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Session 1

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 2019.

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 In March 2017 the RS92 has been replaced by the RS41 as operational radiosonde.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 regular RS92-RS41 twin soundings since 2015 as part of the GRUAN-wide effort in the management of the RS92-RS41 transition. Soundings with RS92 as part of a large research payload are now performed approximately once per month. 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. In 2019 an additional colleague joined Lindenberg observatory to support the GRUAN Lead Centre for a period of 4 years. Budget has been approved for a contract to work on the development of GRUAN dataproducts for Graw radiosondes.

Operations

Impeding ban on R23 cryogen for CFH is a major concern. In cooperation with TU Dresden we have been investigating alternative cooling methods for CFH/FPH using cooled ethanol. Outbreak of African swine flu in Poland complicates the execution of research soundings. If a payload lands in an affected area with access restrictions, payload recovery is not possible. Therefore, more elaborate planning of research soundings is necessary to select favourable trajectories.

Site assessment and certification

The Lindenberg site was GRUAN-certified (for the RS92 measurement program) in 2014, and after assessment by the Working Group the site 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 RS41, M10 and other radiosondes.
- Development a GRUAN data product for RS41 and for the CFH (on-going work).
- Cooperation with TU-Dresden to find alternative to R23 as cryogen for frost point hygrometers.
- Research flights
  - P-CFH: November 20219 (2 flights)
  - FLASH-B: November 2019 (2 flights)
  - Skydew: June, Aug, Sept 2019 (4 flights)
  - Quantum Cascade Laser direct Absorption Spectrometer (QCLAS): December 2019 (2 flights)

Publications:

- Dirksen, R. J., G. E. Bodeker, P. W. Thorne, A. Merlone, T. Reale, J. Wang, D. F. Hurst, B. B. Demoz, T. D. Gardiner, B. Ingleby, M. Sommer, C. von Rohden, and T. Leblanc, Managing the transition from Vaisala RS92 to RS41 radiosondes within the Global Climate Observing System Reference Upper-Air Network (GRUAN): a progress report, *Geoscientific Instrumentation, Methods and Data Systems*, **9**(2), 337355, doi:10.5194/gi-9-337-2020, 2020, `https://gi.copernicus.org/articles/9/337/2020/`.

- Graf, M., P. Scheidegger, A. Kupferschmid, H. Looser, T. Peter, R. Dirksen, L. Emmenegger, and B. Tuzson, Compact and Lightweight Mid-IR Laser Spectrometer for Balloon-borne Water Vapor Measurements in the UTLS, *Atmos. Meas. Tech. Discuss.*, 2020, 121, doi:10.5194/amt-2020-243, 2020, `https://amt.copernicus.org/preprints/amt-2020-243/`.

- Hanumanthu, S., B. Vogel, R. Müller, S. Brunamonti, S. Fadnavis, D. Li, P. Oelsner, M. Naja, B. B. Singh, K. R. Kumar, S.Sonbawne, H.Jauhiainen, H.Vmel, B.Luo, T.Jorge, F.G.Wienhold, R.Dirkson, and T.Peter, Strong variability of the Asian Tropopause Aerosol Layer (ATAL) in August 2016 at the Himalayan foothills, *Atmos. Chem. Phys. Discuss.*, 2020, 142, doi:10.5194/acp-2020-552, 2020, `https://acp.copernicus.org/preprints/acp-2020-552/`.

- Jorge, T., S. Brunamonti, Y. Poltera, F. G. Wienhold, B. P. Luo, P. Oelsner, S. Hanumanthu, B. B. Sing, S. Körner, R. Dirksen, M. Naja, S. Fadnavis, and T. Peter, Understanding cryogenic frost point hygrometer measurements after contamination by mixed-phase clouds, *Atmos. Meas. Tech. Discuss.*, 2020, 176, doi:10.5194/amt-2020-176, 2020, `https://amt.copernicus.org/preprints/amt-2020-176/`.

WG-GRUAN interface

GRUAN Lead Centre resides at Lindenberg observatory.
Christoph von Rohden is member of task team radiosondes.

Other archiving centers

NDACC, WOUDC, BSRN.

Participation in campaigns

Nothing to report.

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.
- Collaborative development of GRUAN data product for Graw radiosondes.
- Organize and host CIMO radiosonde intercomparison campaign in 2021 in collaboration with MeteoSwiss/Payerne.

GRUAN Site Report for Lindenberg (LIN), 2019

Reported time range is Jan 2019 to Dec 2019
Created by the Lead Centre
Version from 2020-11-05

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 +1 / -1
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	1514

1.2 General comments from Lead Centre

No comments 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.

Meteorological data is missing, therefore the operational processing as GNSS-PW-GDP is not possible at moment.

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 LC has been established 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.

Currently, the dataflow includes streams of the Vaisala RS41-SG(P), RS92-SGP, Graw DFM-09, ECC Ozone sonde, and CFH water vapour. 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 4 times per day. Ozone soundings are performed once per week. Research soundings including CFH, ECC, Vaisala RS92 and/or RS41 and Graw DFM-09 are performed up to twice per month. Various sonde combinations have been flown throughout the reporting period.

A regular measurement program for the observation of stratospheric water vapor profiles is performed using CFH.

4.2 GRUAN data products

Product	Version	Soundings received	Available at LC	Distributed by NCEI

4.2.1 Stream: CFH

CFH		28	28	

4.2.2 Stream: COBALD

COBALD		14	14	

4.2.3 Stream: DFM-09

DFM-09		12	12	
DFM-09-RAW	001		12	

4.2.4 Stream: ECC

ECC		77	77	

4.2.5 Stream: IMET-1

IMET-1		5	5	

4.2.6 Stream: IMS-100

IMS-100		15	15	

4.2.7 Stream: M10

M10		2	2	

4.2.8 Stream: RS-11G

RS-11G		3	3	

4.2.9 Stream: RS41

RS41		1558	1558	
RS41-GCA	001		1556	
RS41-RAW	001		1558	
RS41-EDT	001		1554	
RS41-GDP-ALPHA	001		241	
RS41-GDP-ALPHA	002		1277	
RS41-GDP-ALPHA	003		505	
RS41-GDP-ALPHA	004		14	
RS41-GDP-BETA	001		578	

4.2.10 Stream: RS92

RS92		13	13	
RS92-GCA	001		13	
RS92-INT	001		13	
RS92-RAW	002		13	
RS92-EDT	001		13	
RS92-GDP	002		4	

4.2.11 Stream: SRS-C34

SRS-C34		3	3	

Product	Version	Soundings received	Available at LC	Distributed by NCEI

4.2.12 Stream: SRS-C50

SRS-C50		6	6	

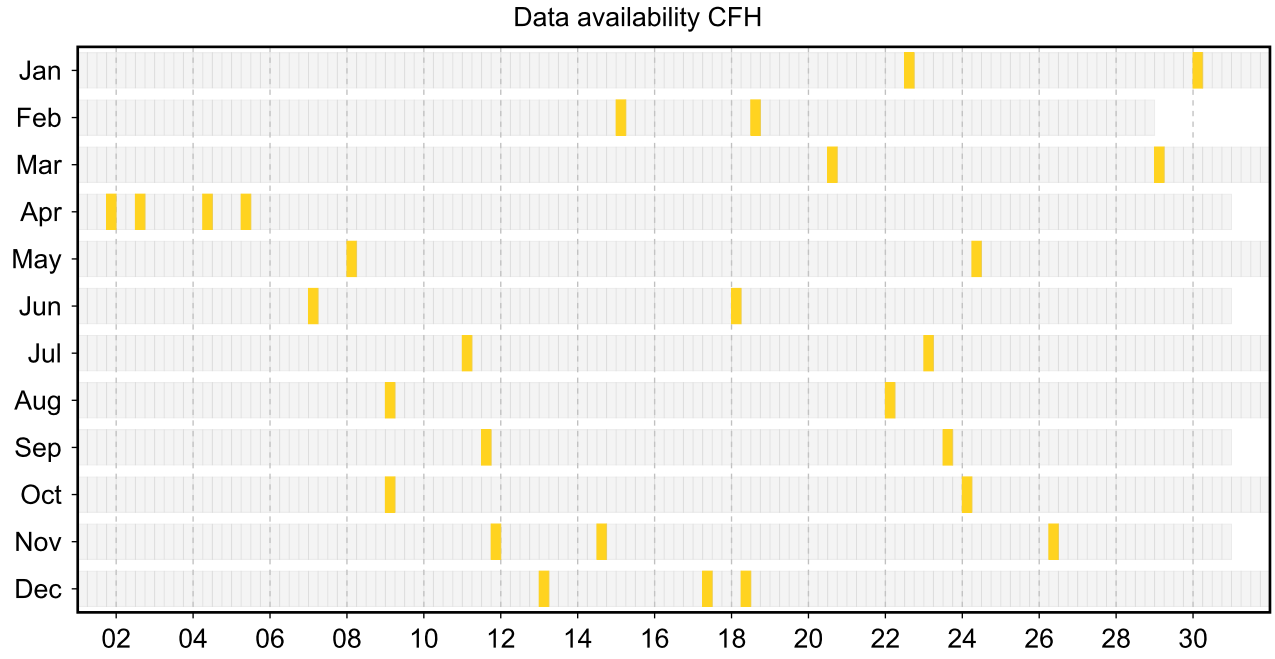
4.3 Availability of data products

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).

