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Coordination Meeting (ICM-11)**

Session 7

Singapore

20 - 24 May 2019

GRUAN Site Report for Lindenberg

(Submitted by Ruud Dirksen)

Summary and Purpose of this Document

Report from the GRUAN site Lindenberg for the period January to December 2018.

Overview

Lindenberg contributes to GRUAN with the following operational data streams: RS41 radiosonde (4 times per day), RS92, and GNSS IPW. Other data streams, which are not official GRUAN products yet, include: Ozone, CFH, COBALD, Graw DFM-09. In March 2017, RS41 replaced RS92 as operational radiosonde. 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. Data are submitted to the Lead Centre using the RsLaunchClient, generally directly after the sounding has been completed. For extended payloads (research soundings) there may 1-2 days delay in data submission.

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 In March 2017 the RS92 has been replaced by the RS41 as operational radiosonde.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 been performing weekly RS92-RS41 twin soundings since 2015 as part of the GRUAN-wide effort in the management of the RS92-RS41 transition. For research instruments such as CFH, COBALD and Ozone sonde, the RS41 is employed 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 ozone and research soundings (CFH, COBALD, etc) on a regular basis. DWD has supplied funding to expand the Lead Centre with one FTE for a period of 4 years.

Operations

Impeding ban on R23 cryogen for CFH is a major concern. We are actively investigating alternative cooling methods for CFH/FPH in cooperation with TU Dresden. Literature study found no liquid/gas with the desired thermodynamic properties to replace R23. Possible alternatives that are subject to further investigation include a light-weight miniature dewar for liquid nitrogen and a wire-mesh embedded in a frozen mass.

Site assessment and certification

The Lindenberg site was GRUAN-certified (for the RS92 measurement program) in 2014, and after assessment by the Working Group has been recertified in May 2018.

GRUAN-related research

- RS92-RS41 intercomparison.
- Regular comparison with Graw DFM-09 radiosonde.
- Regular soundings with research instruments such as CFH, Ozone, COBALD.
- Set up of calibration facility for FLASH-B. Various soundings were performed.
- 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 TU-Dresden to find alternative to R23 as cryogen for frost point hygrometers.

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.*, **11**(9), 49815006, doi:10.5194/amt-11-4981-2018, 2018, <https://www.atmos-meas-tech.net/11/4981/2018/>.
- Göpfert, T., R. Dirksen, T. Naebert, and U. Hesse, Alternativen zu R23 zur Temperierung von Messsensoren in der Stratosphäre, Deutscher Kälte- und Klimatechnischer Verein (DKV), 2018.

WG-GRUAN interface

GRUAN Lead Centre resides at Lindenberg observatory.

Christoph von Rohden is member of task team radiosondes.

Items for ICM-11 plenary discussions

- Situation regarding availability of R23 cryogen. Possible alternatives for R23 as well as for CFH as stratospheric hygrometer.
- Need for an intercomparison campaign for stratospheric hygrometers.

Other archiving centers

NDACC, WOUDC, BSRN.

Participation in campaigns

- One additional ozonesonde launched in framework of the MATCH campaign (Jan-March 2018). Quantification of anthropogenic ozone loss. See e.g. <https://public.wmo.int/en/bulletin/match-campaigns-measure-stratospheric-ozone-loss-contribution-international-polar-year>
- Involvement in preparation of CONCIERTO campaign (beginning of 2019, Reunion island). Investigate trop.-strat. exchange processes related to storm events, using CFH/COBALD soundings. In addition various RS92-RS41-M10 soundings to investigate differences between the radiosonde types at high solar elevation angles.

Future plans

- Continue RS41-RS92 intercomparison, continue sounding program with research/reference sondes (e.g. CFH).
- Continue measurements with new set-up to assess solar radiation error of radiosondes temperature sensor and use these results in the GRUAN dataproducts for RS92 and RS41.
- Continue development of GDP RS92 v3, and GDP RS41 v1.
- Continue cooperation with TU-Dresden to find alternative cooling method for CFH/FPH.
- Organize and host CIMO radiosonde intercomparison campaign in 2021 in collaboration with MeteoSwiss/Payerne.



GRUAN Site Report for Lindenberg (LIN), 2018

Reported time range is Jan 2018 to Dec 2018

Created by the Lead Centre

Version from 2019-05-09

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	1548

1.2 General comments from Lead Centre

No comments available from Lead Centre.

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

Object	Value
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	Dirksen, Ruud
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)

Object	Value
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	Dirksen, Ruud
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, M10, RS41, RS80, RS92

4.1 Lead Centre comments

4.1.1 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.

4.1.2 General

Routine soundings with Vaisala RS41 are performed four times per day. Ozone soundings are performed once per week. Research soundings using CFH, ECC, and Vaisala RS92, RS41, and Graw DFM-09 are launched twice per month. Various sonde combinations have been flown through the reporting period.

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		27	27	
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4.2.2 Stream: COBALD

COBALD		15	15	
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4.2.3 Stream: DFM-09

DFM-09		20	20	
DFM-09-RAW	001		19	

4.2.4 Stream: ECC

ECC		87	87	
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4.2.5 Stream: RS41

RS41		1583	1583	
RS41-GCA	001		1514	
RS41-RAW	001		1582	
RS41-EDT	001		1578	
RS41-GDP-ALPHA	002		1156	

4.2.6 Stream: RS92

RS92		104	104	
RS92-GCA	001		103	
RS92-INT	001		98	
RS92-RAW	001		5	
RS92-RAW	002		103	
RS92-EDT	001		103	
RS92-GDP	002		62	46

