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GLOBAL CLIMATE OBSERVING  
SYSTEM (GCOS)

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Coordination Meeting (ICM-10)**

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Session 7

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## GRUAN Site Report for Lindenberg

*(Submitted by Ruud Dirksen)*

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

Report from the GRUAN site Lindenberg for the period January to December 2017.

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# GRUAN Site Report for Lindenberg (LIN)

Reporting for the period January to December 2017

Date: 3-April-2018

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## Overview

Lindenberg contributes to GRUAN with the following operational data streams: RS92 radiosonde (4 times per day) and GNSS IPW. Other data streams, which are not official GRUAN products yet, include: Ozone, CFH, COBALD, Graw DFM-09, RS41. In March 2017, RS41 replaced RS92 as operational radiosonde. These additional soundings are performed at least once per month, depending on instrument type. All measurements are performed in accordance with GRUAN operational procedures, which in case of the radiosondes means the application of a manufacturer-independent ground check in an SHC at 100 %RH prior to launch.

## Change and change management

The procedures for the operational RS92 and GNSS data streams have not been altered. In March 2017 the RS92 has been replaced by the RS41 as operational radiosonde. In order to manage this change we have implemented an extensive intercomparison program to investigate the differences between both radiosondes. This intercomparison program is part of the GRUAN-wide effort in the RS92-RS41 change management; it consists of weekly dual soundings with RS92 & RS41 and was initiated in 2015. The Vaisala receiving systems have been upgraded to MW41. For research instruments such as CFH, COBALD and Ozone sonde, the RS41 has replaced the Internet iMet-1 as carrier sonde.

## **Resourcing**

The situation at Lindenberg is good: we have stable (financial + personal) resources to perform 4 radiosoundings per day, as well as numerous research soundings with CFH, COBALD and alike.

## **Operations**

Availability of R23 cryogen for CFH in the near future is a major concern.

## **Site assessment and certification**

The Lindenberg site was GRUAN-certified (for the RS92 measurement program) in 2014, and is currently undergoing re-assessment of the certification.

## **GRUAN-related research**

- RS92-RS41 intercomparison.
- Regular comparison with Graw DFM-09 radiosonde
- Regular soundings with research instruments such as CFH, Ozone, COBALD, FLASH-B.
- Characterization of radiosondes errors and uncertainties under laboratory conditions.
- Characterization of the radiation error of the temperature sensor of various radiosondes.
- Development a GRUAN data product for RS41 and for the CFH (on-going work).
- Development of upgrade for RS92 data product (version 3).
- Cooperation with GFZ Potsdam in modification of data processor for the GRUAN GNSS IPW data product.
- Participation in StratoClim campaign in Nepal (July-August 2017)
- Participation in SHUTLS measurement campaign on Reunion Island (supported by TNA-ACTRIS II)
- Organisation of CoreTemp campaign, testing of Korean Multi-thermistor Radiosonde model and comparison with RS92/RS41/DFM-09

## **Publications:**

- Borger, C., M. Schneider, B. Ertl, F. Hase, O. E. García, M. Sommer, M. Höpfner, S. A. Tjemkes, and X. Calbet, Evaluation of MUSICA MetOp/IASI tropospheric water vapour profiles by theoretical error assessments and comparisons to GRUAN Vaisala RS92 measurements, *Atmos. Meas. Tech. Discuss.*, 2017, 1-37, doi:10.5194/amt-2017-374, 2017.
- Calbet, X., N. Peinado-Galan, P. Ripodas, T. Trent, R. Dirksen, and M. Sommer, Consistency between GRUAN sondes, LBLRTM and IASI, *Atmos. Meas. Tech.*, 10(6), 2323-2335, doi:10.5194/amt-10-2323-2017, 2017.
- von Rohden, C., T. Naebert, M. Sommer, and R. Dirksen, Temperaturmessung in der atmosphäre mit radiosonden, *Technisches Messen*, 84(12), 804-813, doi:10.1515/teme-2017-0074, 2017, ISSN 2196-7113.
- Vèrèmes, H., G. Payen, P. Keckhut, V. Dufлот, J.-L. Baray, J.-P. Cammas, J. Leclair De Bellevue, S. Evan, F. Posny, F. Gabarrot, J.-M. Metzger, N. Marquestaut, S. Meier, H. Vömel, and R. Dirksen, A Raman lidar at Maïdo Observatory (Reunion Island) to measure water vapor in the troposphere and lower stratosphere: calibration and validation, *Atmos. Meas. Tech. Discuss.*, 2017, 1-38, doi:10.5194/amt-2017-32, 2017.

## **WG-GRUAN interface**

GRUAN Lead Centre resides at Lindenberg observatory.

Christoph von Rohden is member of task team radiosondes.

## **Items for ICM-10 plenary discussions**

N/A

## **Other archiving centers**

NDACC, WOUDC.

## **Participation in campaigns**

- Additional ozonesondes launched in framework of the MATCH campaign (Feb-March 2017)
- Participation in StratoClim campaign in Nepal (July-August 2017)

- Participation in SHUTLS measurement campaign on Reunion Island (May 2017, supported by TNA-ACTRIS II)
- Organisation of CoreTemp campaign, testing of Korean Multi-thermistor Radiosonde model and comparison with RS92/RS41/DFM-09 (September 2017)

## **Future plans**

- Continue RS41-RS92 intercomparison, continue sounding program with research/reference sondes (e.g. CFH).
- Finalize new set-up to assess solar radiation error of radiosondes temperature sensor and use this improved set up to to characterize radiation error of RS92 and RS41.
- Continue development of GDP RS92 v3, and GDP RS41 v1.
- Participate in and support international measurement campaigns.



# GRUAN Site Report for Lindenberg (LIN), 2017

Reported time range is Jan 2017 to Dec 2017

Created by the Lead Centre

Version from 2018-04-10

## 1 General GRUAN site information

Object	Value
Station name	Lindenberg
Unique GRUAN ID	LIN
Geographical position	52.2100 °N, 14.1200 °E, 98.0 m
Operated by	MOL   Meteorologisches Observatorium Lindenberg, part of: DWD   Deutscher Wetterdienst
Main contact	Dirksen, Ruud
WMO no./name	10393 LINDENBERG
Operators	currently 16, changes +0 / -0
Sounding Site	1
GNSS	2

### 1.1 General information about GRUAN measurement systems

System	Name	Type	Setups	Measurements
LIN-GN-01	GNSS Site LDB0	GNSS	1	operational
LIN-GN-02	GNSS Site LDB2	GNSS	0	not operational
LIN-RS-01	Lindenberg Radiosonde Launch Site	Sounding Site	7	1500

### 1.2 General comments from Lead Centre

No comments available from Lead Centre.

## 2 System: GNSS Site LDB0 (LIN-GN-01)

<b>Object</b>	<b>Value</b>
System name	GNSS Site LDB0
Unique GRUAN ID	LIN-GN-01
System type	GNSS (GN - GNSS)
Geographical position	52.2096 °N, 14.1185 °E, 160.2 m
Operated by	GFZ   Deutsches GeoForschungsZentrum GFZ, part of: HELMHOLTZ   Helmholtz-Gemeinschaft
Instrument contact	Bisek, Krispin
Started at	2007-05-25
Defined setups	1 (HOURLY)
Possible streams	-

### 2.1 Lead Centre comments

#### 2.1.1 Dataflow

Dataflow of GNSS data to GRUAN LC and to the GRUAN GNSS processing centre at GFZ has started in September 2013. The current dataflow includes manufacturer raw data, converted raw data (RINEX), instrument logs, and processed data.



