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GLOBAL CLIMATE OBSERVING
SYSTEM (GCOS)

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

Session 5

Bern

11 March - 15 March 2024

GRUAN Site Report for La Réunion

(Submitted by Jerome Brioude)

Summary and Purpose of this Document

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

Overview

Réunion Island has three measurement sites: the Maïdo observatory on the western part of the island (2160 m ASL), Gillot Airport (northern part of the island, 10 m ASL) and the University of La Réunion in Saint-Denis (northern part of the island, 80 m ASL). Weekly ozonesondes (using M10 radiosonde and EN-SCI ECC ozonesonde) are launched from Gillot as part of SHADOZ and NDACC, and M10/CFH sondes are launched from the Mado Observatory on a campaign basis.

Change and change management

Since February 2022, Reunion is one of the launch site of the B2SAP project, a NOAA Earth's Radiation Budget Initiative Project, led by NOAA/CSL and GML laboratories to monitor the climate. FPH, POPS and ozone sondes are launched once every semester. 4 payloads of POPS+FPH+Ozone instruments are launched per year. <https://cs1.noaa.gov/projects/b2sap/>

Resourcing

Balloons are still being launched with helium from the Maïdo and Gillot sites on Réunion. With the recent price increase, the use of helium may potentially pose a financial issue, especially for the weekly ozone launches.

Operations

Currently raw M10 data collected at Le Chaudron in La Réunion and Trappes Palaiseau in Paris radiosonde sites are initially recorded at the site's local servers file system (or database). Both sites use automatic radiosonde launchers. Raw data are sent together with their accompanying site surface meteorological data and metadata. After processing, the M10 radiosonde data is sent to the GRUAN Lead Centre for archiving (backup) and storing in the central database of GRUAN products. The products are then distributed to the end users by the GRUAN Lead Centre but also by the AERIS data center in France.

Covid-19

No effect

Site assessment and certification

The M10 GRUAN certification is still a work in progress. We will not wait further and the documents for the certification of the La Réunion will be submitted this year.

GRUAN-related research

The eruption of the Hunga TongaHunga Ha'apai (HTHH) volcano on 15 January 2022 offered a good opportunity to explore the early impacts of tropical volcanic eruptions on stratospheric composition (Evan et al., 2023). Balloon-borne observations from CFH, COBALD, POPS and ECC sondes revealed the unprecedented amount of water vapor injected by the volcano. The enhanced stratospheric humidity, radiative cooling, and expanded aerosol surface area in the volcanic plume created the ideal conditions for swift ozone depletion of 5% in the tropical stratosphere in just 1 week. The decrease in hydrogen chloride by 0.4ppbv and the increase in chlorine monoxide by 0.4 ppbv observed by the AURA MLS satellite measurements provided compelling evidence for chlorine activation within the volcanic plume.

Evan S., et al.: Rapid ozone depletion after humidification of the stratosphere by the Hunga Tonga Eruption, *Science*, 382, eadg2551 doi:<https://doi.org/10.1126/science.adg2551>, 2023

WG-GRUAN interface

None

Other archiving centers

The ozonesonde data are archived on the SHADOZ website:
<https://tropo.gsfc.nasa.gov/shadoz/Reunion.html>

Participation in campaigns

The Hunga Tonga volcano erupted on January 15th. A week after the eruption, a rapid response experiment was organized at the Maïdo Observatory in Réunion Island. Due to zonal easterly winds in the stratosphere (20-50km), La Réunion Island was favorably located downwind of the plume. From 20 to 24 January 2022, multiple meteorological balloons carrying aerosol, H₂O, SO₂ and ozone instruments were launched each night to provide key measurements of the volcanic plume composition.

Future plans

For logistical reasons, we are in the process of relocating the CFH and FPH launch site from Maïdo Observatory to Gillot.