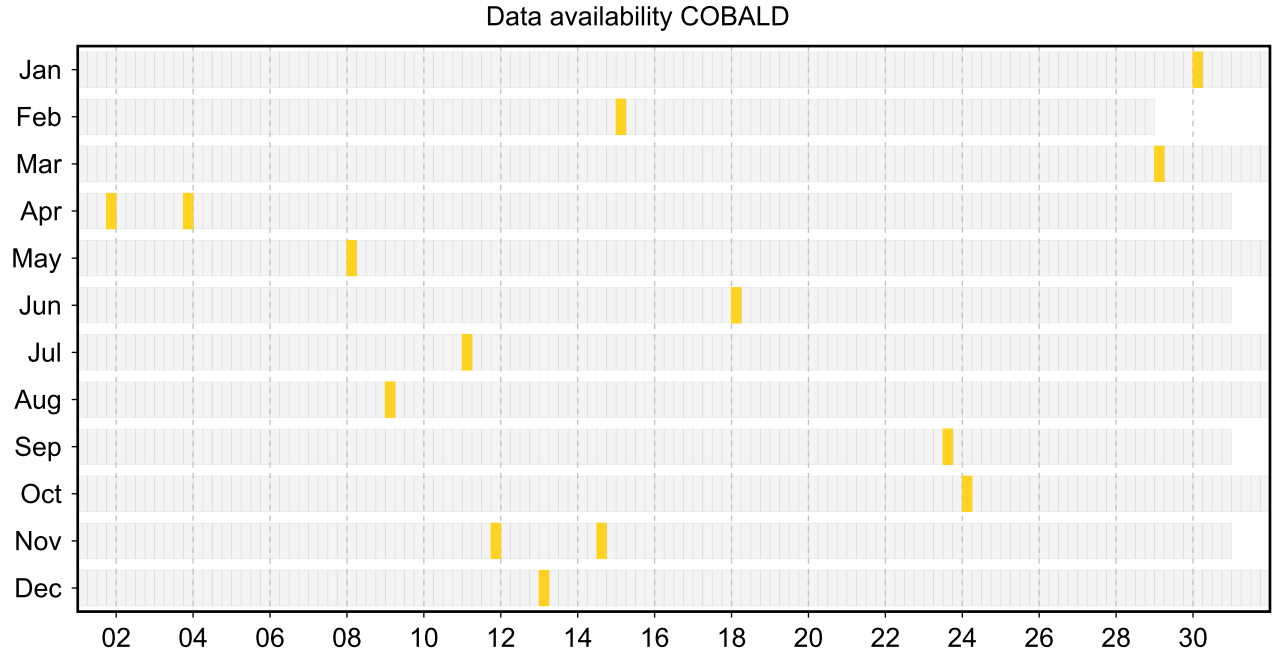
Unprocessed (yellow): The manufacturer-produced file with raw measurement data has been successfully converted into a GRUAN-standardized raw data format (NetCDF). The GRUAN data processing has not been performed or was aborted. Reasons for this may be a still missing GRUAN data processor or a processing-software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