### 3 System: GNSS Site LDB2 (LIN-GN-02)

<b>Object</b>	<b>Value</b>
System name	GNSS Site LDB2
Unique GRUAN ID	LIN-GN-02
System type	GNSS (GN - GNSS)
Geographical position	52.2091 °N, 14.1209 °E, 159.5 m
Operated by	-
Instrument contact	Bisek, Krispin
Started at	-
Defined setups	-
Possible streams	-

#### 3.1 Lead Centre comments

##### 3.1.1 Dataflow

No GNSS dataflow to GRUAN LC as yet.

## 4 System: Lindenberg Radiosonde Launch Site (LIN-RS-01)

Object	Value
System name	Lindenberg Radiosonde Launch Site
Unique GRUAN ID	LIN-RS-01
System type	Sounding Site (RS - Radiosonde)
Geographical position	52.2100 °N, 14.1200 °E, 112.0 m
Operated by	MOL   Meteorologisches Observatorium Lindenberg, part of: DWD   Deutscher Wetterdienst
Instrument contact	Dirksen, Ruud
Started at	-
Defined setups	7 (ROUTINE, RESEARCH, OZONE, DUAL1, ROUTINE2, OZONE2, DUAL2)
Possible streams	CFH, COBALD, ECC, FPH, RS41, RS80, RS92

### 4.1 Lead Centre comments

#### 4.1.1 Change management

Dual launches of Vaisala RS92-SGP and RS41-SGP are performed biweekly since December 2014 and weekly since August 2015.

#### 4.1.2 Dataflow

Sonde dataflow to the GRUAN LC operational since January 2008.

Now, the dataflow includes streams of the Vaisala RS41-SG(P), RS92-SGP, Graw DFM-09, ECC Ozone sonde, CFH water vapour, and Internet iMet-1. All launches are promptly recorded using the RsLaunchClient. The site is used as test bed for the RsLaunchClient.

#### 4.1.3 General

Routine soundings are performed four times per day. Ozone soundings are performed once per week. Research soundings using CFH, ECC, iMet-1, and Vaisala RS92, RS41 are launched twice per month. Graw radiosondes have been used as redundant sonde during weekly dual soundings till July 2015 (after biweekly). Vaisala RS41 have been used as redundant sonde during biweekly dual soundings since December 2014 and weekly since August 2015. Various sonde combinations have been flown through the reporting period.

Change of operational sonde from Vaisala RS92-SGP to Vaisala RS41-SGP was on 21 March 2017.

## 4.2 GRUAN data products

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

CFH		25	25	
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### 4.2.2 Stream: COBALD

COBALD		11	11	
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### 4.2.3 Stream: DFM-09

DFM-09		33	33	
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### 4.2.4 Stream: ECC

ECC		79	79	
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### 4.2.5 Stream: IMET-1

IMET-1		5	5	
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### 4.2.6 Stream: RS41

RS41		1204	1204	
RS41-RAW	001		1204	
RS41-EDT	001		1200	

### 4.2.7 Stream: RS92

RS92		394	394	
RS92-INT	001		2	
RS92-RAW	001		392	
RS92-RAW	002		394	
RS92-EDT	001		394	
RS92-GDP	002		302	256

### 4.2.8 Stream: SRS-C34

SRS-C34		4	4	
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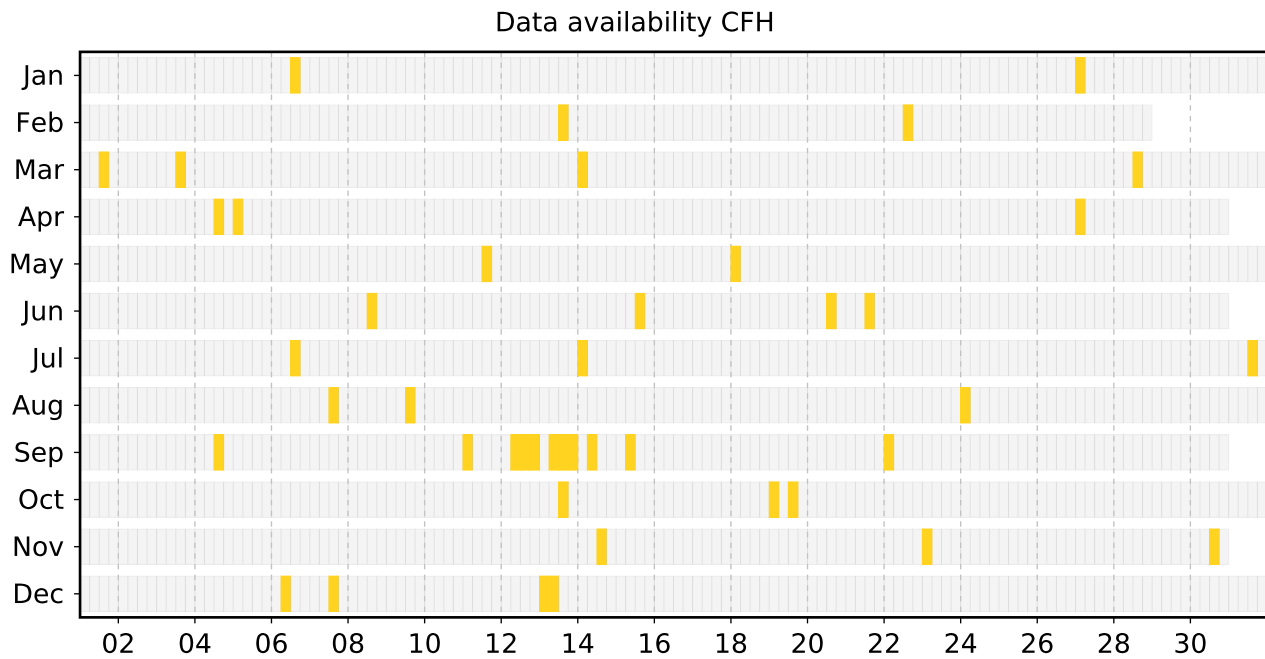
### 4.3 Data availability of data products

Available (green): All steps of processing have been successfully completed. The data file is available at LC (e.g. unapproved or uncertified GRUAN data products) and at NCEI (approved and certified GRUAN data products).