GRUAN Site Report for LaReunion (REU), 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 | LaReunion |
| Unique GRUAN ID | REU |
| Geographical position | -21.0797 °S, 55.3831 °E, 2165.0 m |
| Operated by | COOP-MF-OPAR Cooperation between Meteo-France and OPAR |
| Main contact | Evan, Stephanie |
| WMO no./name | - |
| Operators | currently 9, changes +0 / -0 |
| Sounding Site | 3 |
| Lidar | 1 |
| GNSS | 2 |

1.1 General information about GRUAN measurement systems

| System | Name | Type | Setups | Measurements |
|-----------|--|---------------|--------|-----------------|
| REU-GN-01 | Maïdo GNSS Site MAIG | GNSS | 0 | not operational |
| REU-GN-02 | Saint Denis GNSS Site STDE | GNSS | 0 | not operational |
| REU-LI-01 | LIDAR 1200 Maïdo Raman Water Vapor Lidar | Lidar | 0 | 0 |
| REU-RS-01 | Maïdo Radiosonde Launch Site | Sounding Site | 4 | 0 |
| REU-RS-02 | Saint Denis Radiosonde Launch Site | Sounding Site | 1 | 548 |
| REU-RS-03 | Gillot Ozonesonde Launch Site | Sounding Site | 0 | 0 |

1.2 General comments from Lead Centre

1.2.1 General

The GRUAN site REU includes three locations for launching radiosondes. The operational routine soundings are performed at REU-RS-02 (Saint Denis). Research flights are performed at REU-RS-01 (Maido). Ozone soundings are performed at REU-RS-03 (Gillot).

1.2.2 Request

It is requested to restart the submitting of soundings at REU-RS-01 (Maido), especially the stratospheric water vapor measurements.

2 System: Maïdo GNSS Site MAIG (REU-GN-01)

| Object | Value |
|-----------------------|---|
| System name | Maïdo GNSS Site MAIG |
| Unique GRUAN ID | REU-GN-01 |
| System type | GNSS (GN - GNSS) |
| Geographical position | -21.0800 °S, 55.3800 °E, 2160.0 m |
| Operated by | OPAR Observatoire de Physique de l'Atmosphère de la Réunion, part of: UNIV-REUNION Univers de La Réunion |
| Instrument contact | Payen, Guillaume |
| Started at | 2013-01-01 |
| Defined setups | - |
| Possible streams | - |

2.1 Lead Centre comments

2.1.1 Dataflow

No GNSS dataflow to LC has been established yet.

3 System: Saint Denis GNSS Site STDE (REU-GN-02)

| Object | Value |
|-----------------------|---------------------------------|
| System name | Saint Denis GNSS Site STDE |
| Unique GRUAN ID | REU-GN-02 |
| System type | GNSS (GN - GNSS) |
| Geographical position | -20.8967 °S, 55.4950 °E, 46.0 m |
| Operated by | MF Meteo-France |
| Instrument contact | Chambon, Paul |
| Started at | 2018-01-23 |
| Defined setups | - |
| Possible streams | - |

3.1 Lead Centre comments

3.1.1 Dataflow

No GNSS dataflow to LC has been established yet.

4 System: LIDAR 1200 Maïdo Raman Water Vapor Lidar (REU-LI-01)

| Object | Value |
|-----------------------|---|
| System name | LIDAR 1200 Maïdo Raman Water Vapor Lidar |
| Unique GRUAN ID | REU-LI-01 |
| System type | Lidar (LI - Lidar) |
| Geographical position | -21.0800 °S, 55.3800 °E, 2160.0 m |
| Operated by | OPAR Observatoire de Physique de l'Atmosphère de la Réunion, part of: UNIV-REUNION Univers de La Réunion |
| Instrument contact | Keckhut, Philippe |
| Started at | 2013-04-01 |
| Defined setups | - |
| Possible streams | - |

4.1 Lead Centre comments

4.1.1 Dataflow

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

5 System: Maïdo Radiosonde Launch Site (REU-RS-01)

| Object | Value |
|-----------------------|---|
| System name | Maïdo Radiosonde Launch Site |
| Unique GRUAN ID | REU-RS-01 |
| System type | Sounding Site (RS - Radiosonde) |
| Geographical position | -21.0797 °S, 55.3831 °E, 2164.6 m |
| Operated by | UNIV-REUNION Univers de La Réunion |
| Instrument contact | Evan, Stephanie |
| Started at | - |
| Defined setups | 4 (MALICCA-1, CFH, MORGANE, CONCIERTO) |
| Possible streams | CFH, COBALD, ECC, IMET-1, M10, PCFH, RS41, RS92 |

5.1 Lead Centre comments

5.1.1 Dataflow

The dataflow of radiosonde measurements to LC is interrupted since March 2019 (after CONCIERTO campaign).