4.2.7 Stream: SRS-C34

SRS-C34		6	6	
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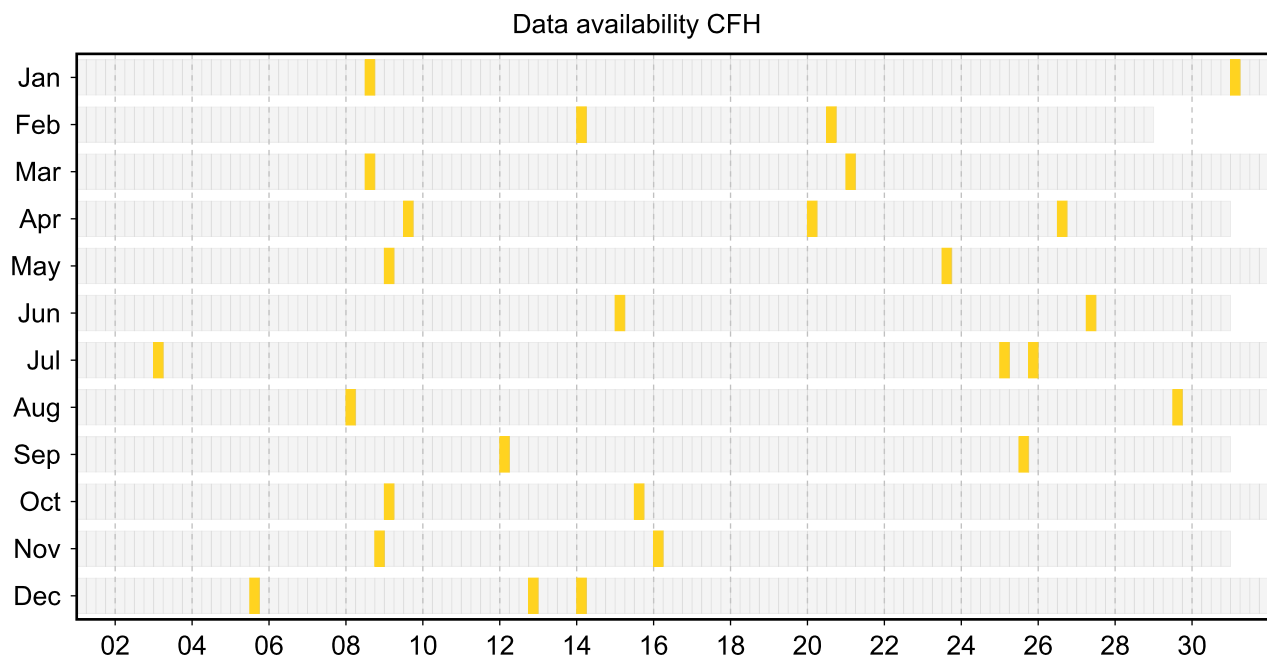
4.3 Data availability of data products

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).

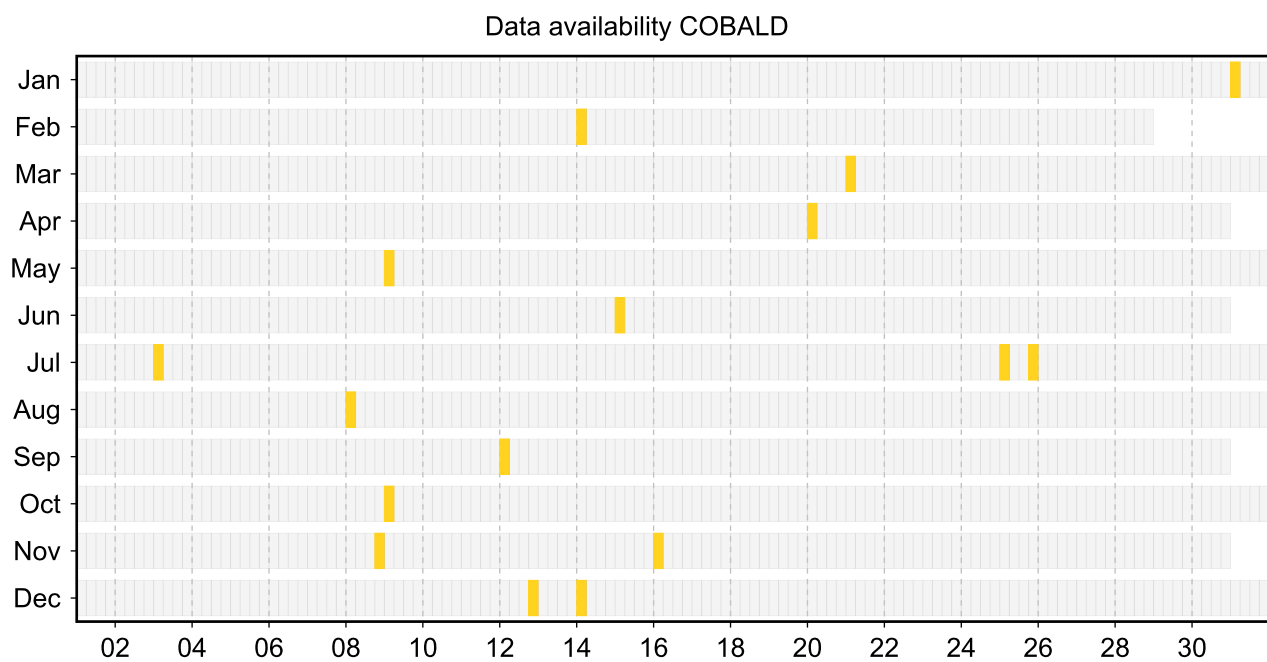
Unprocessed (yellow): The raw data file has been successfully converted to a GRUAN standardized raw data file format (NetCDF). The processing (e.g. GRUAN data processing) has not yet been done, or has not been completed. Reason may be a processing routine which does not yet exist, or software errors.