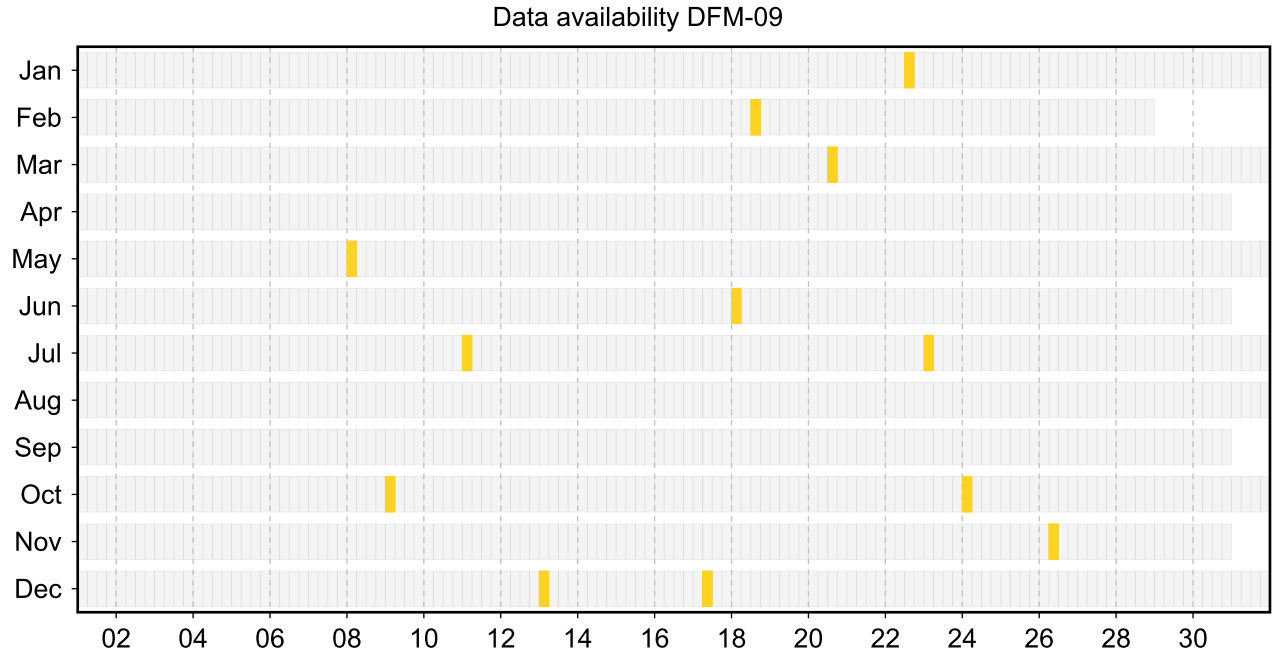
4.3.1 Stream: CFH



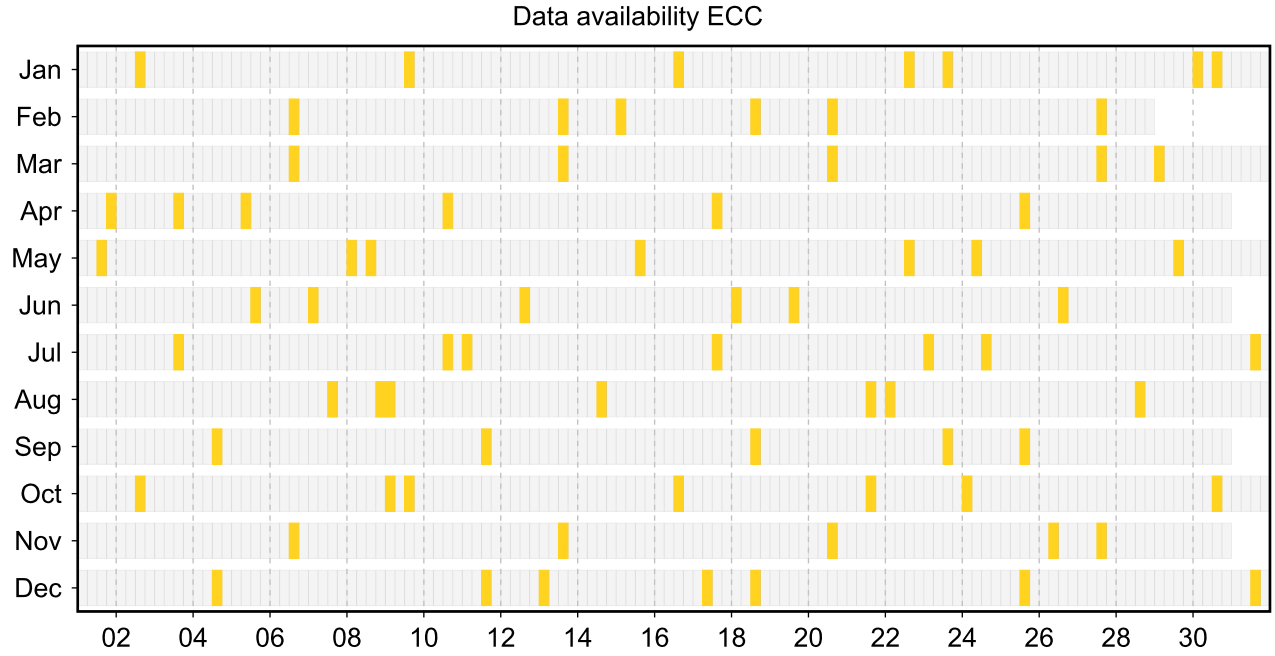
4.3.2 Stream: COBALD



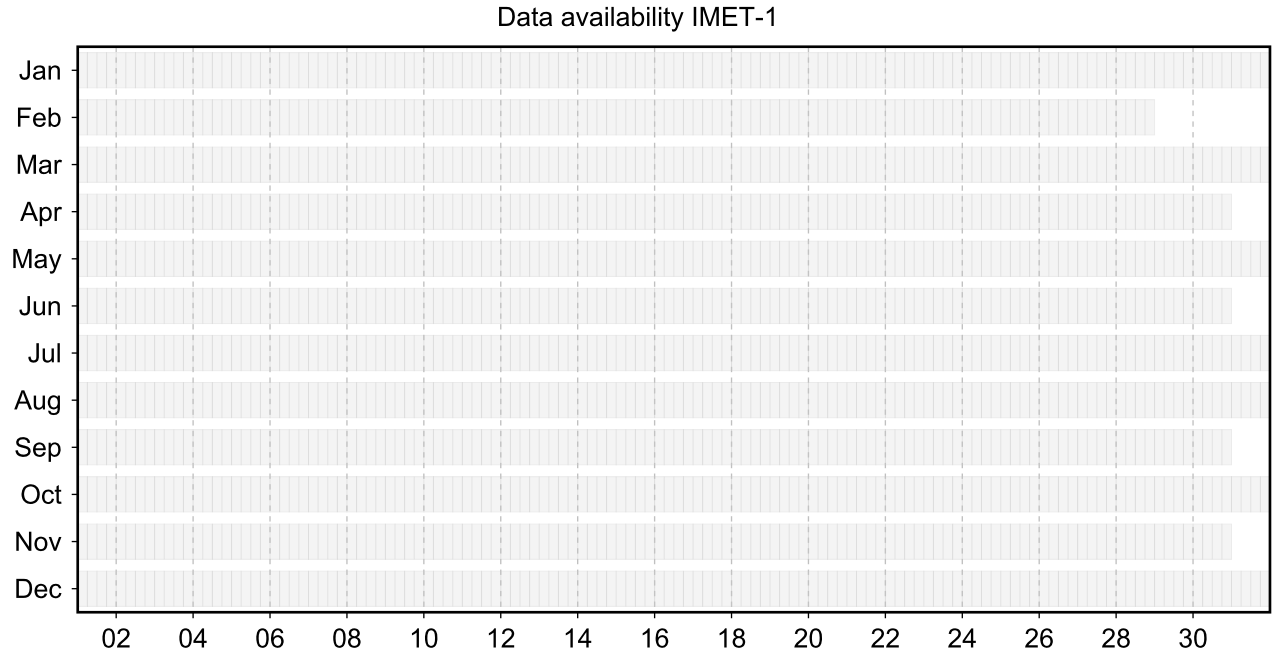
4.3.3 Stream: DFM-09



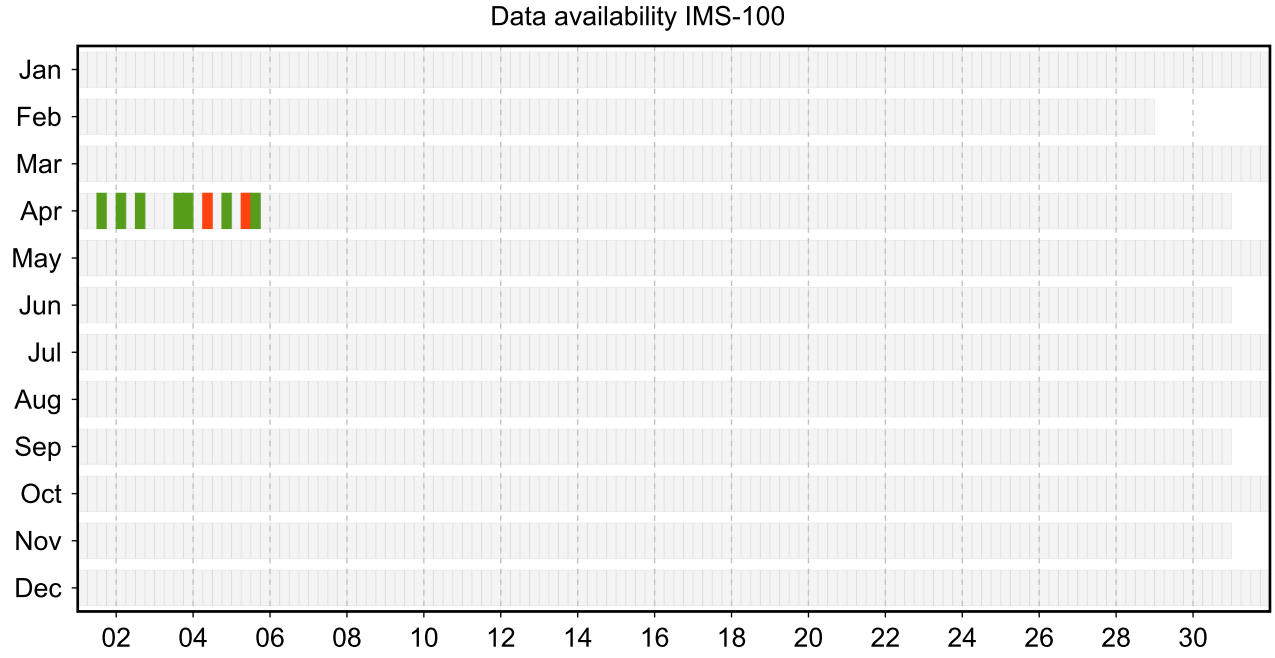
4.3.4 Stream: ECC



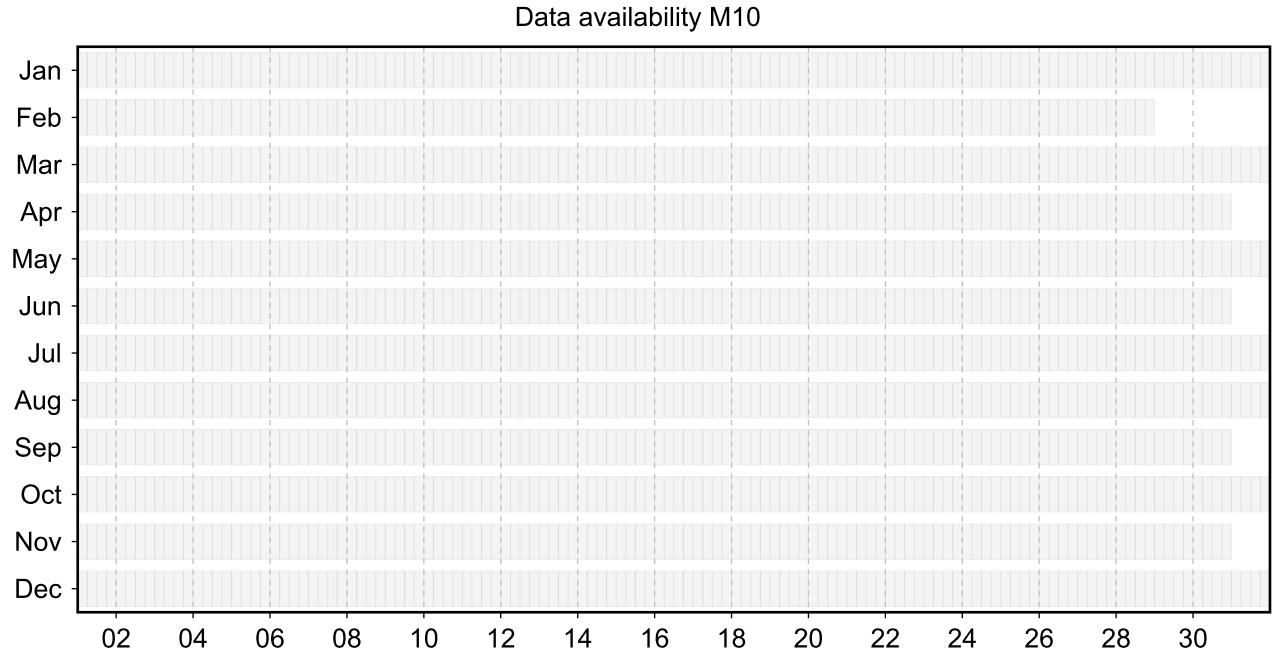
4.3.5 Stream: IMET-1



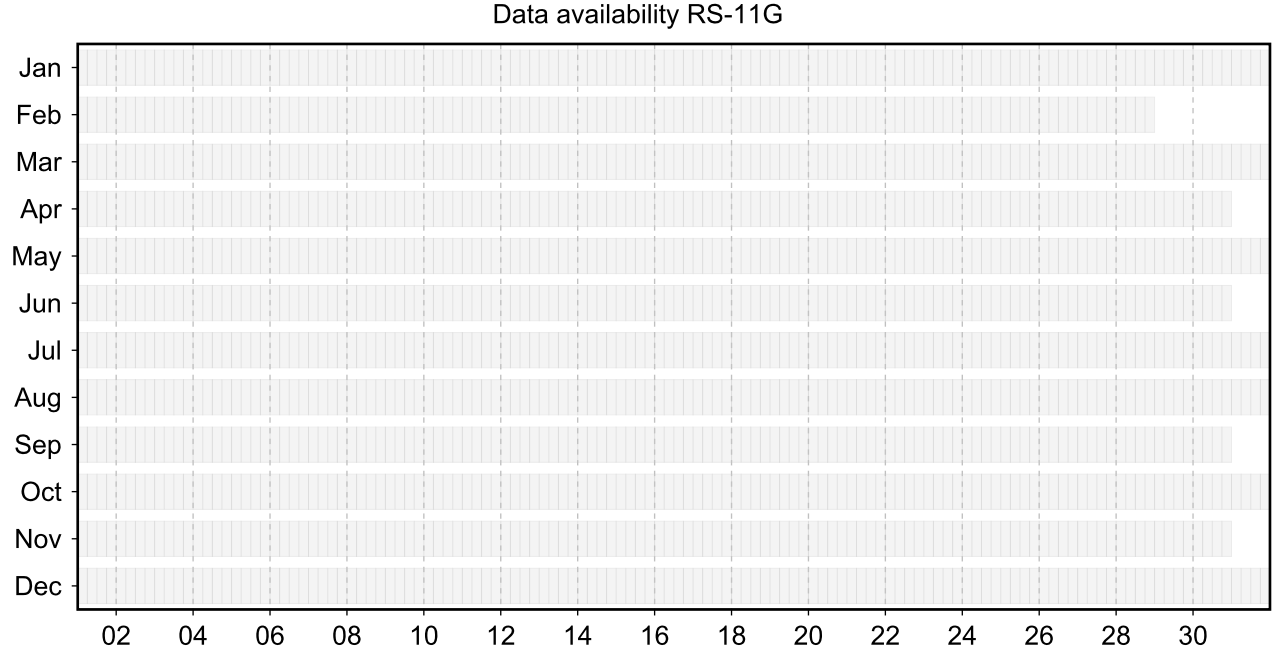
4.3.6 Stream: IMS-100



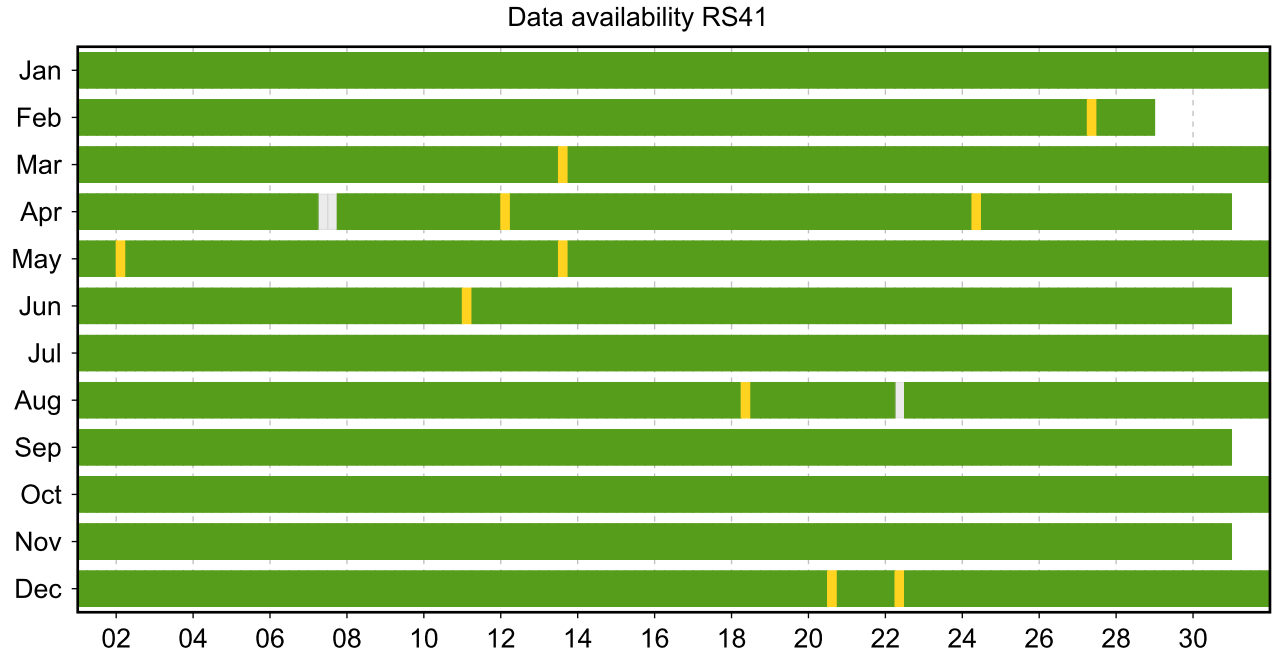
4.3.7 Stream: M10



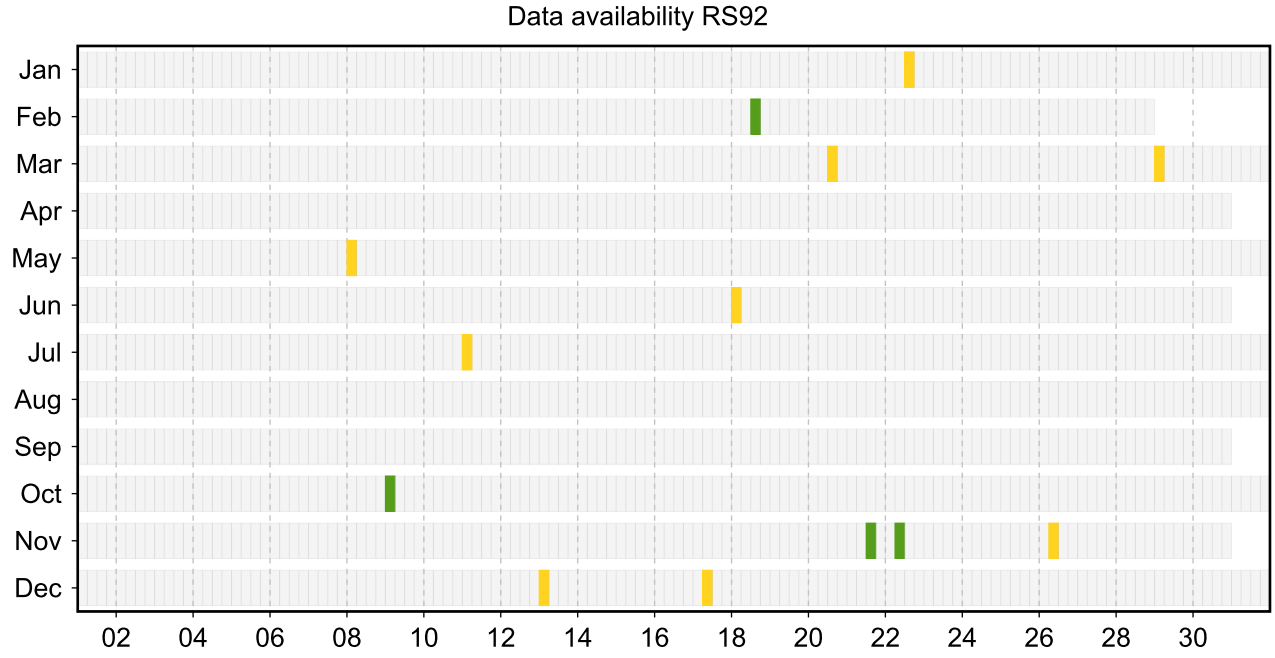
4.3.8 Stream: RS-11G



