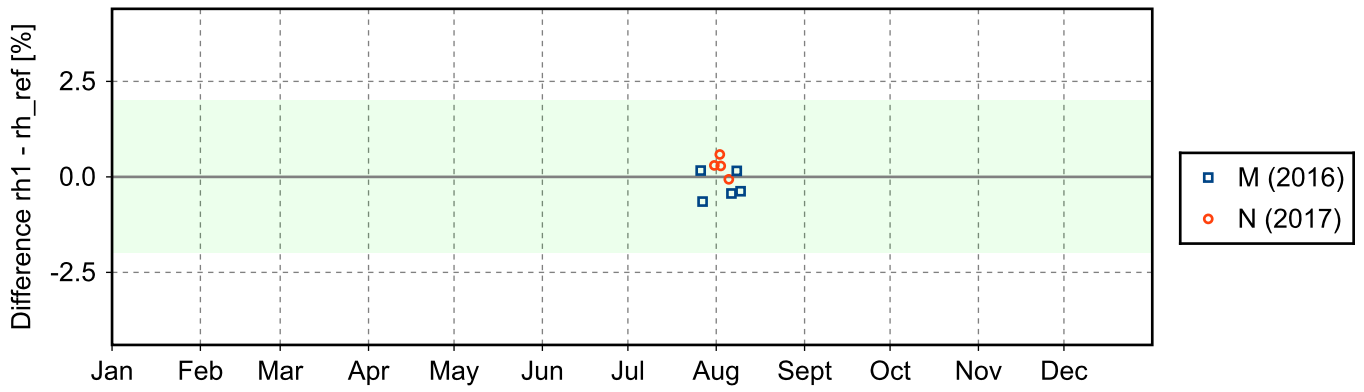
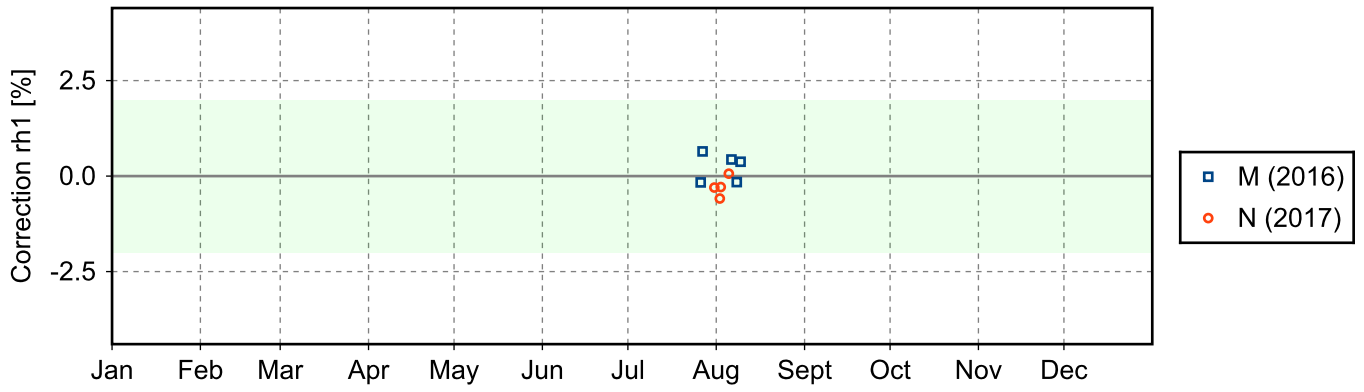