6 System: Saint Denis Radiosonde Launch Site (REU-RS-02)

| Object | Value |
|-----------------------|------------------------------------|
| System name | Saint Denis Radiosonde Launch Site |
| Unique GRUAN ID | REU-RS-02 |
| System type | Sounding Site (RS - Radiosonde) |
| Geographical position | -20.8967 °S, 55.4950 °E, 46.0 m |
| Operated by | MF Meteo-France |
| Instrument contact | Marin, Frédéric |
| Started at | - |
| Defined setups | 1 (AUTO1) |
| Possible streams | M10 |

6.1 Lead Centre comments

6.1.1 Dataflow

Sonde dataflow to the GRUAN LC is operational in a fully automated mode since September 2020.

6.1.2 General

Current operational radiosonde is the Modem M10.

There is very good performance in terms of burst altitude which is regularly 10 hPa to 5 hPa and higher.

Is noticeable that burst altitudes seem to be given on a discret grid (pressure levels with integer values).

6.2 GRUAN data products

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

6.2.1 Stream: M10

| | | | | |
|--------------|-----|-----|-----|--|
| M10 | | 548 | 548 | |
| M10-GDP-BETA | 001 | | 538 | |

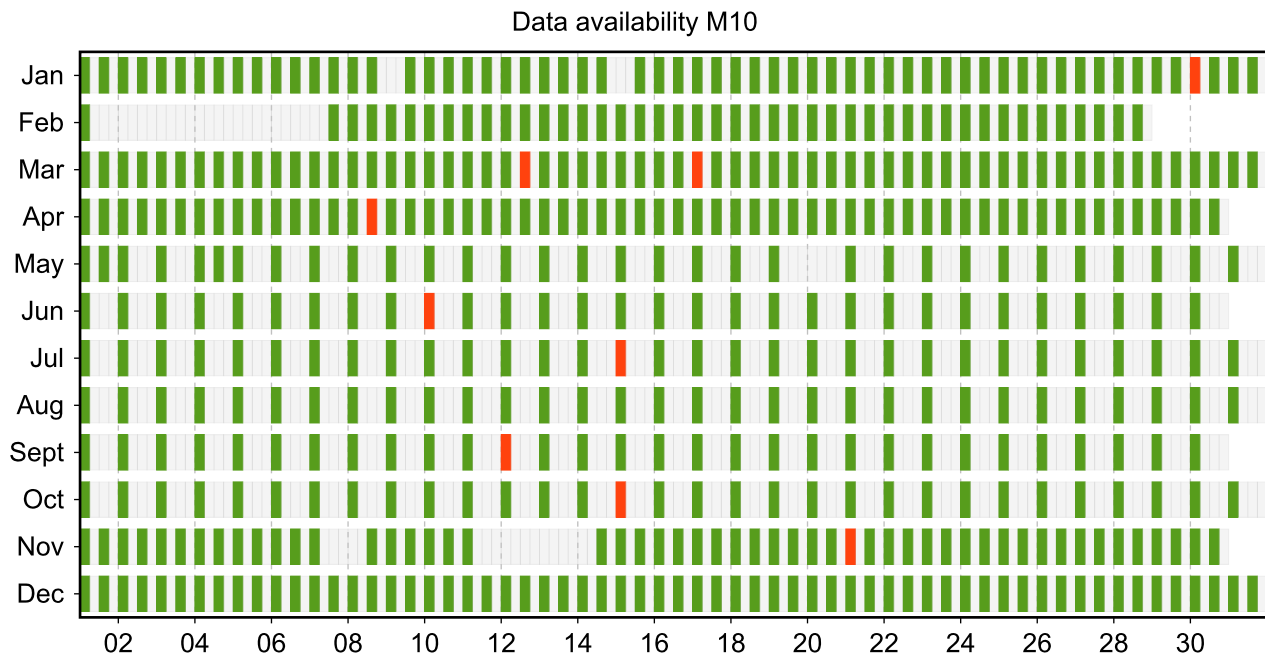
6.3 Availability of data products

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.