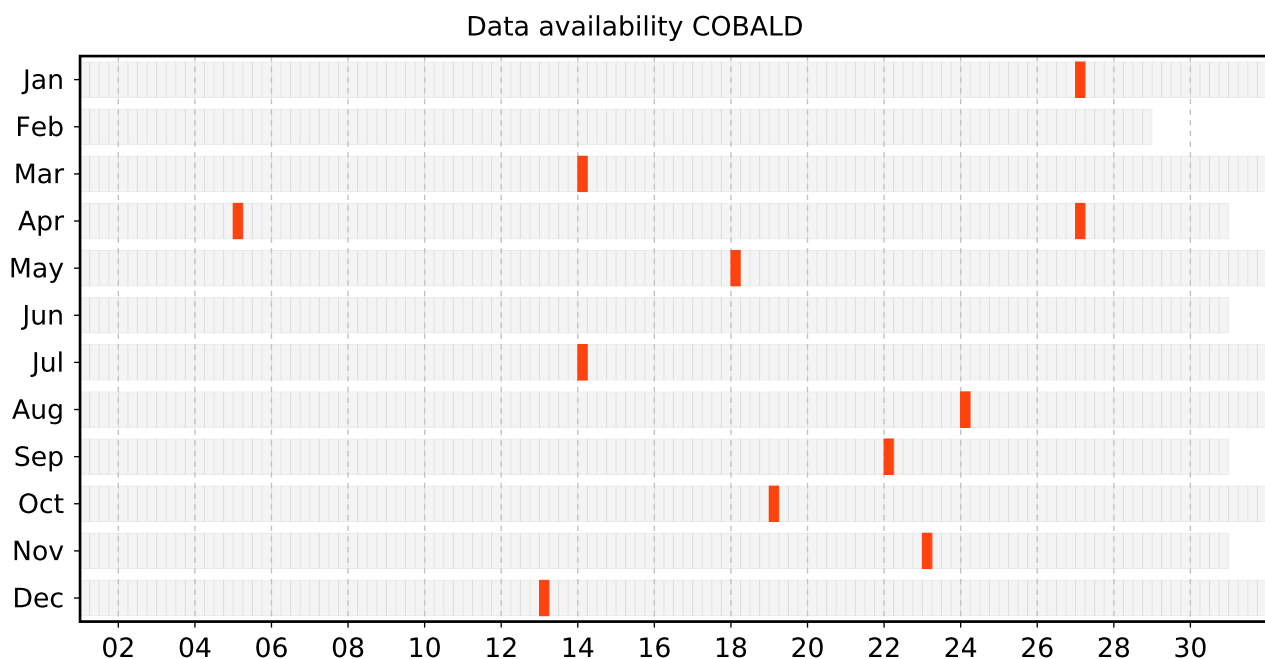
Unprocessed (yellow): The raw data file has been successfully converted to a GRUAN standardized raw data file format (NetCDF). The processing (e.g. GRUAN data processing) has not yet been done, or has not been completed. Reason may be a processing routine which does not yet exist, or software errors.

Original (red): The original raw data file is available (e.g. MWX). The raw data file was not converted to a GRUAN standardized raw data file format (NetCDF). Reason may be a converting routine which does not yet exist, or a corrupt original raw data file, or software errors.