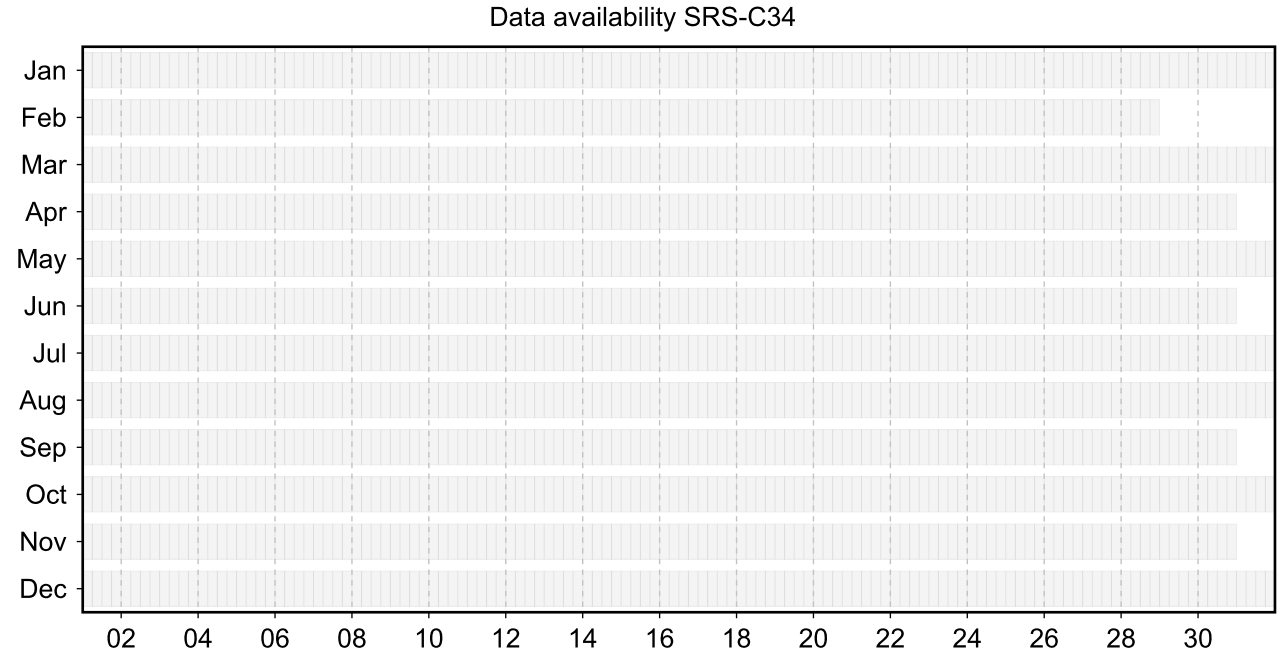
4.3.9 Stream: RS41



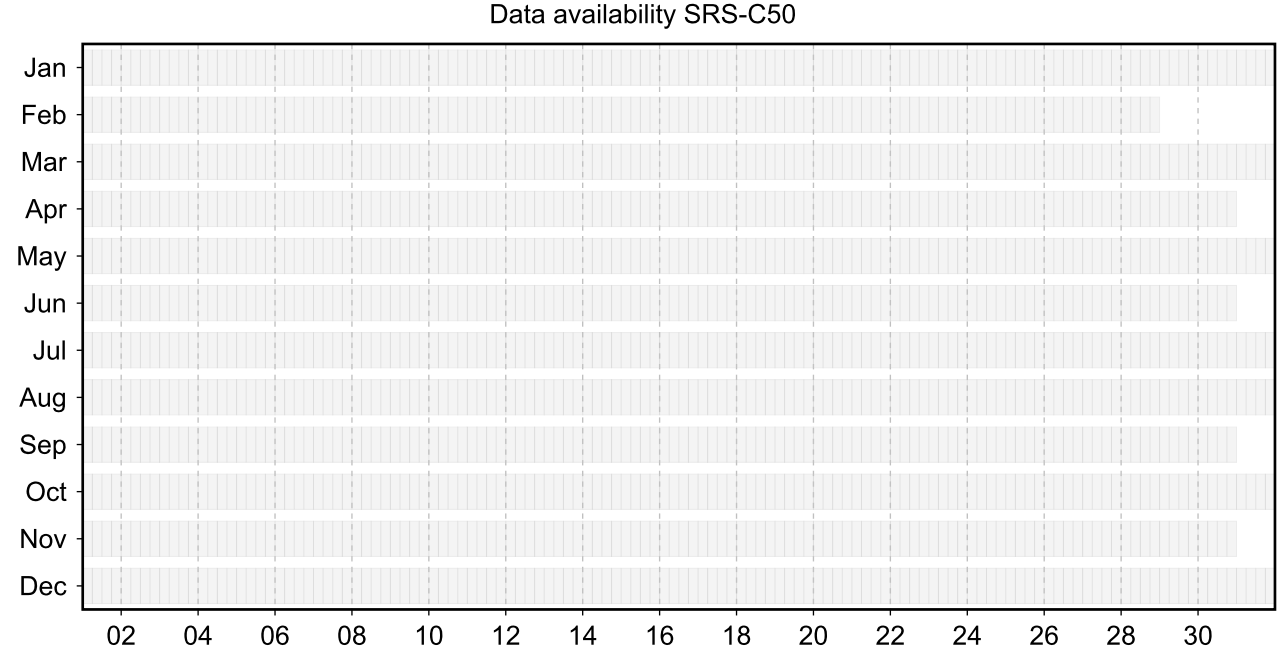
4.3.10 Stream: RS92



4.3.11 Stream: SRS-C34



4.3.12 Stream: SRS-C50



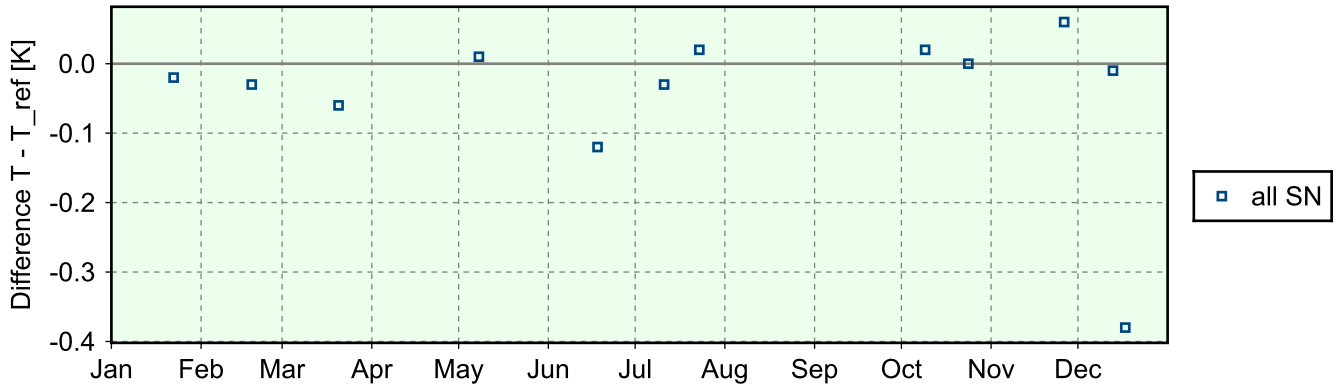
4.4 Instrument combinations of LIN-RS-01

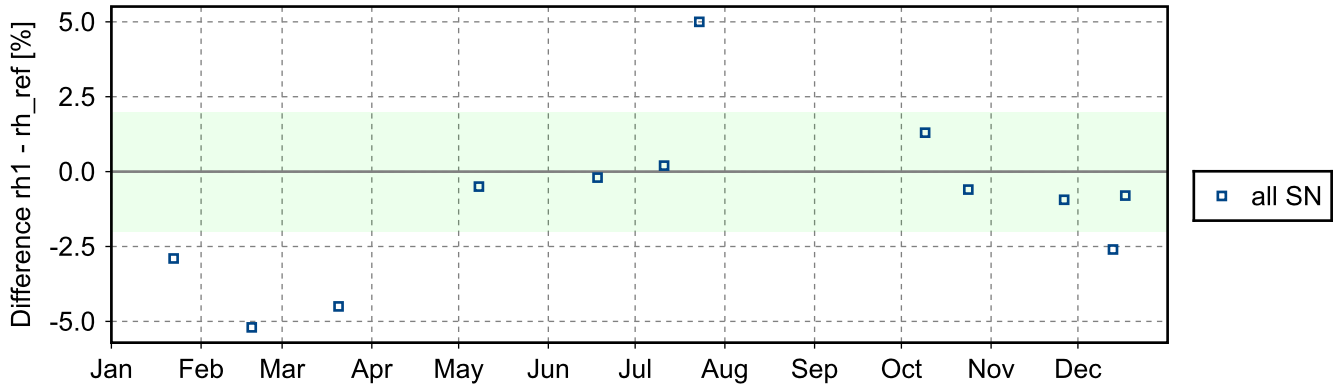
Count	Instrument combination
1	CFH, COBALD, DFM-09, ECC, RS41
4	CFH, COBALD, DFM-09, ECC, RS41, RS92
2	CFH, COBALD, ECC, IMET-1, 2x RS41
1	CFH, COBALD, ECC, IMS-100, RS-11G, RS41
1	CFH, COBALD, ECC, 2x RS41
1	CFH, COBALD, ECC, RS41
1	CFH, COBALD, ECC, 2x RS41, RS92
2	CFH, COBALD, 2x RS41
3	CFH, DFM-09, ECC, IMET-1, RS41, RS92
1	CFH, DFM-09, ECC, 2x RS41
3	CFH, DFM-09, ECC, RS41, RS92
1	CFH, ECC, IMS-100, 2x RS41
4	CFH, ECC, 2x RS41
1	CFH, IMS-100, RS-11G, 2x RS41
1	CFH, IMS-100, 2x RS41
1	CFH, RS41
1	COBALD, IMS-100, RS-11G, RS41
54	ECC, RS41
4	IMS-100, RS41
3	2x IMS-100, 2x RS41
2	M10, RS41, RS92
5	5x RS41
1404	RS41
3	4x RS41
1	2x RS41
1	RS41, SRS-C34
1	2x RS41, SRS-C34
3	RS41, SRS-C50
1	SRS-C34
3	SRS-C50