6.3.1 Stream: M10



6.4 Instrument combinations of REU-RS-02

| Count | Instrument combination |
|-------|------------------------|
| 548 | M10 |

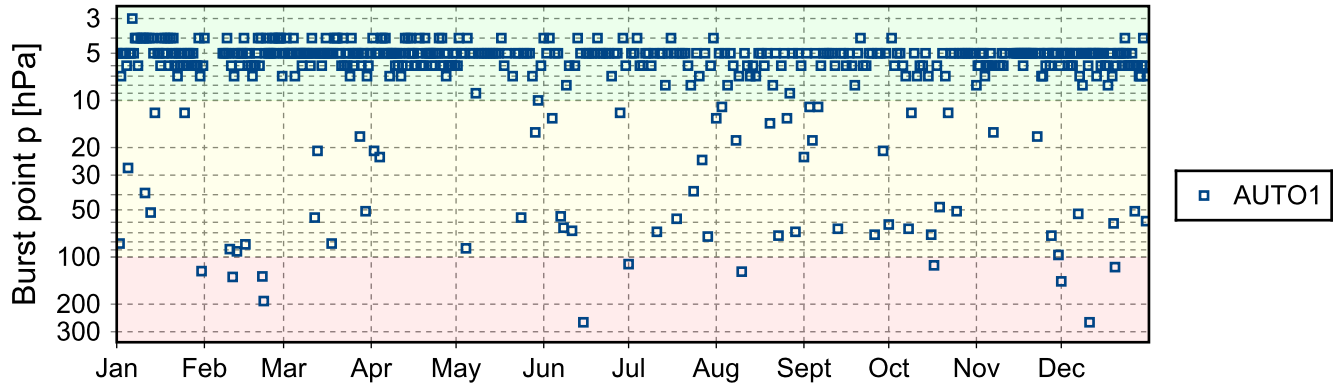
6.5 Instrument ground check

6.5.1 Stream: M10

(1) GroundCheck: GC-SHC

(2) GroundCheck: GC-TU(room)

6.6 Measurement events



7 System: Gillot Ozonesonde Launch Site (REU-RS-03)

| Object | Value |
|-----------------------|--------------------------------------|
| System name | Gillot Ozonesonde Launch Site |
| Unique GRUAN ID | REU-RS-03 |
| System type | Sounding Site (RS - Radiosonde) |
| Geographical position | -21.0600 °S, 55.4800 °E, 13.0 m |
| Operated by | UNIV-REUNION Univers de La Réunion |
| Instrument contact | Evan, Stephanie |
| Started at | 1998-01-01 |
| Defined setups | - |
| Possible streams | - |

7.1 Lead Centre comments

7.1.1 Dataflow

No dataflow of radiosonde and ozone measurements to LC has been established yet.



GRUAN Site Report for LaReunion (REU), 2023

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Created by the Lead Centre

Version from 2024-03-01

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| Main contact | Evan, Stephanie |
| WMO no./name | - |
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| REU-GN-02 | Saint Denis GNSS Site STDE | GNSS | 0 | not operational |
| REU-LI-01 | LIDAR 1200 Maïdo Raman Water Vapor Lidar | Lidar | 0 | 0 |
| REU-RS-01 | Maïdo Radiosonde Launch Site | Sounding Site | 4 | 0 |
| REU-RS-02 | Saint Denis Radiosonde Launch Site | Sounding Site | 1 | 540 |
| REU-RS-03 | Gillot Ozonesonde Launch Site | Sounding Site | 0 | 0 |

1.2 General comments from Lead Centre

1.2.1 General

The GRUAN site REU includes three locations for launching radiosondes. The operational routine soundings are performed at REU-RS-02 (Saint Denis). Research flights are performed at REU-RS-01 (Maido). Ozone soundings are performed at REU-RS-03 (Gillot).