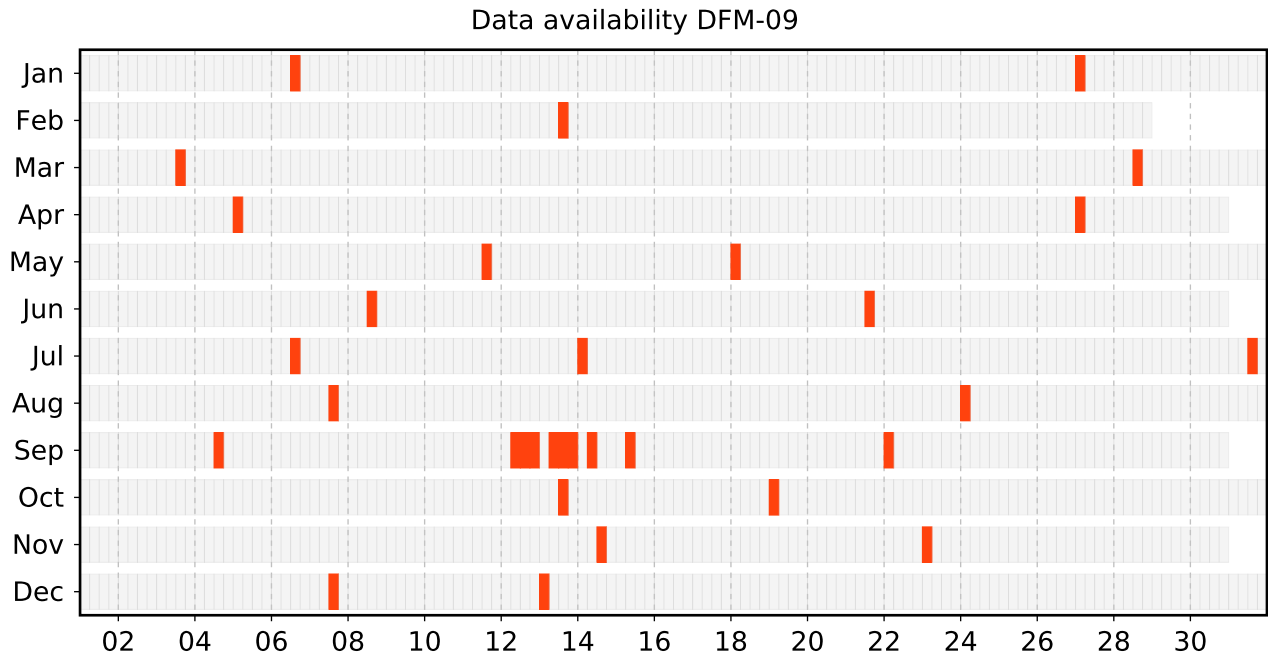
#### 4.3.1 Stream: CFH



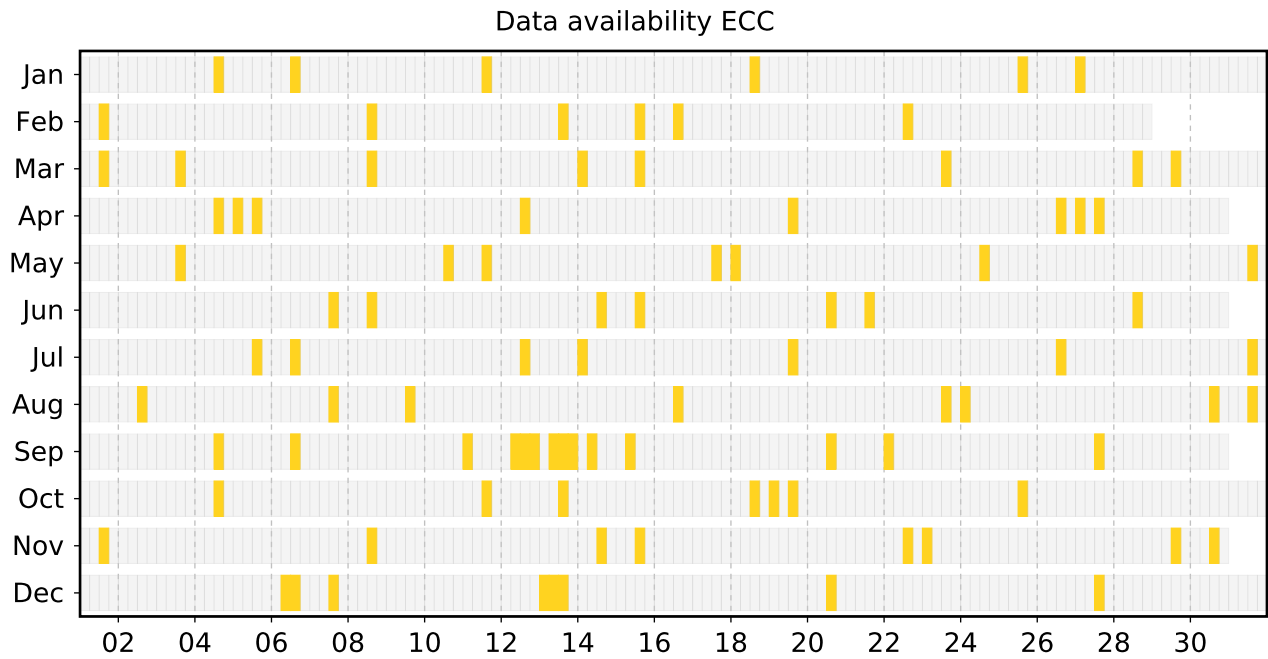
#### 4.3.2 Stream: COBALD



### 4.3.3 Stream: DFM-09

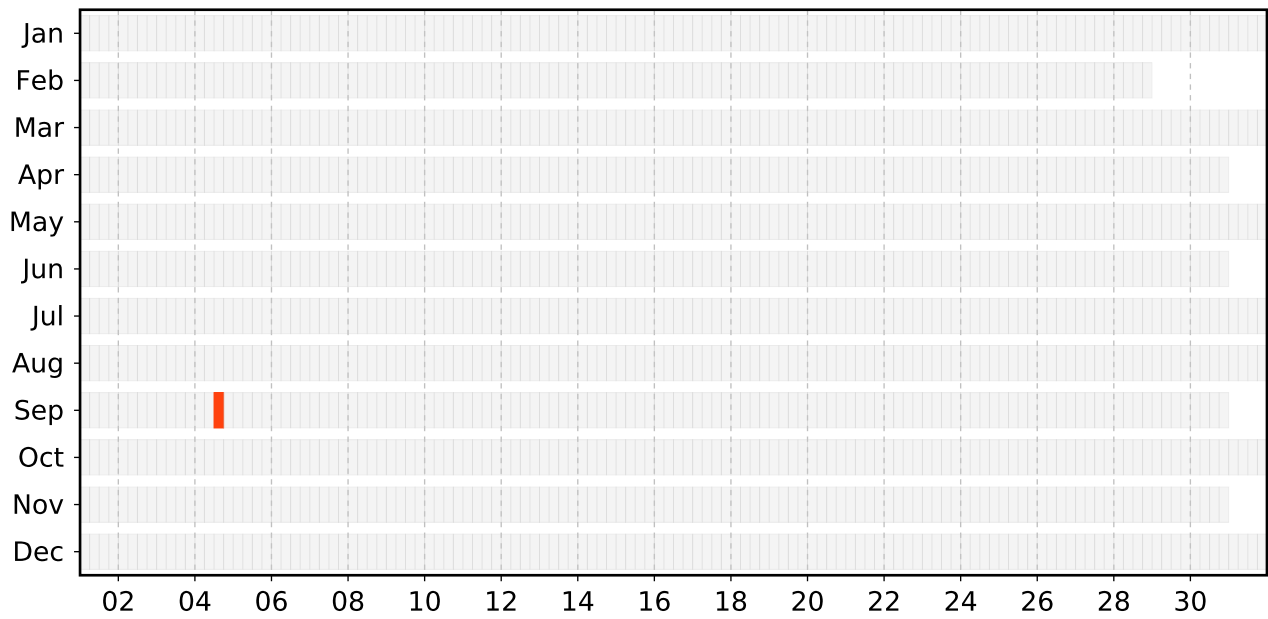


### 4.3.4 Stream: ECC



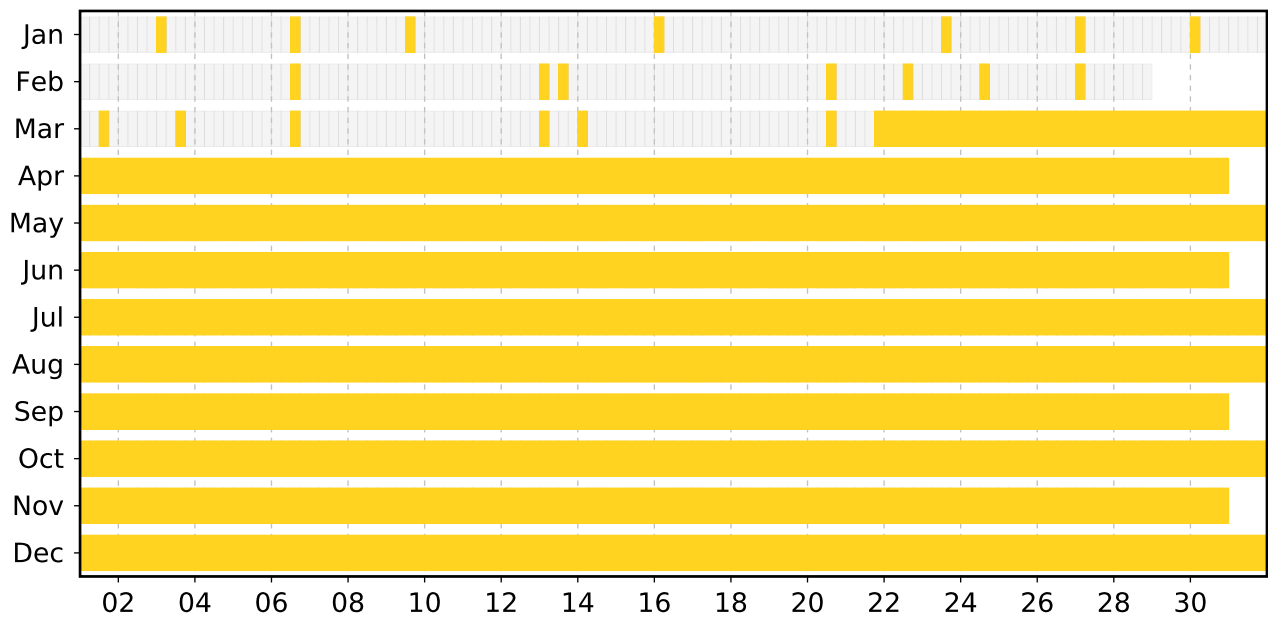
4.3.5 Stream: IMET-1

Data availability IMET-1

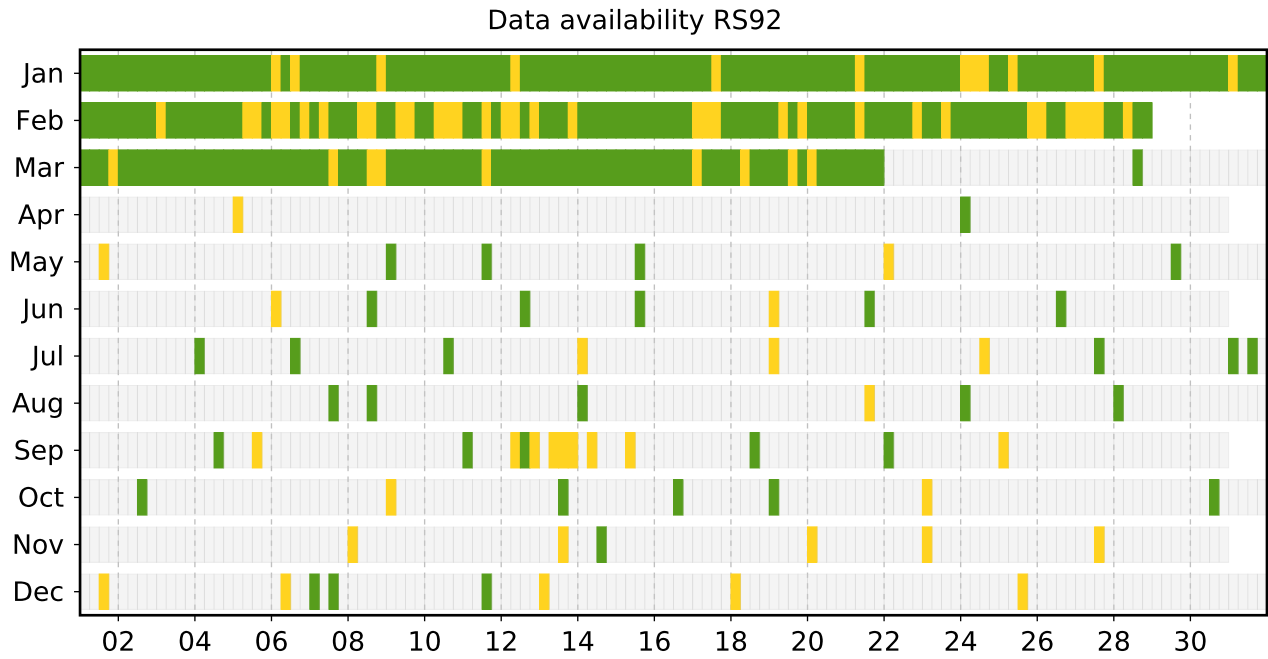


4.3.6 Stream: RS41