4.5 Instrument ground check

4.5.1 Stream: DFM-09

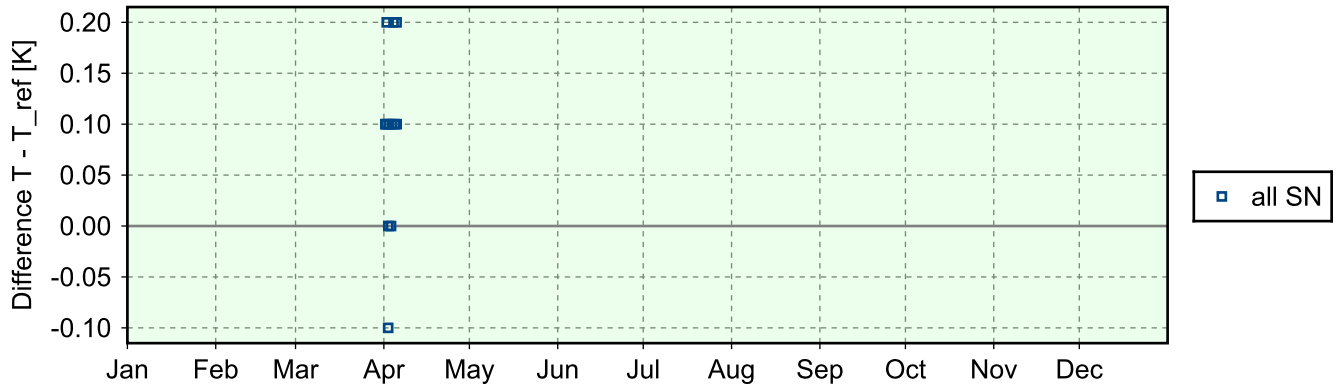
(1) GroundCheck: GC-SHC

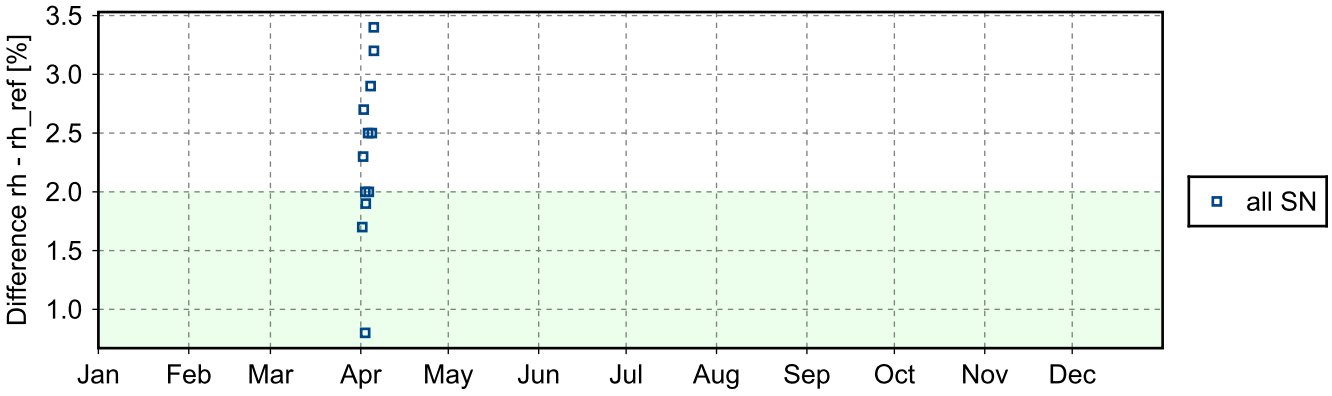




4.5.2 Stream: IMS-100

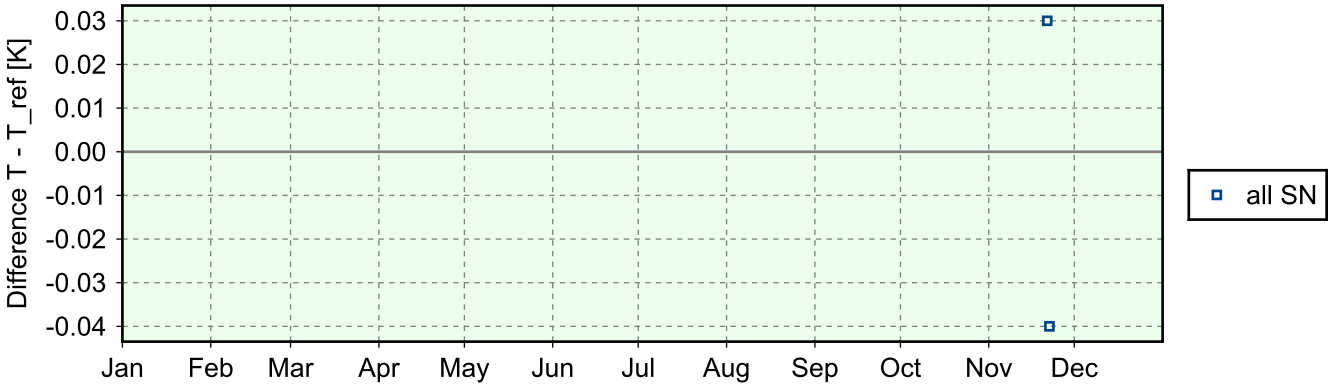
(1) GroundCheck: GC-TU(room)

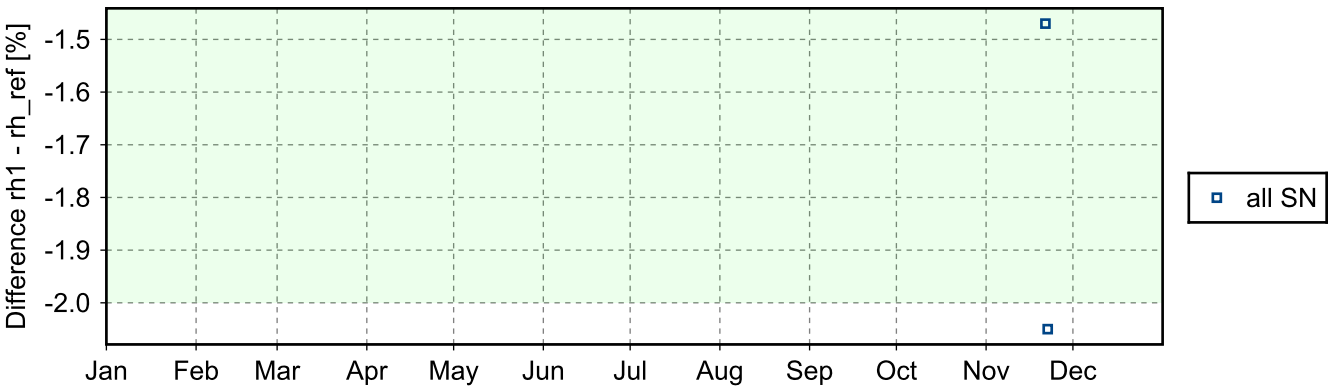




4.5.3 Stream: M10

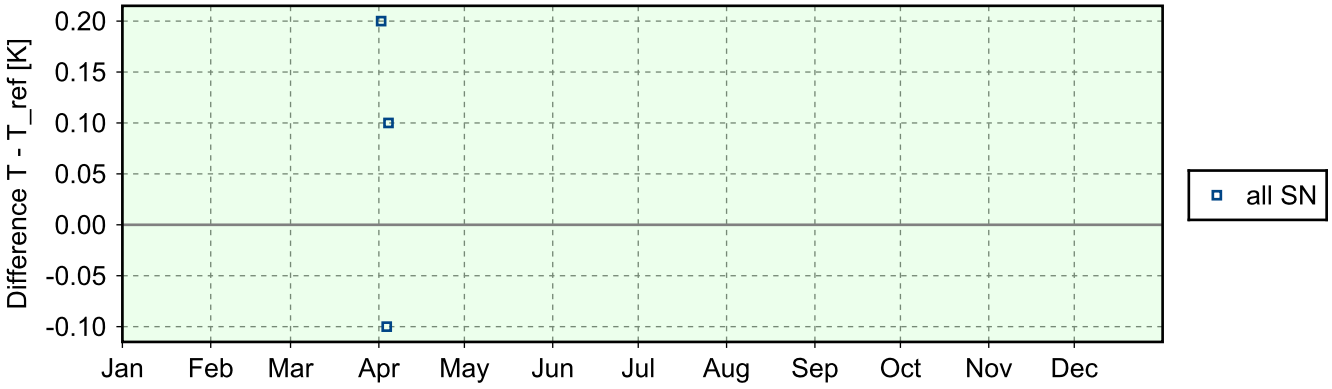
(1) GroundCheck: GC-SHC

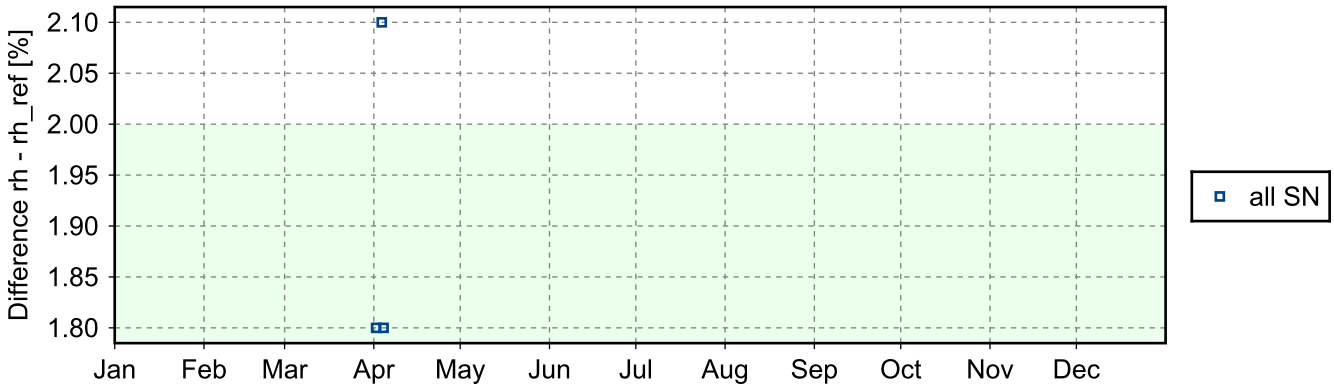




4.5.4 Stream: RS-11G

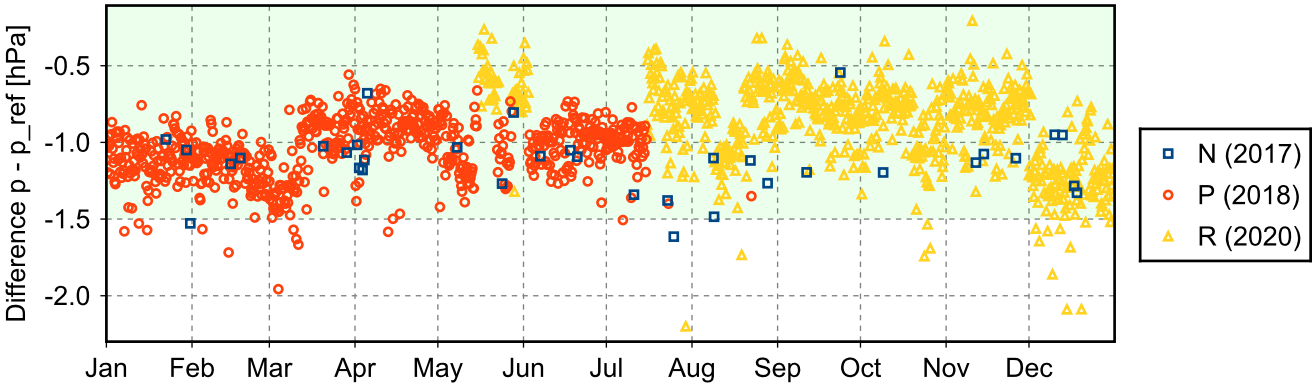
(1) GroundCheck: GC-TU(room)