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

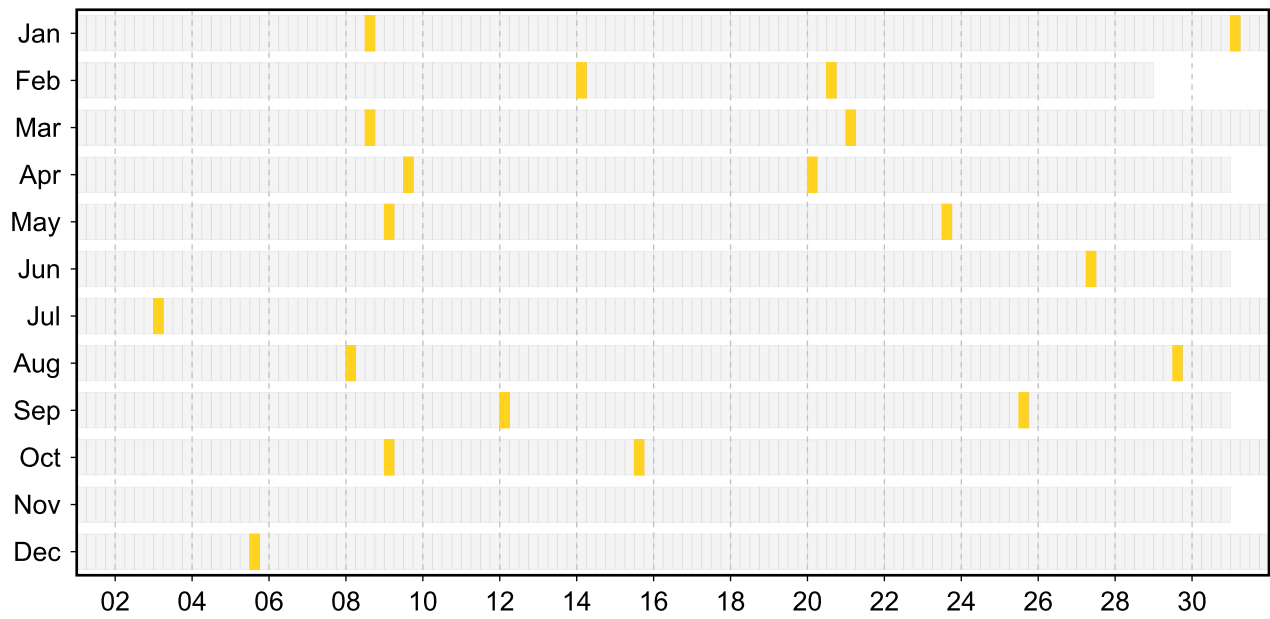


4.3.2 Stream: COBALD



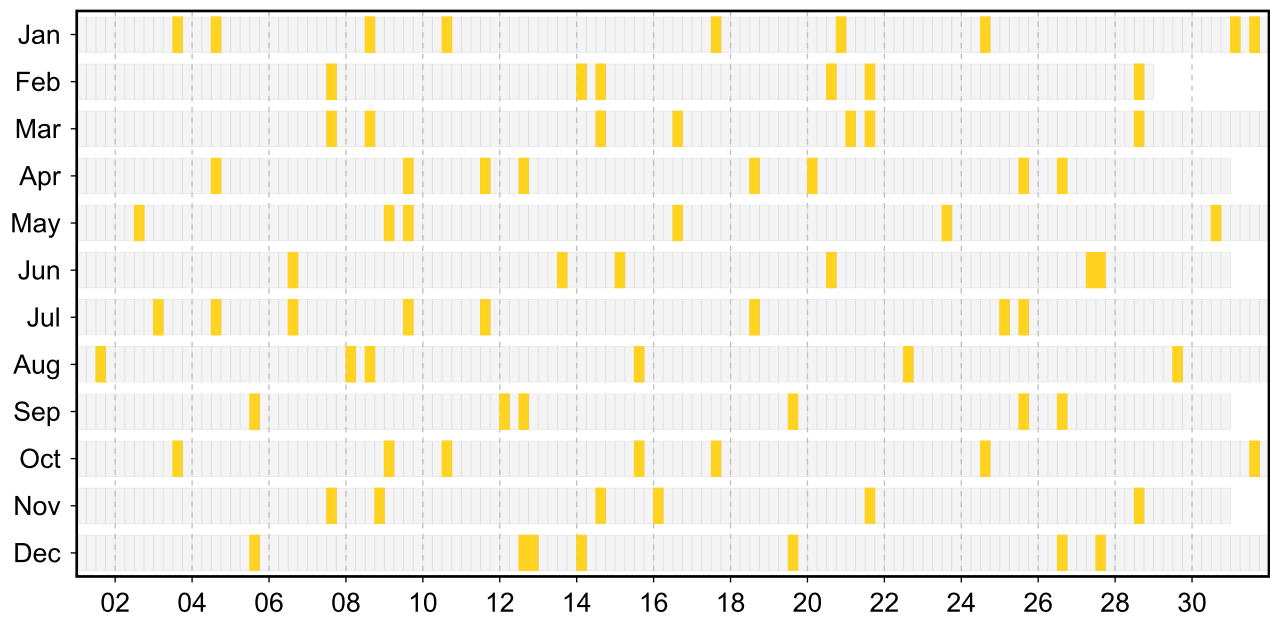
4.3.3 Stream: DFM-09

Data availability DFM-09



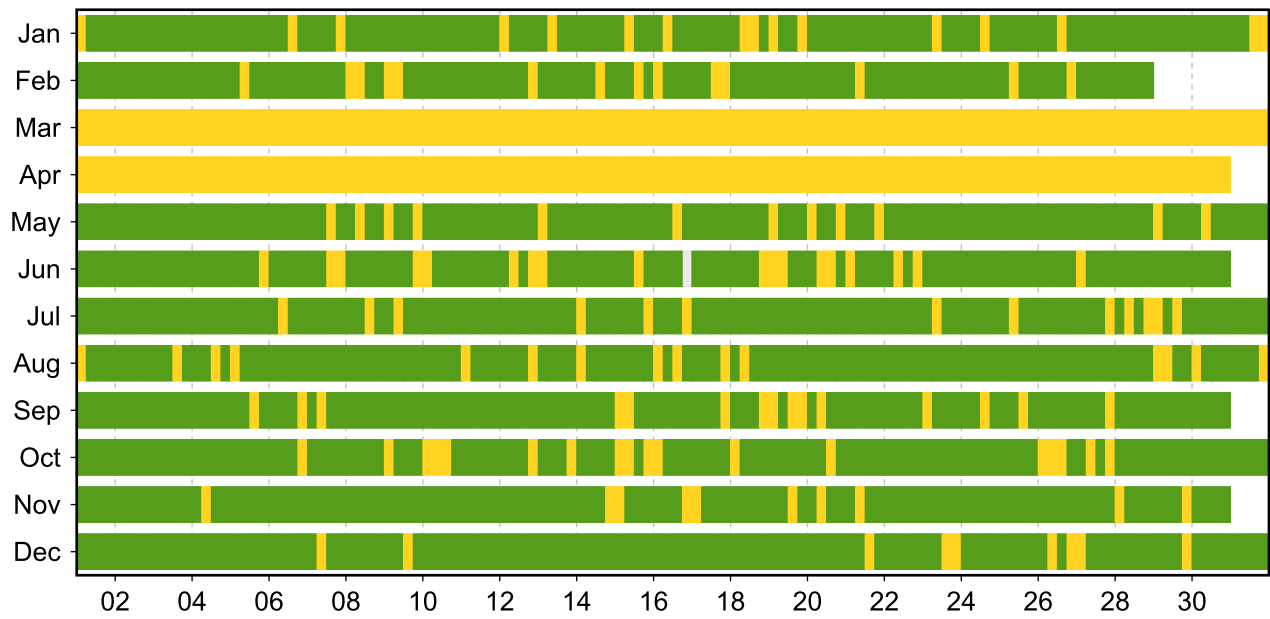
4.3.4 Stream: ECC

Data availability ECC



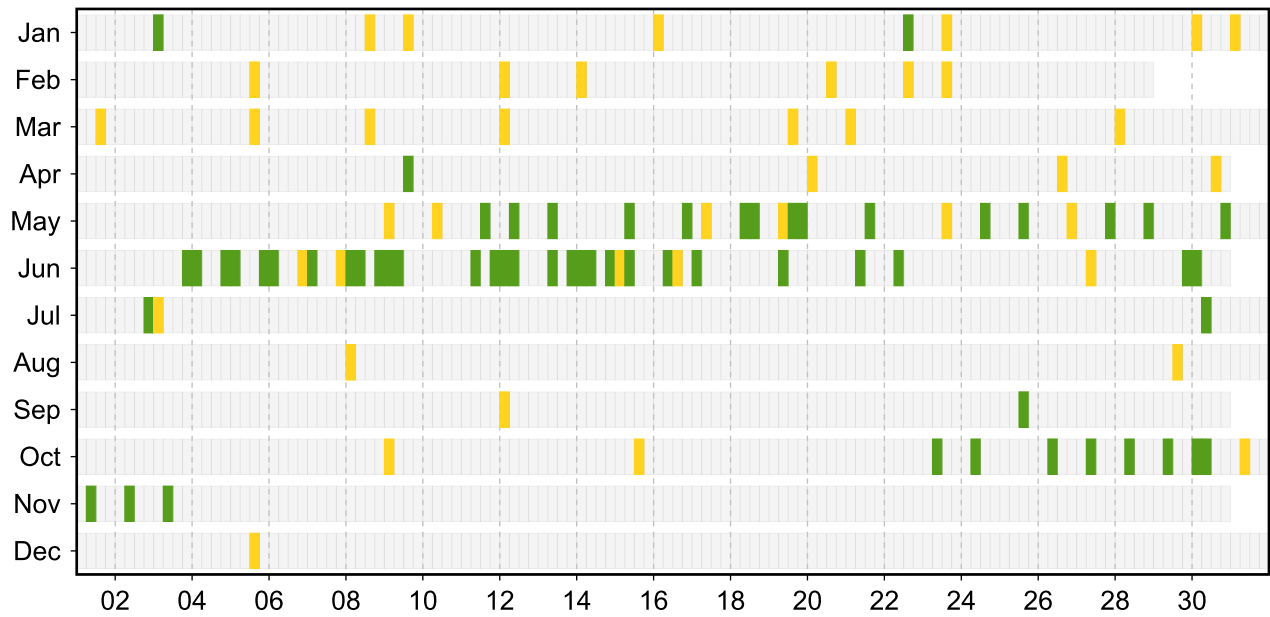
4.3.5 Stream: RS41

Data availability RS41



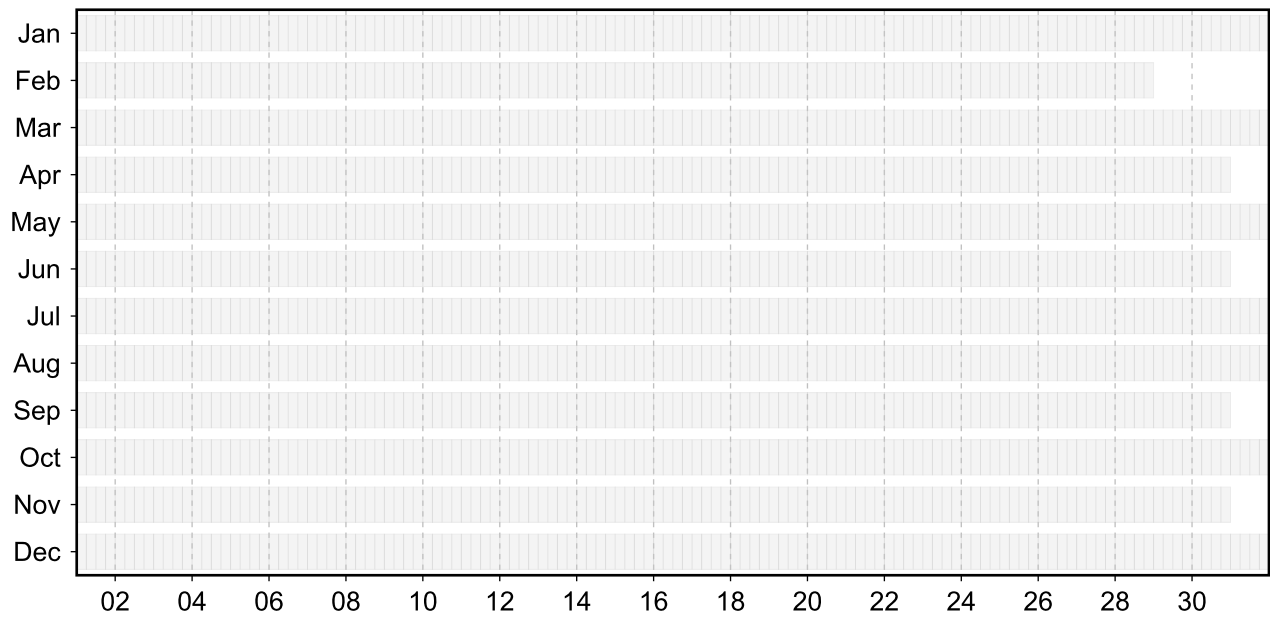