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| Operated by | OPAR Observatoire de Physique de l'Atmosphère de la Réunion, part of: UNIV-REUNION Univers de La Réunion |
| Instrument contact | Payen, Guillaume |
| Started at | 2013-01-01 |
| Defined setups | - |
| Possible streams | - |

2.1 Lead Centre comments

2.1.1 Dataflow

No GNSS dataflow to LC has been established yet.

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|-----------------------|---------------------------------|
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| System type | GNSS (GN - GNSS) |
| Geographical position | -20.8967 °S, 55.4950 °E, 46.0 m |
| Operated by | MF Meteo-France |
| Instrument contact | Chambon, Paul |
| Started at | 2018-01-23 |
| Defined setups | - |
| Possible streams | - |

3.1 Lead Centre comments

3.1.1 Dataflow

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| System type | Lidar (LI - Lidar) |
| Geographical position | -21.0800 °S, 55.3800 °E, 2160.0 m |
| Operated by | OPAR Observatoire de Physique de l'Atmosphère de la Réunion, part of: UNIV-REUNION Univers de La Réunion |
| Instrument contact | Keckhut, Philippe |
| Started at | 2013-04-01 |
| Defined setups | - |
| Possible streams | - |

4.1 Lead Centre comments

4.1.1 Dataflow

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| Instrument contact | Evan, Stephanie |
| Started at | - |
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| Possible streams | CFH, COBALD, ECC, IMET-1, M10, PCFH, RS41, RS92 |

5.1 Lead Centre comments

5.1.1 Dataflow

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6 System: Saint Denis Radiosonde Launch Site (REU-RS-02)

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|-----------------------|------------------------------------|
| System name | Saint Denis Radiosonde Launch Site |
| Unique GRUAN ID | REU-RS-02 |
| System type | Sounding Site (RS - Radiosonde) |
| Geographical position | -20.8967 °S, 55.4950 °E, 46.0 m |
| Operated by | MF Meteo-France |
| Instrument contact | Marin, Frédéric |
| Started at | - |
| Defined setups | 1 (AUTO1) |
| Possible streams | M10 |

6.1 Lead Centre comments

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|---------|---------|--------------------|-----------------|---------------------|

6.2.1 Stream: M10

| | | | | |
|--------------|-----|-----|-----|--|
| M10 | | 540 | 540 | |
| M10-GDP-BETA | 001 | | 535 | |

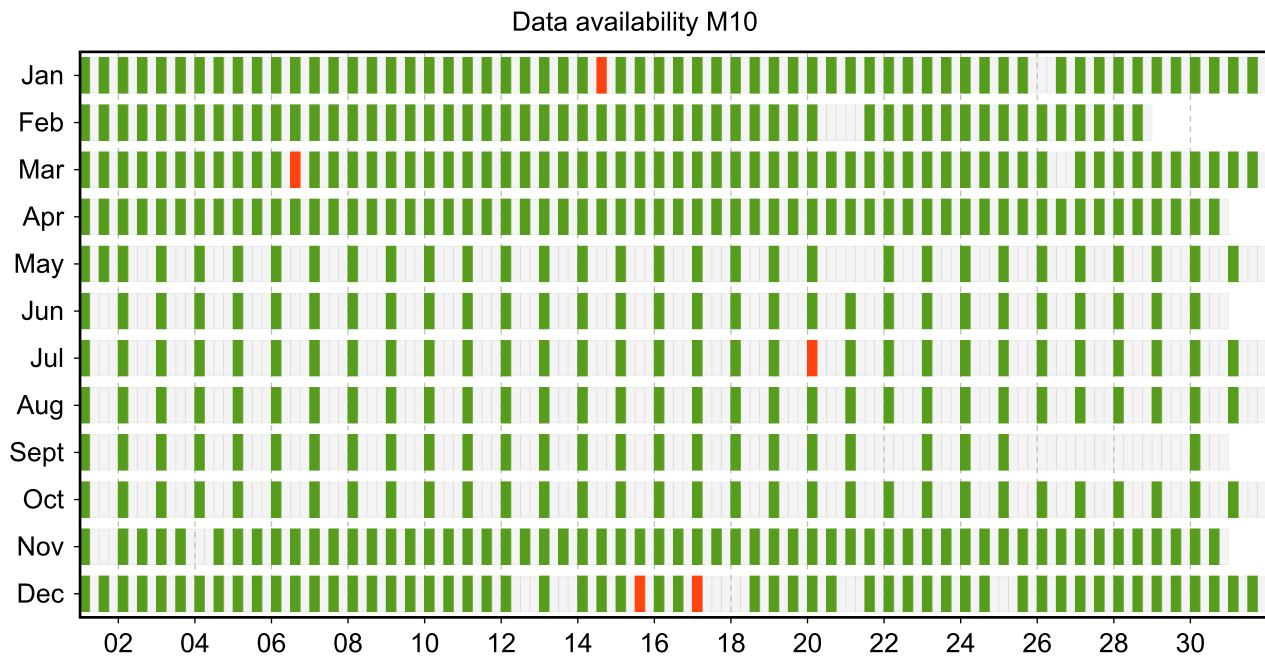
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6.3.1 Stream: M10