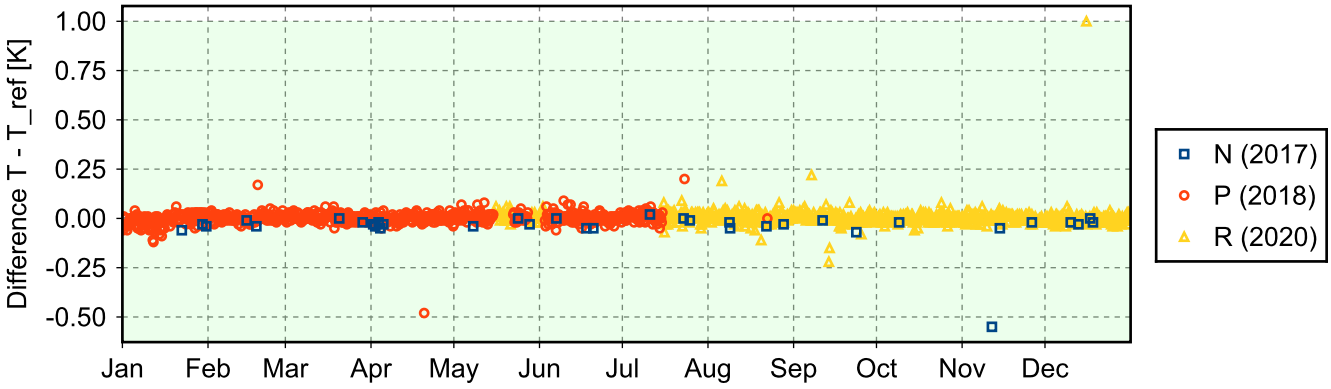


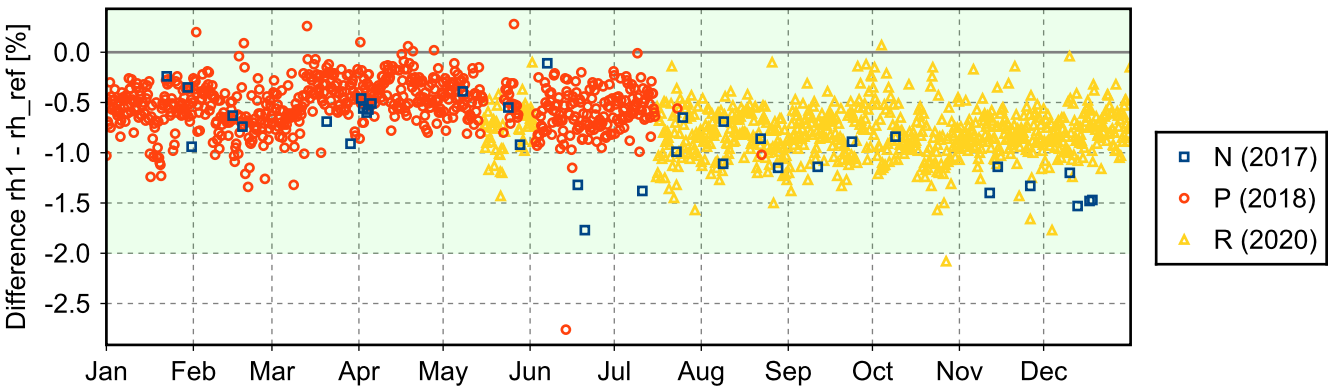
4.5.5 Stream: RS41

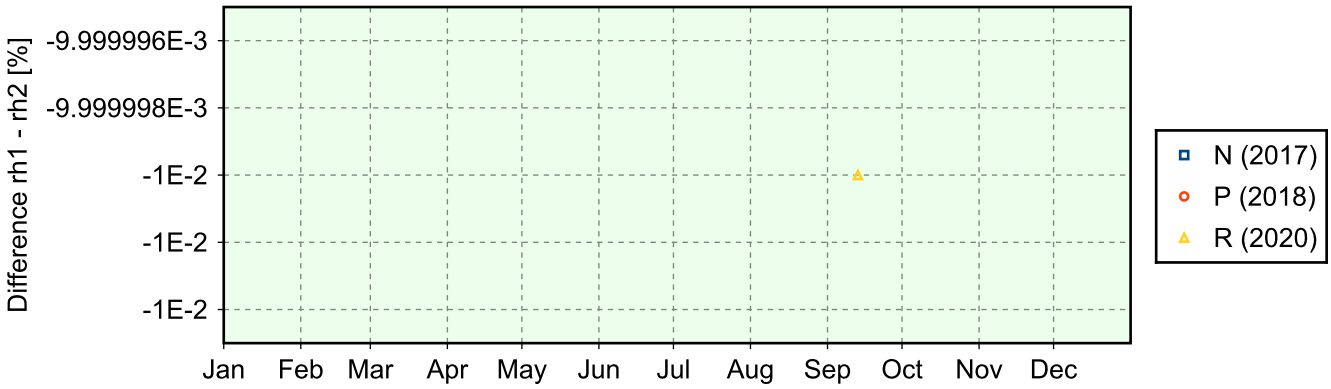
(1) GroundCheck: GC-RI41



(2) GroundCheck: GC-SHC

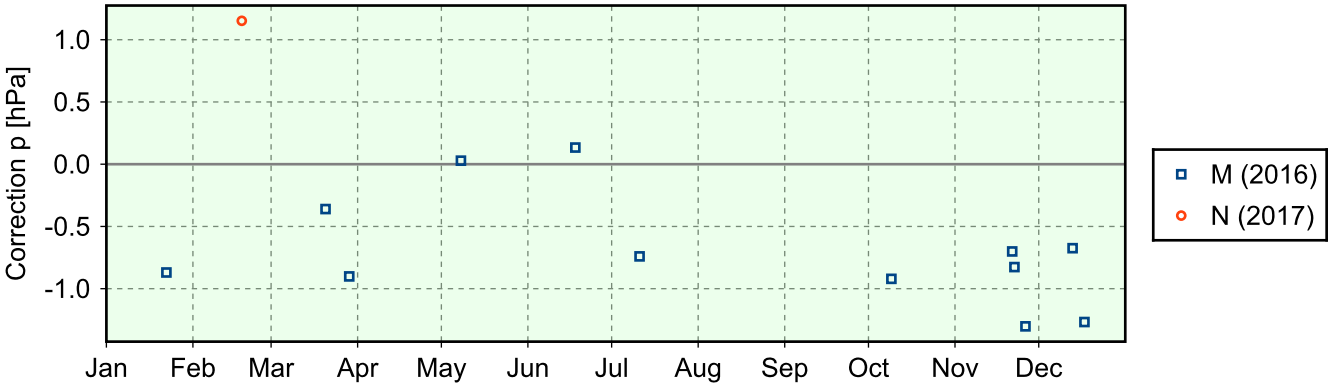


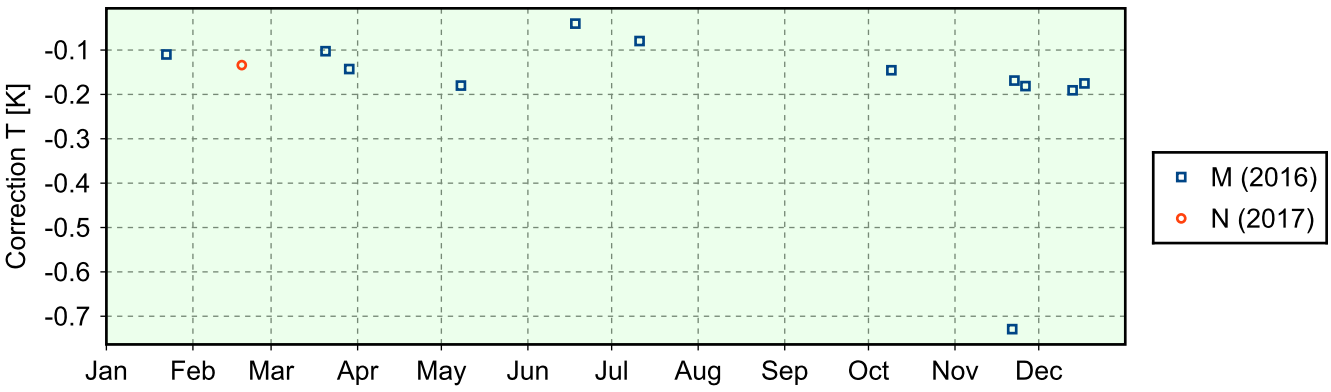


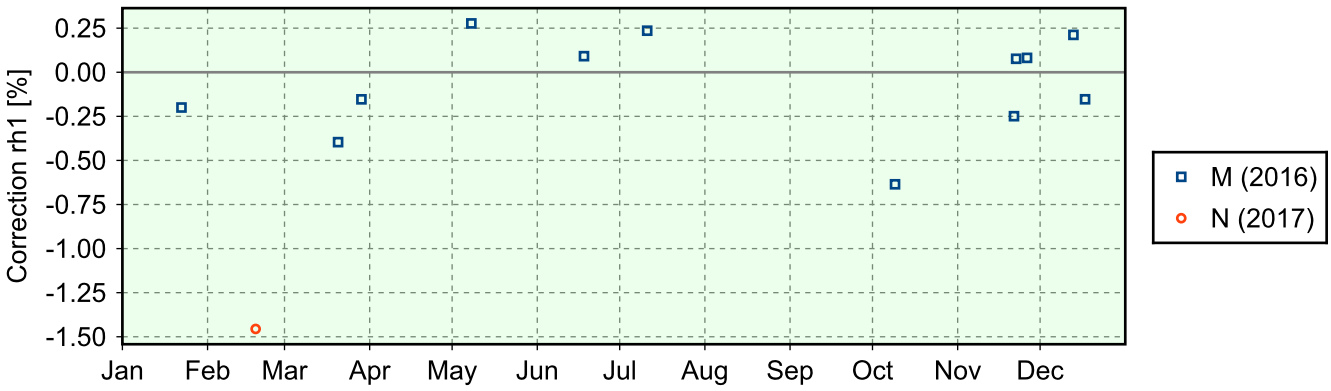