4.3.6 Stream: RS92

Data availability RS92



4.3.7 Stream: SRS-C34

Data availability SRS-C34



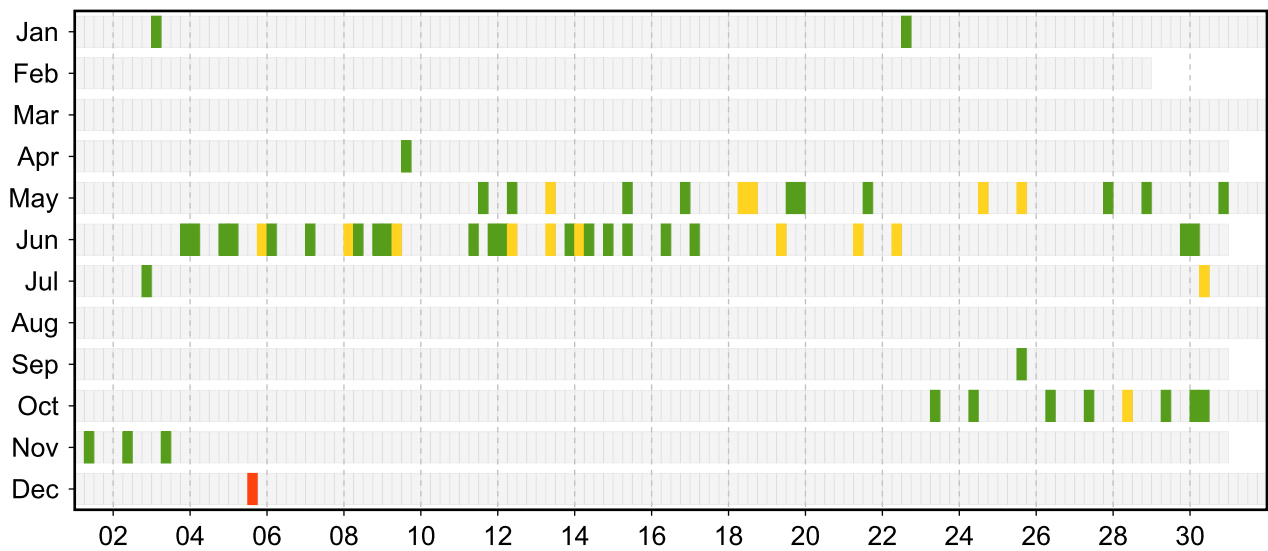
4.4 Data quality of current GRUAN data products

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

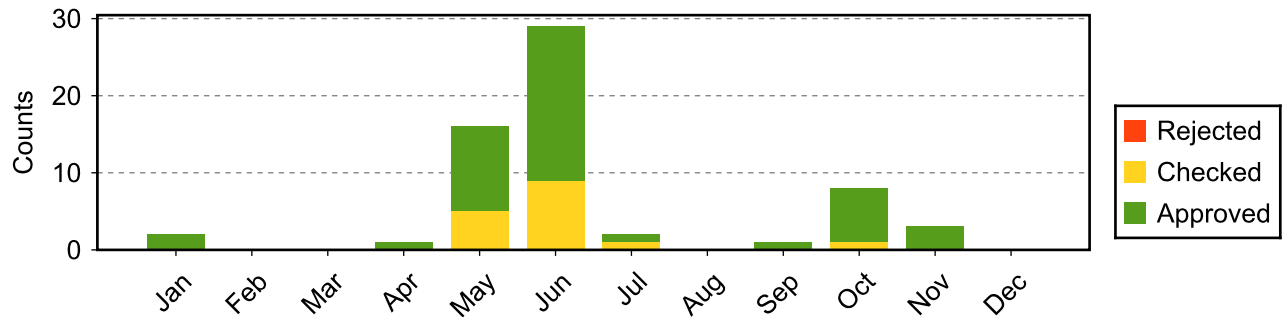
4.4.1 Stream: RS92 (Product: RS92-GDP-002)

Month	Total	Approved	Checked	Rejected	Meta-data	Process.	Press	Temp	RH