6.4 Instrument combinations of REU-RS-02

| Count | Instrument combination |
|-------|------------------------|
| 540 | M10 |

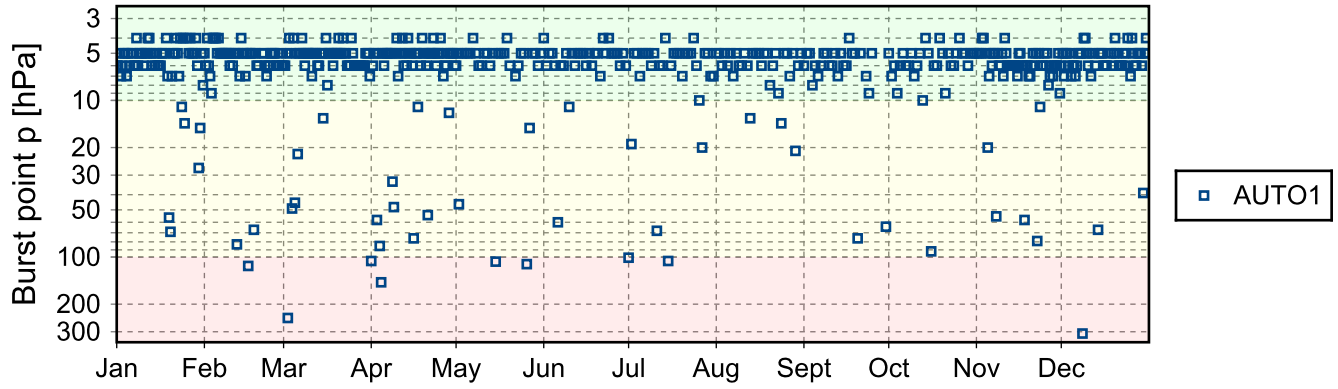
6.5 Instrument ground check

6.5.1 Stream: M10

(1) GroundCheck: GC-SHC

(2) GroundCheck: GC-TU(room)

6.6 Measurement events



7 System: Gillot Ozonesonde Launch Site (REU-RS-03)

| Object | Value |
|-----------------------|--------------------------------------|
| System name | Gillot Ozonesonde Launch Site |
| Unique GRUAN ID | REU-RS-03 |
| System type | Sounding Site (RS - Radiosonde) |
| Geographical position | -21.0600 °S, 55.4800 °E, 13.0 m |
| Operated by | UNIV-REUNION Univers de La Réunion |
| Instrument contact | Evan, Stephanie |
| Started at | 1998-01-01 |
| Defined setups | - |
| Possible streams | - |

7.1 Lead Centre comments

7.1.1 Dataflow

No dataflow of radiosonde and ozone measurements to LC has been established yet.