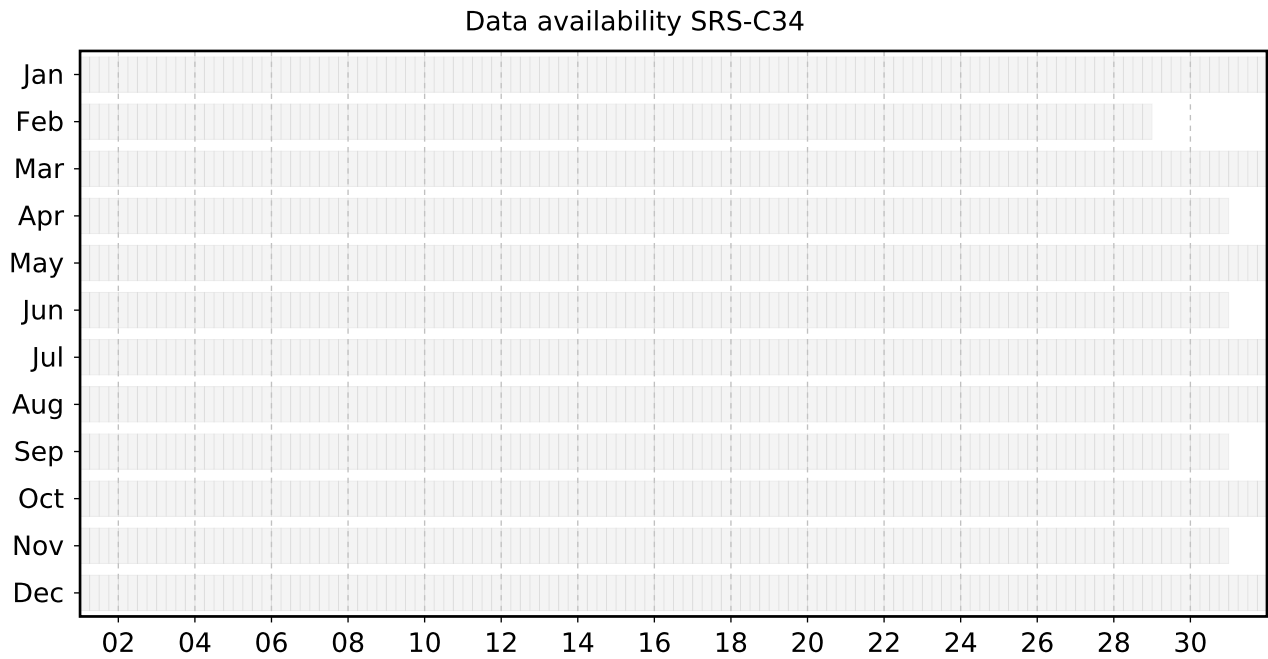
Data availability RS41



### 4.3.7 Stream: RS92



### 4.3.8 Stream: SRS-C34



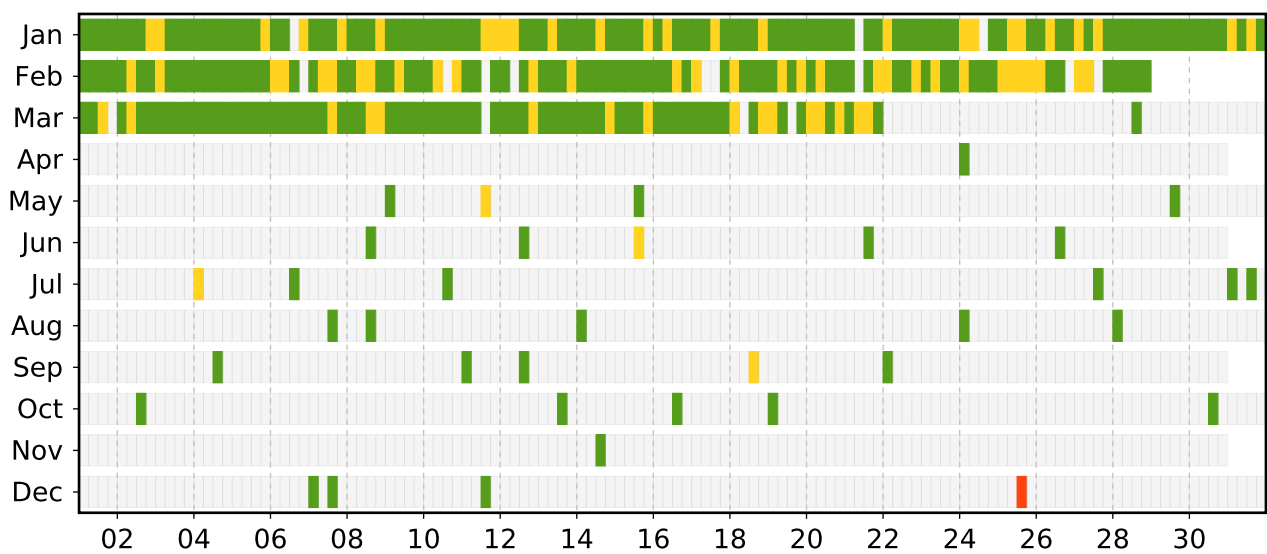
### 4.4 Data quality of current GRUAN data products

Month	Total	GRUAN Data Quality			Issues				
		Approved	Checked	Rejected	Meta-data	Process.	Press	Temp	RH

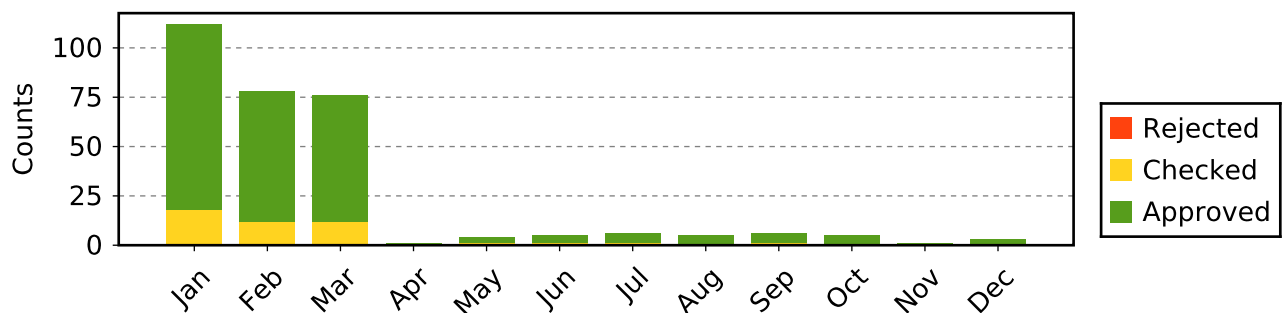
#### 4.4.1 Stream: RS92 (Product: RS92-GDP-002)