Jan	2	2							
Feb									
Mar									
Apr	1	1							
May	16	11	5				3	2	1
Jun	29	20	9				3	6	5
Jul	2	1	1				1		
Aug									
Sep	1	1							
Oct	8	7	1				1		
Nov	3	3							
Dec									
Sum	62	46	16				8	8	6

Data quality of stream RS92



Data quality statistic of stream RS92



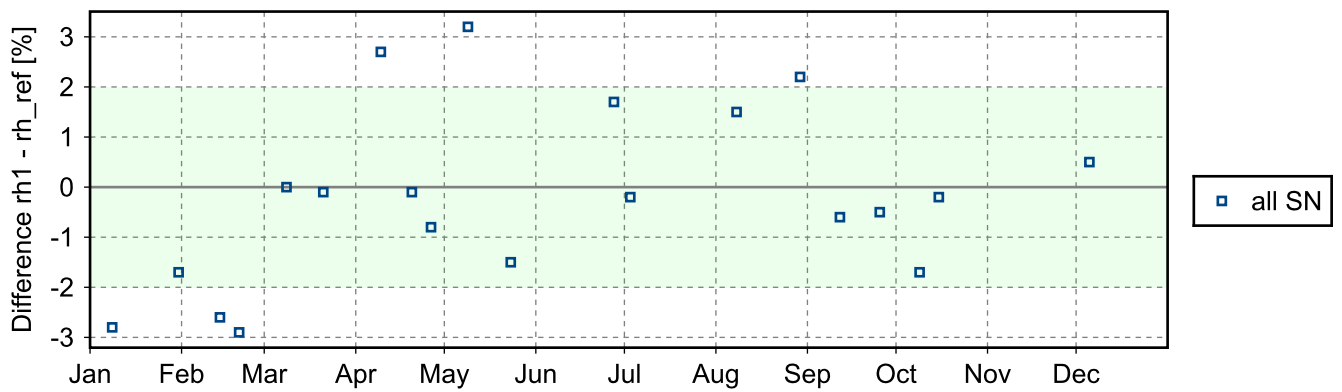
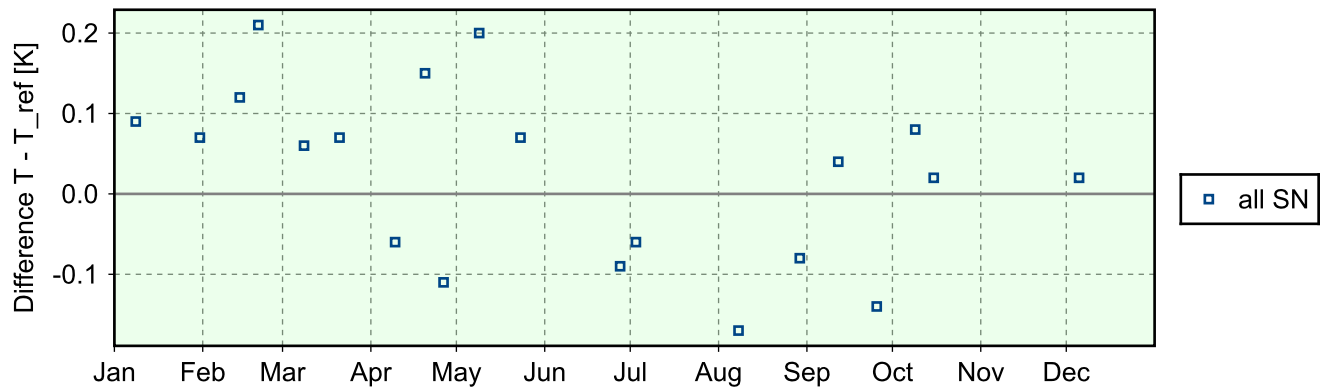
4.5 Instrument combinations of LIN-RS-01