(2) GroundCheck: GC-SHC

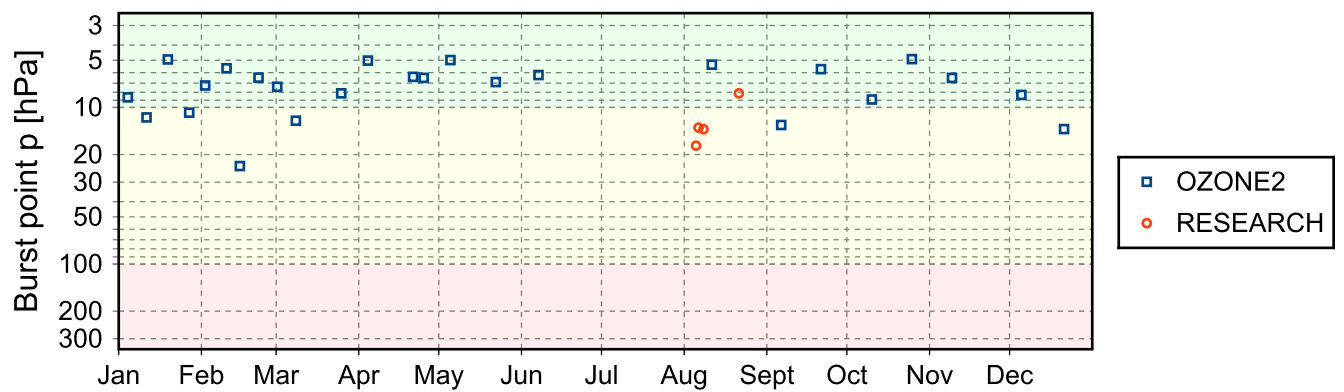
#### 3.5.2 Stream: RS92

(1) GroundCheck: GC-GC25





### 3.6 Measurement events



## 4 System: Automatic Sodankylä Launch System (AUTOSONDE) (SOD-RS-02)

Object	Value
System name	Automatic Sodankylä Launch System (AUTOSONDE)
Unique GRUAN ID	SOD-RS-02
System type	Sounding Site (RS - Radiosonde)
Geographical position	67.3663 °N, 26.6313 °E, 179.0 m
Operated by	FMI   Ilmatieteen laitos
Instrument contact	Kivi, Rigel
Started at	2008-01-01
Defined setups	2 (ROUTINE, ROUTINE3)
Possible streams	RS41, RS92

### 4.1 Lead Centre comments

#### 4.1.1 Dataflow

Dataflow to GRUAN LC is operational since January 2011. The dataflow includes radiosoundings with Vaisala RS41-SG. All data are transmitted using the GRUAN tool gtRsl.

#### 4.1.2 General

This is the autolauncher system.

Recommended burst altitude of 10 hPa is not reached in summer for the operational radiosoundings. Burst point data suggest a change in balloon type before winter and summer, which is not updated in the documentation (metadata).

### 4.2 GRUAN data products

Product	Version	Soundings received	Available at LC	Distributed by NCEI
---------	---------	--------------------	-----------------	---------------------

#### 4.2.1 Stream: RS41

RS41		733	733	
RS41-RAW	001		733	
RS41-EDT	001		726	
RS41-GDP	001		723	

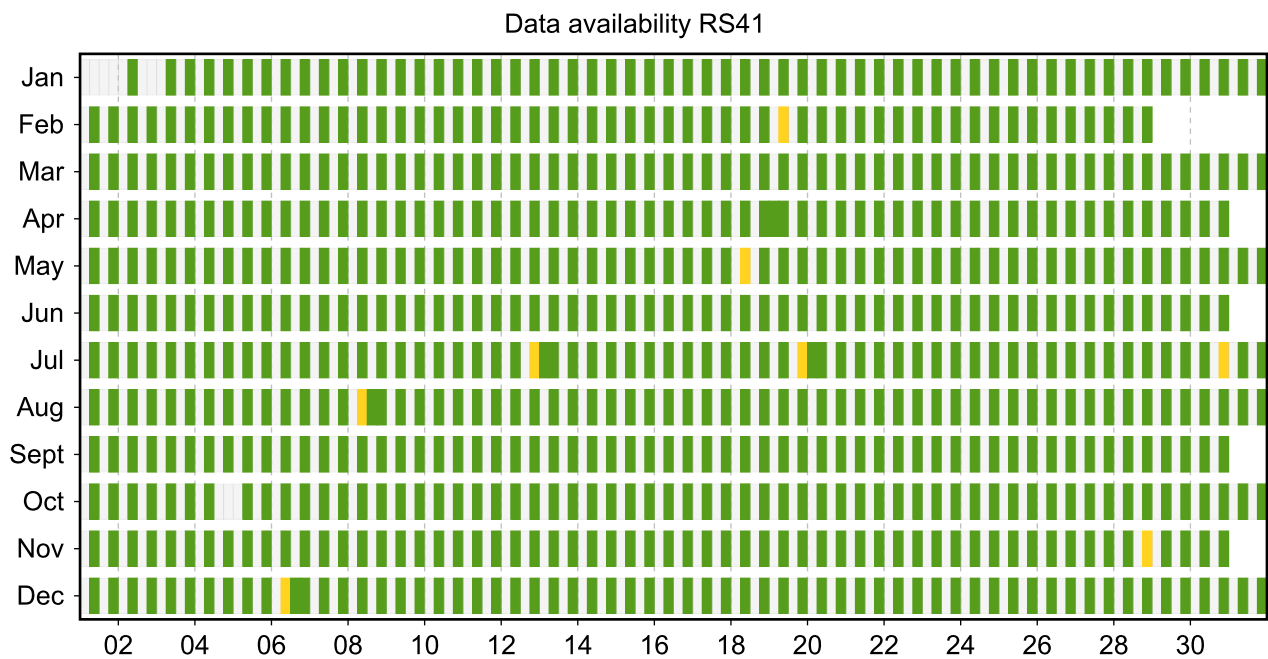
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#### 4.3.1 Stream: RS41



### 4.4 Instrument combinations of SOD-RS-02

Count	Instrument combination
733	RS41

### 4.6 Measurement events