Jan	112	94	18				18	2	9
Feb	78	66	12				12	10	19
Mar	76	64	12				12	10	19
Apr	1	1							1
May	4	3	1				1		
Jun	5	4	1				1	1	2
Jul	6	5	1				1	2	1
Aug	5	5						1	1
Sep	6	5	1				1		
Oct	5	5						1	
Nov	1	1							
Dec	3	3							2
<b>Sum</b>	<b>302</b>	<b>256</b>	<b>46</b>				<b>46</b>	<b>27</b>	<b>54</b>

Data quality of stream RS92



Data quality statistic of stream RS92





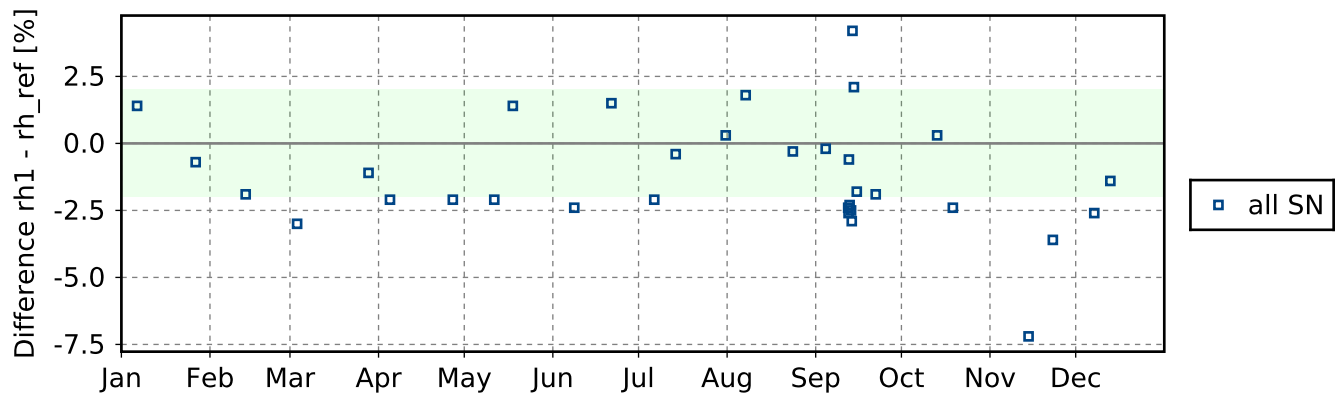
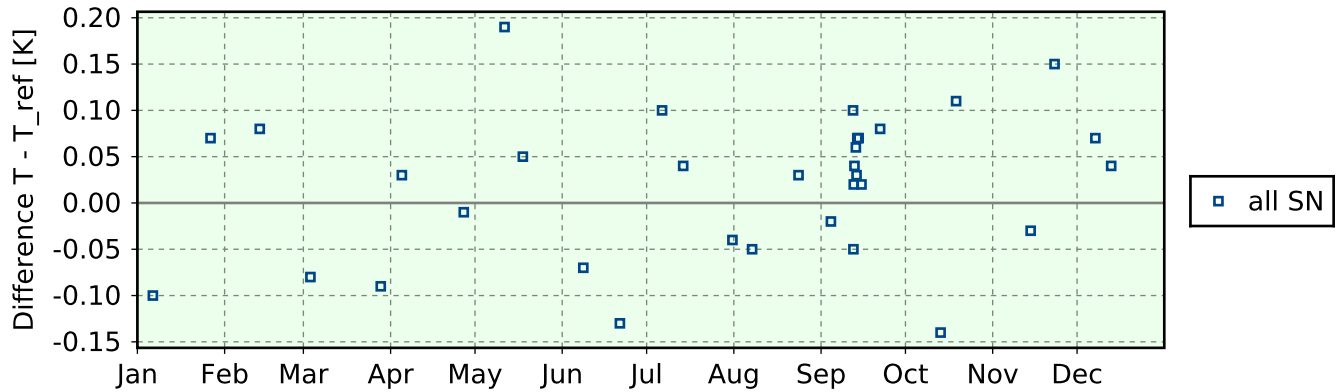
## 4.5 Instrument combinations of LIN-RS-01

Count	Instrument combination
1	CFH, COBALD, DFM-09, ECC, IMET-1, 2x RS41, RS92
1	CFH, COBALD, DFM-09, ECC, IMET-1, RS41, RS92
2	CFH, COBALD, DFM-09, ECC, RS41
6	CFH, COBALD, DFM-09, ECC, RS41, RS92
1	CFH, COBALD, ECC, IMET-1, 2x RS41, RS92
2	CFH, DFM-09, ECC, IMET-1, RS41, RS92
11	CFH, DFM-09, ECC, RS41, RS92
1	CFH, DFM-09, ECC, 2x RS41, RS92
8	DFM-09, RS41, RS92
1	DFM-09, 2x RS41, RS92
40	ECC, RS41
2	ECC, 2x RS41
1	ECC, 2x RS41, RS92
11	ECC, RS92
1059	RS41
1	RS41, 2x RS92
53	RS41, RS92
1	3x RS41, RS92
4	RS41, SRS-C34
294	RS92