Count	Instrument combination
9	CFH, COBALD, DFM-09, ECC, RS41, RS92
2	CFH, COBALD, ECC, 2x RS41
1	CFH, COBALD, ECC, RS41
1	CFH, COBALD, ECC, 3x RS41
1	CFH, COBALD, ECC, RS41, RS92
11	CFH, DFM-09, ECC, RS41, RS92
2	CFH, ECC, RS41
1	COBALD, RS41
60	ECC, RS41
1340	RS41
31	2x RS41
83	RS41, RS92
6	RS41, SRS-C34

4.6 Instrument ground check

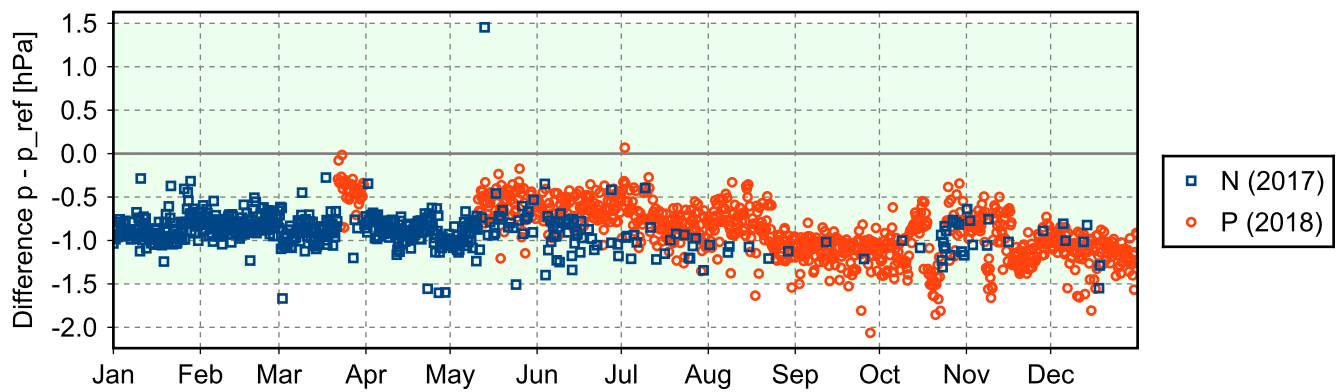
4.6.1 Stream: DFM-09

(1) GroundCheck: GC-SHC

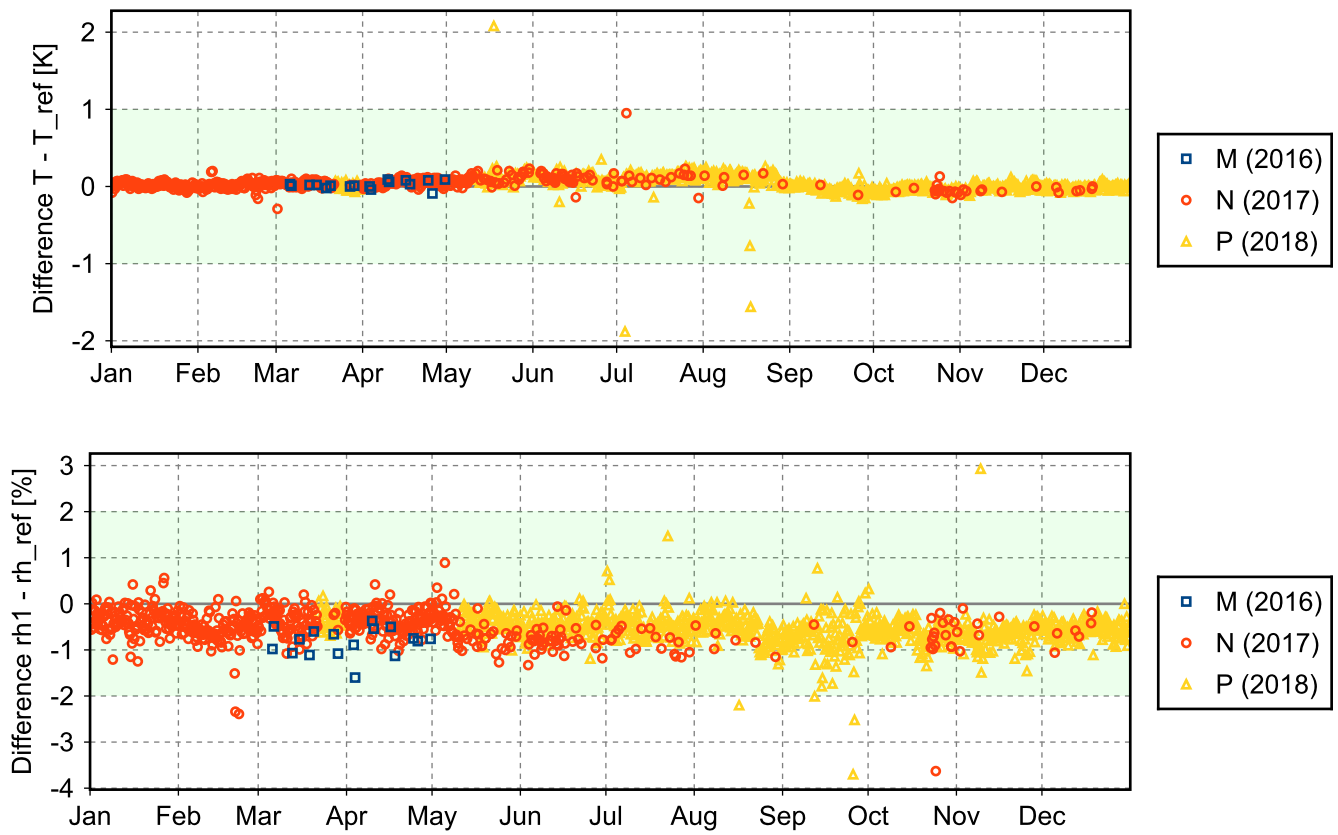


4.6.2 Stream: RS41

(1) GroundCheck: GC-RI41

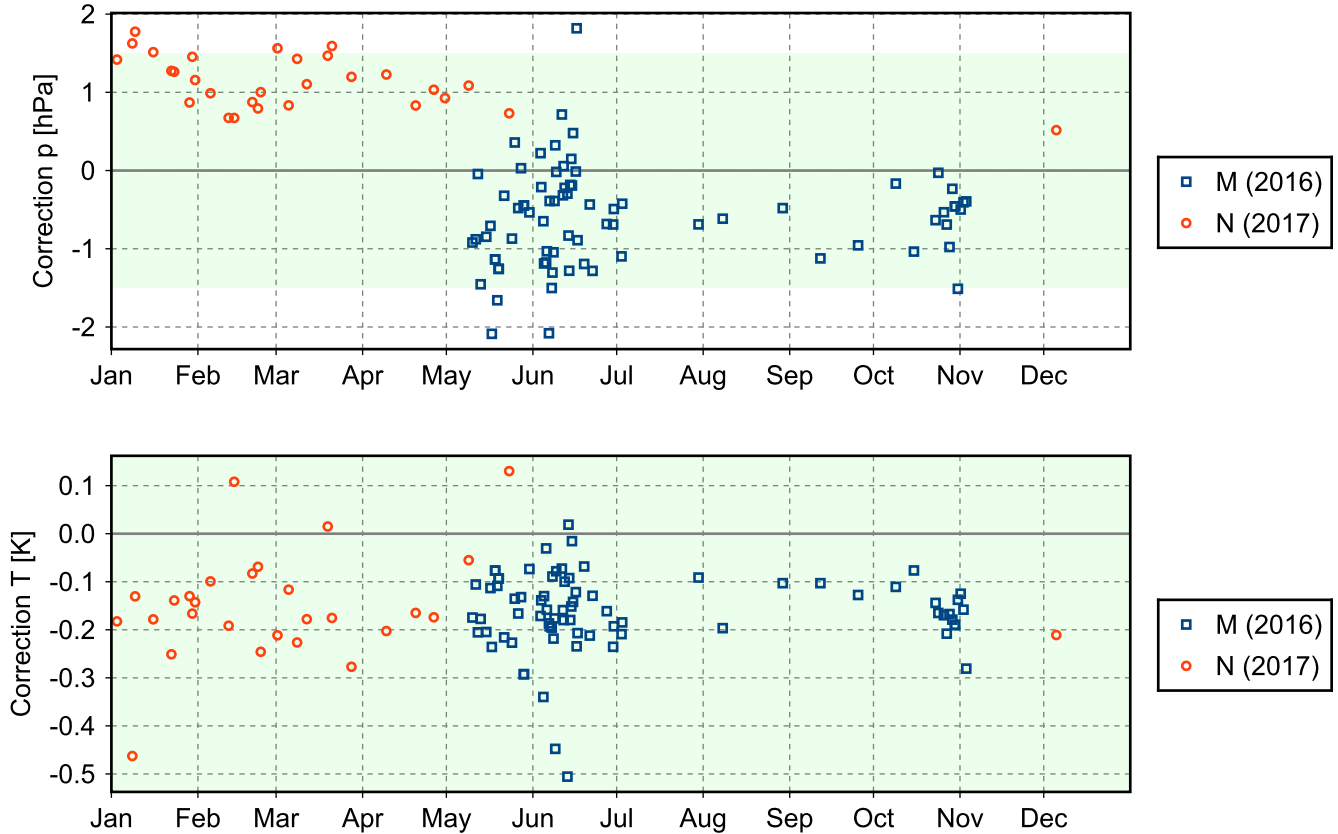


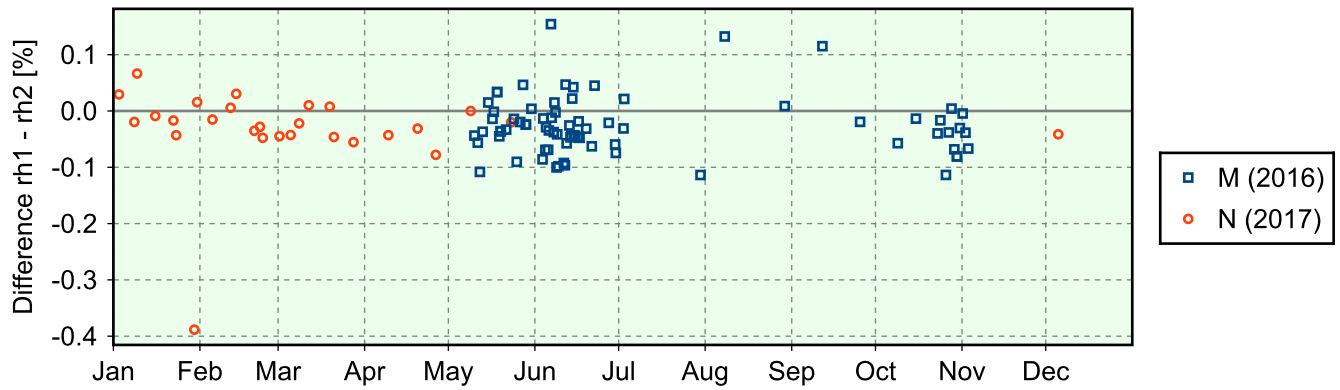
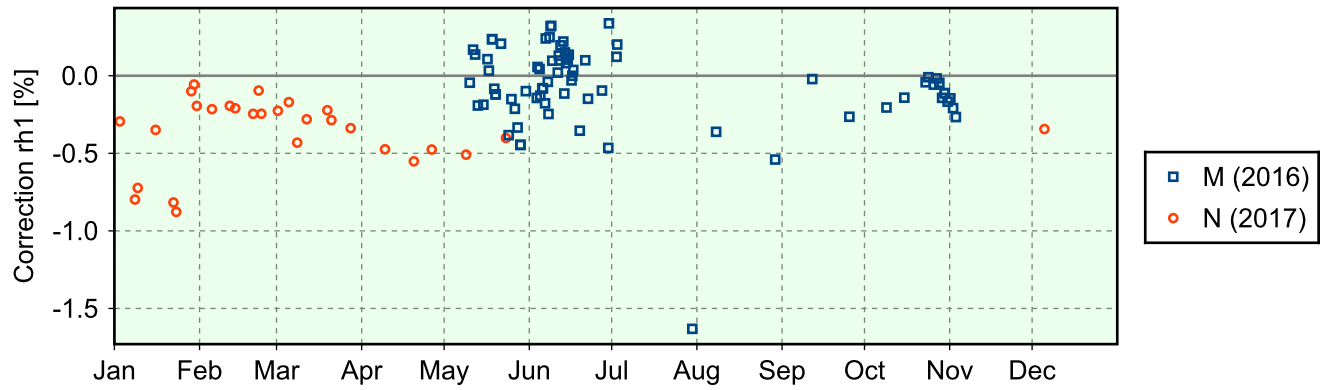
(2) GroundCheck: GC-SHC