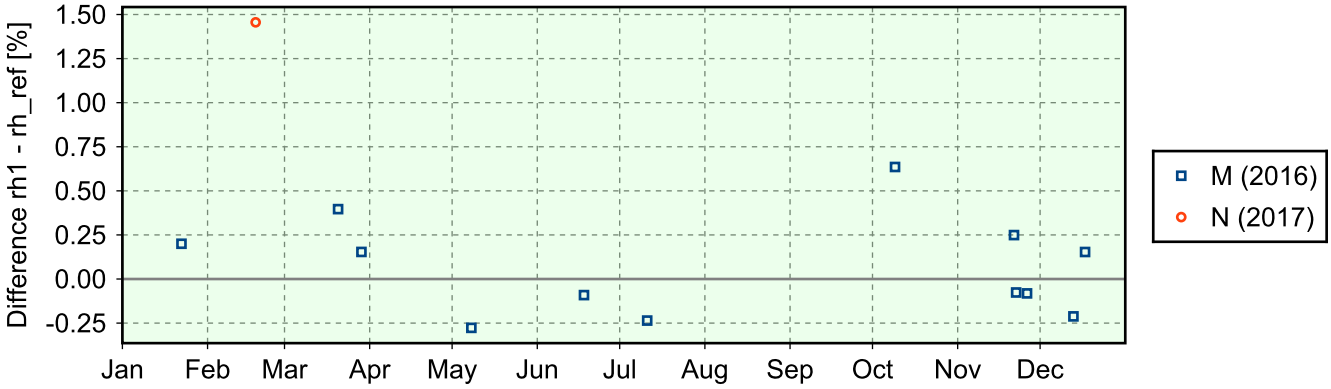
4.5.6 Stream: RS92

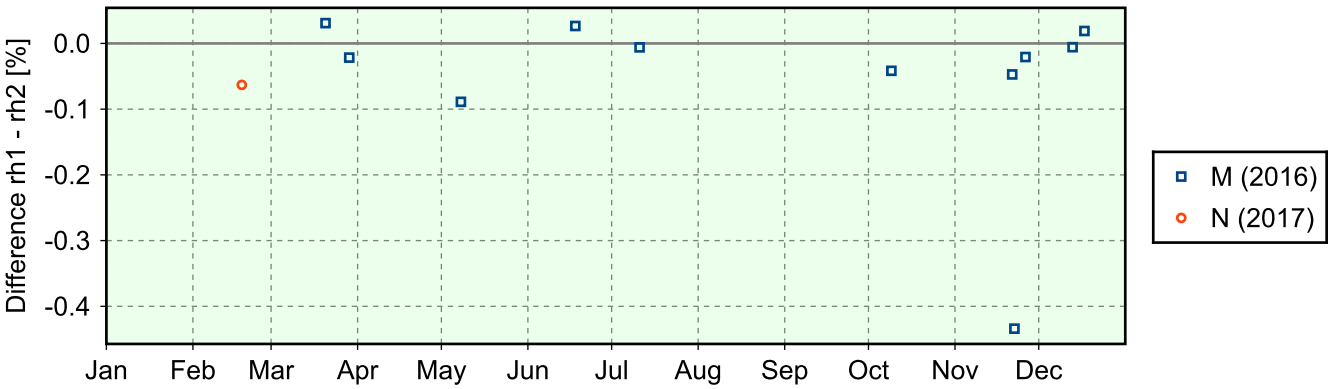
(1) GroundCheck: GC-GC25



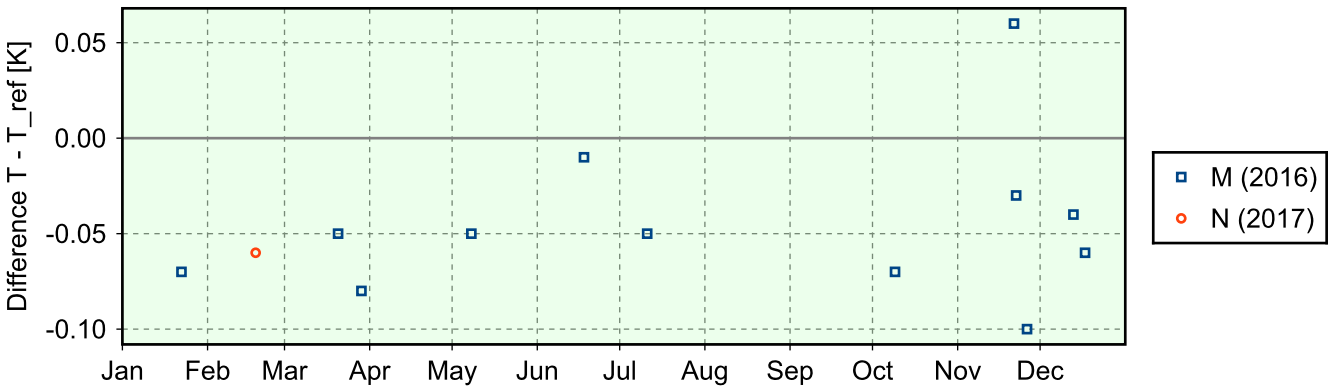


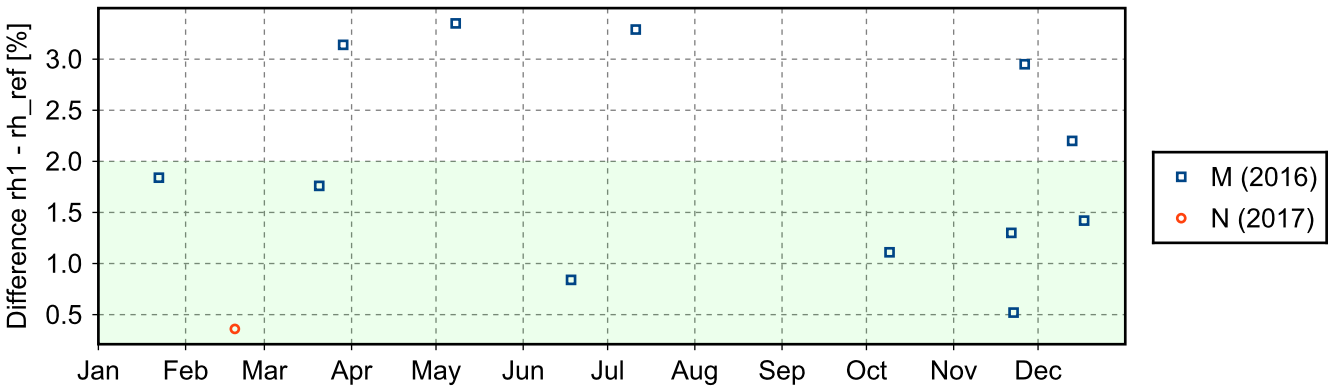


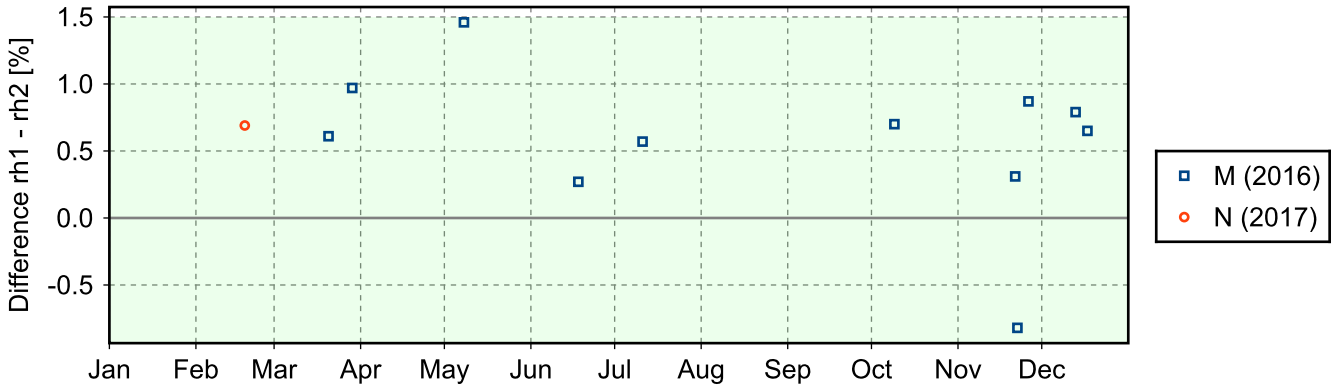




(2) GroundCheck: GC-SHC







4.6 Measurement events