## 4.6 Instrument ground check

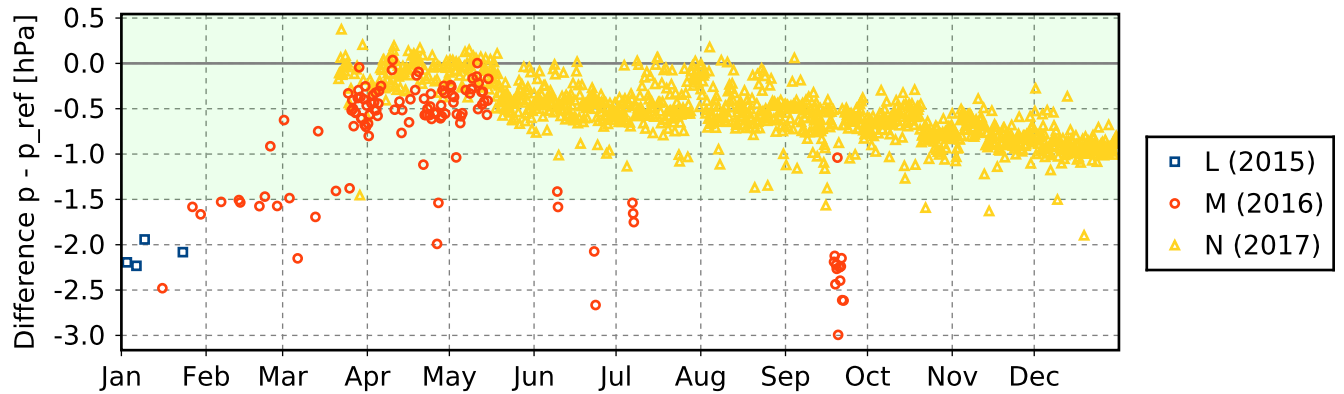
### 4.6.1 Stream: DFM-09

(1) GroundCheck: GC-SHC

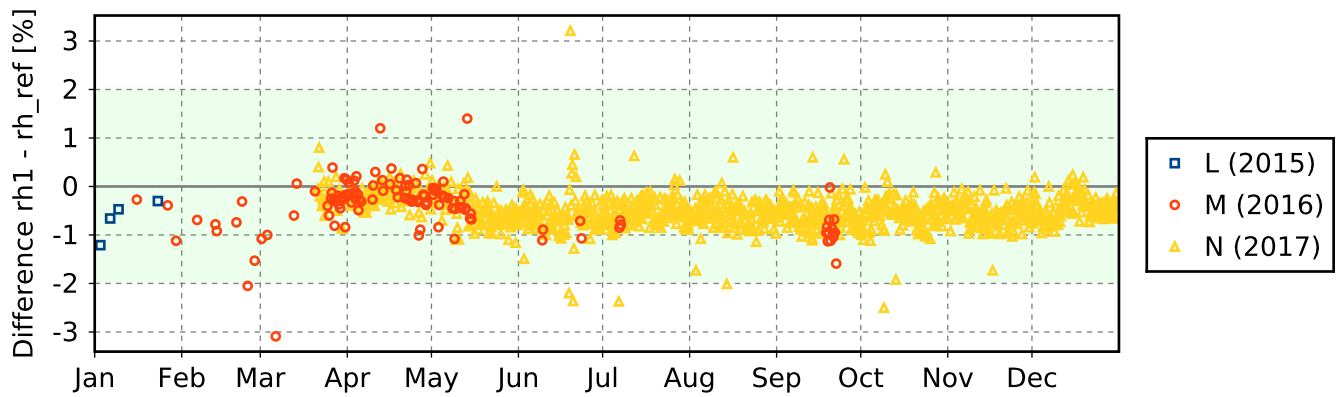
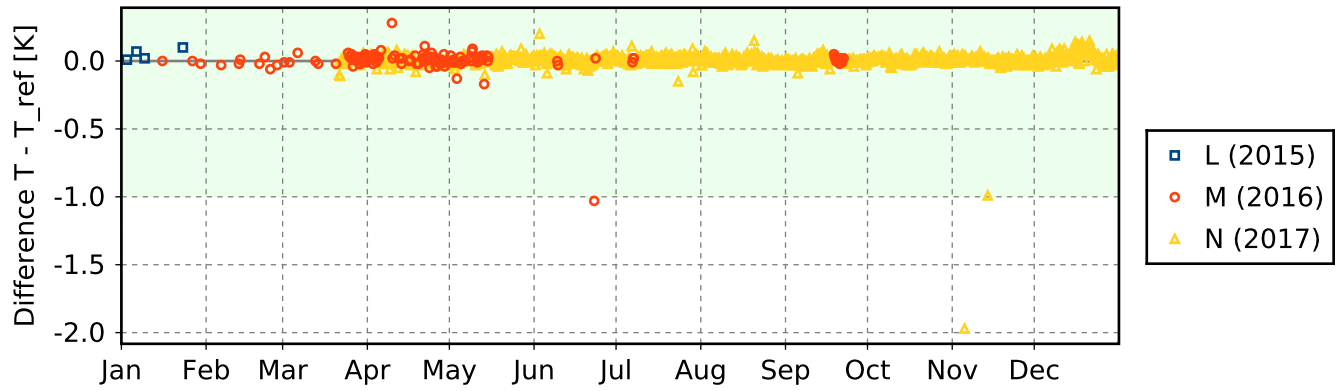


### 4.6.2 Stream: RS41

(1) GroundCheck: GC-RI41

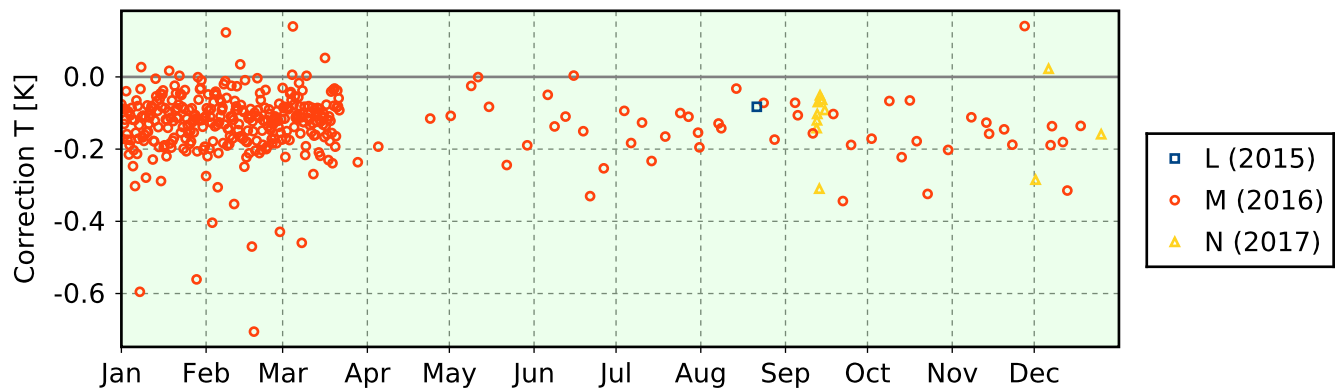
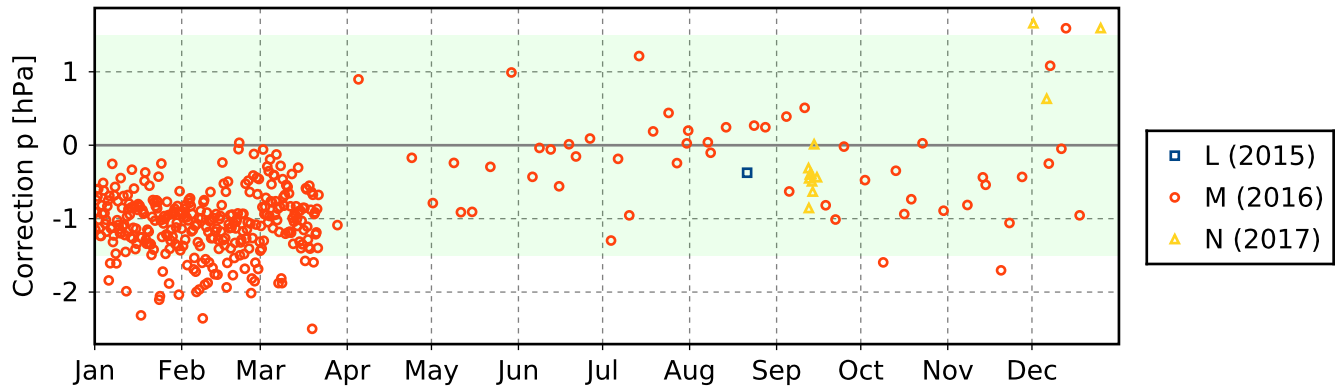