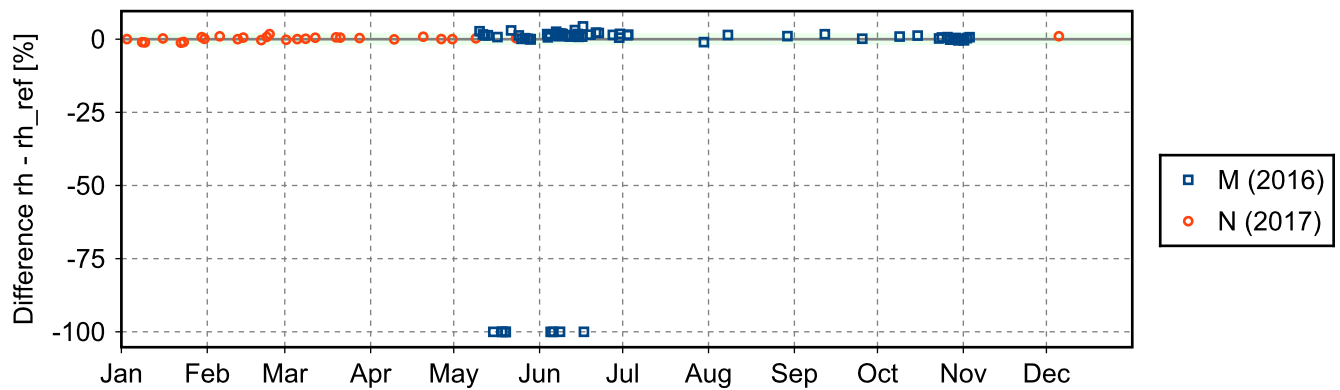
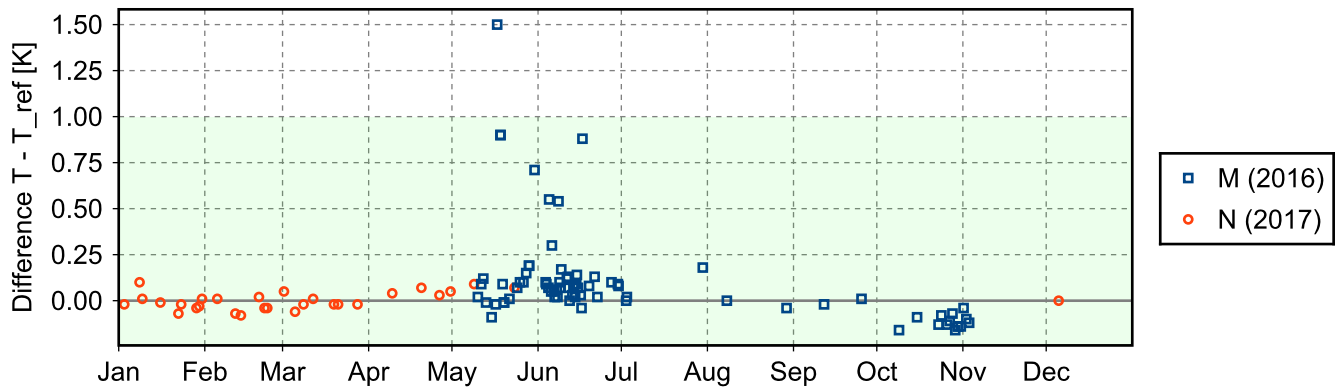
4.6.3 Stream: RS92

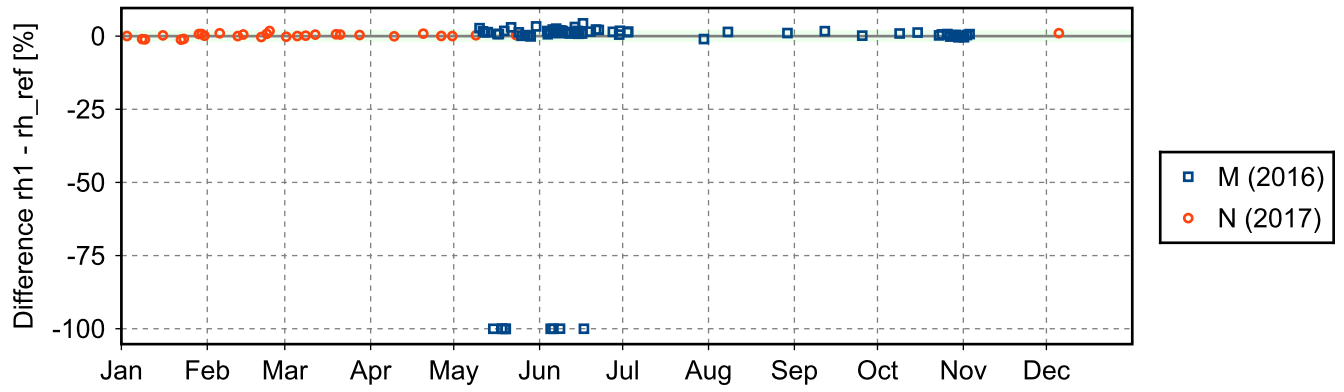
(1) GroundCheck: GC-GC25





(2) GroundCheck: GC-SHC





4.7 Measurement events