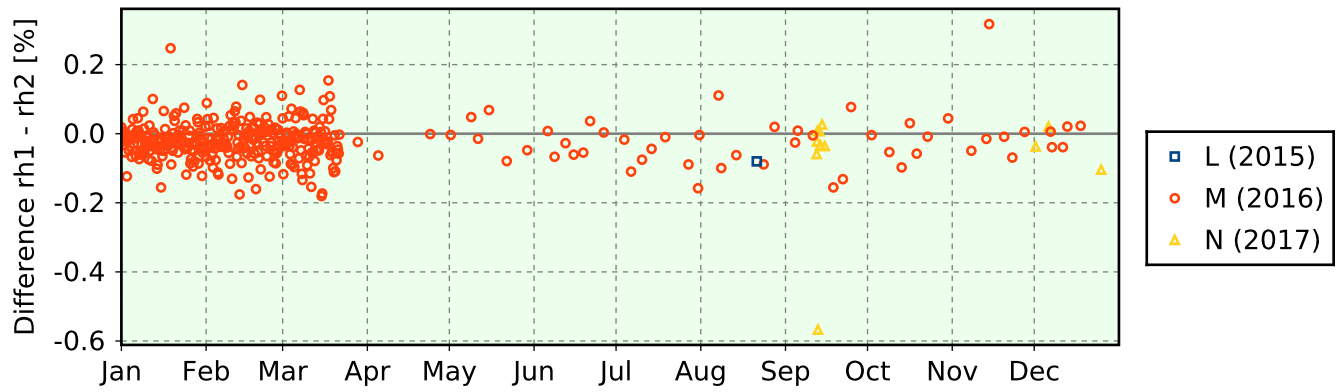
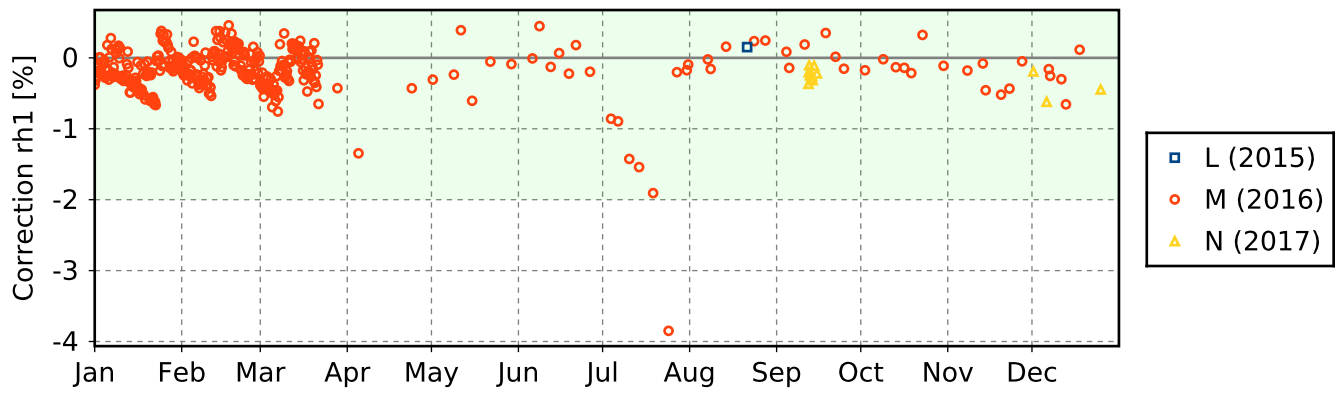
**(2) GroundCheck: GC-SHC**



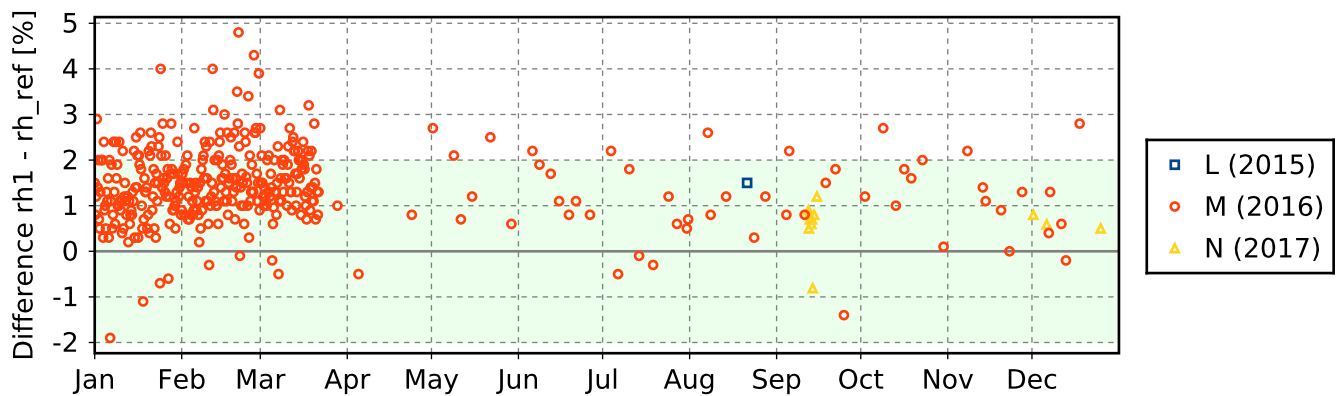
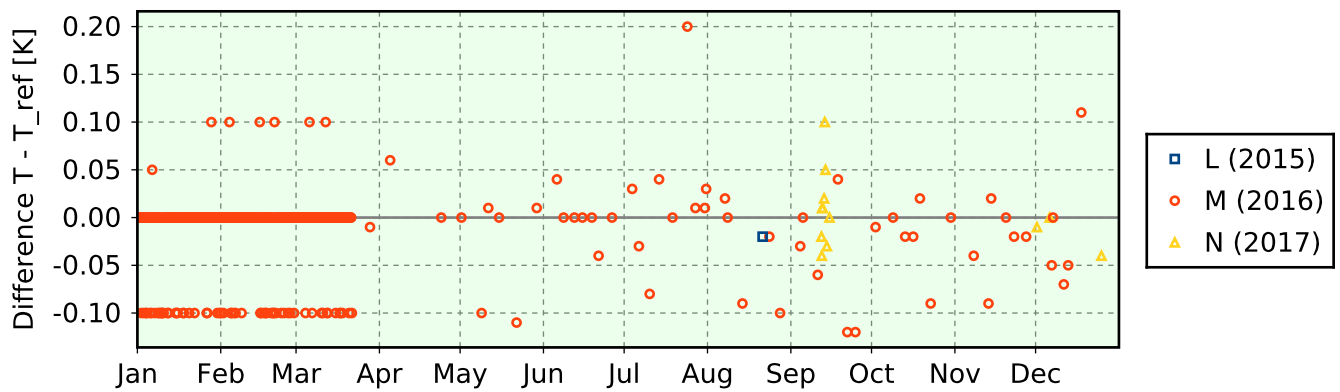
4.6.3 Stream: RS92

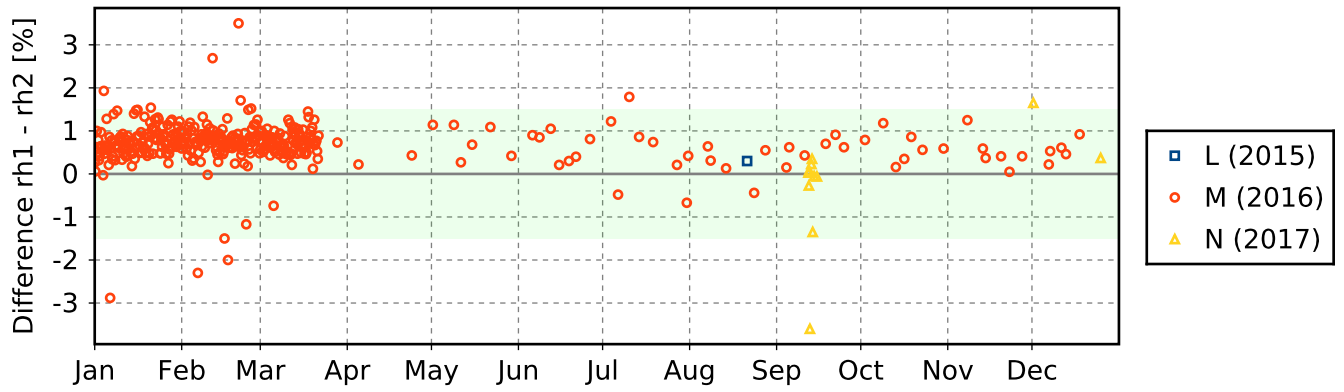
**(1) GroundCheck: GC-GC25**





**(2) GroundCheck: GC-SHC**





### 4.7 Measurement events

