CFI Climate Sentinels Gault MRR-2 processed data [McGill, UQAM]

Authors

Mathieu Lachapelle (Lead author, corresponding author)
Ph.D. Candidate/Student
Department of Earth and Atmospheric Sciences
Université du Québec à Montréal
lachapelle.mathieu@courrier.uqam.ca

Dustin Fraser (Lead author, corresponding author)
Ph.D. Candidate/Student
Department of Atmospheric and Oceanic Sciences
McGill University
dustin.fraser@mail.mcgill.ca

Ève Bigras (co-author)
CFI-9 Adaptable Earth Observation System Project Manager
Department of Atmospheric and Oceanic Sciences
McGill University
eve.bigras@mcgill.ca

John Gyakum (co-author)
Professor
Department of Atmospheric and Oceanic Sciences
McGill University
john.gyakum@mcgill.ca

Véronique Meunier (co-author)
Research Assistant
Department of Atmospheric and Oceanic Sciences
McGill University
veronique.meunier2@mail.mcgill.ca

Julie M. Thériault (co-author)
Professor
Department of Earth and Atmospheric Sciences
Université du Québec à Montréal
theriault.julie@uqam.ca
ORCID: 0000-0001-6534-5083

Hadleigh D. Thompson (co-author)
Research Assistant
Department of Earth and Atmospheric Sciences
Université du Québec à Montréal
thompson.hadleigh@uqam.ca
ORCID: orcid: 0000-0001-5145-5951

Margaux Girouard (co-author)

Master Candidate/Student
Department of Earth and Atmospheric Sciences
Université du Québec à Montréal
girouard.margaux@courrier.uqam.ca

Yeechian Low
Ph.D. Candidate/Student
Department of Atmospheric and Oceanic Sciences
McGill University
yeechian.low@mail.mcgill.ca

Juliann Wray (co-author)
Master Candidate/Student
Department of Atmospheric and Oceanic Sciences
McGill University
juliann.wray@mail.mcgill.ca

1. Data Set Description

1.1. Introduction: This dataset contains post-processed data from a METEK vertically profiling K-band Micro Rain Radar (MRR-2) installed at the climate sentinel in the Gault Nature Reserve (GAUL), about 30 km east of Montréal, Québec. The instrument provides vertical profiles of reflectivity, Doppler velocity, and spectrum width. The site is located at the southern flank of Mont-Saint-Hilaire, a mountain with an elevation of about 400 m (above mean sea-level). Several other sites also collected MRR data during WINTRE-MIX. Data from these other sites will also be made available in the WINTRE-MIX data archive (https://data.eol.ucar.edu/master_lists/generated/wintre-mix/).

1.2. Data version: v1.0, September 2022

1.3. Time period covered: 1 November 2021 – 30 April 2022

1.4. Location:
- The MRR-2 is mounted on a short post at the site, co-located with other meteorological instruments. The approximate location is shown in Fig. 2. The MRR-2 is mounted 2 m above the station platform.
- Latitude: 45.535021°
- Longitude: -73.149006°
- Elevation: 132 m MSL

1.5. Data frequency: 10 seconds

1.6. Web address: https://doi.org/10.26023/AKWD-BRV8-R80D

Preliminary MRR-2 data are visualized as "quick look" plots on the WINTRE-MIX field catalog (https://catalog.eol.ucar.edu/wintre-mix/114/date/).

1.7. **Dataset restrictions:** Please refer to the WINTRE-MIX data policy (https://www.eol.ucar.edu/content/wintre-mixdata-policy) as well as the WINTRE-MIX data management plan (https://www.eol.ucar.edu/system/files/Data_Management_Plan-1Dec2021.pdf) for more information regarding dataset restrictions and dissemination.
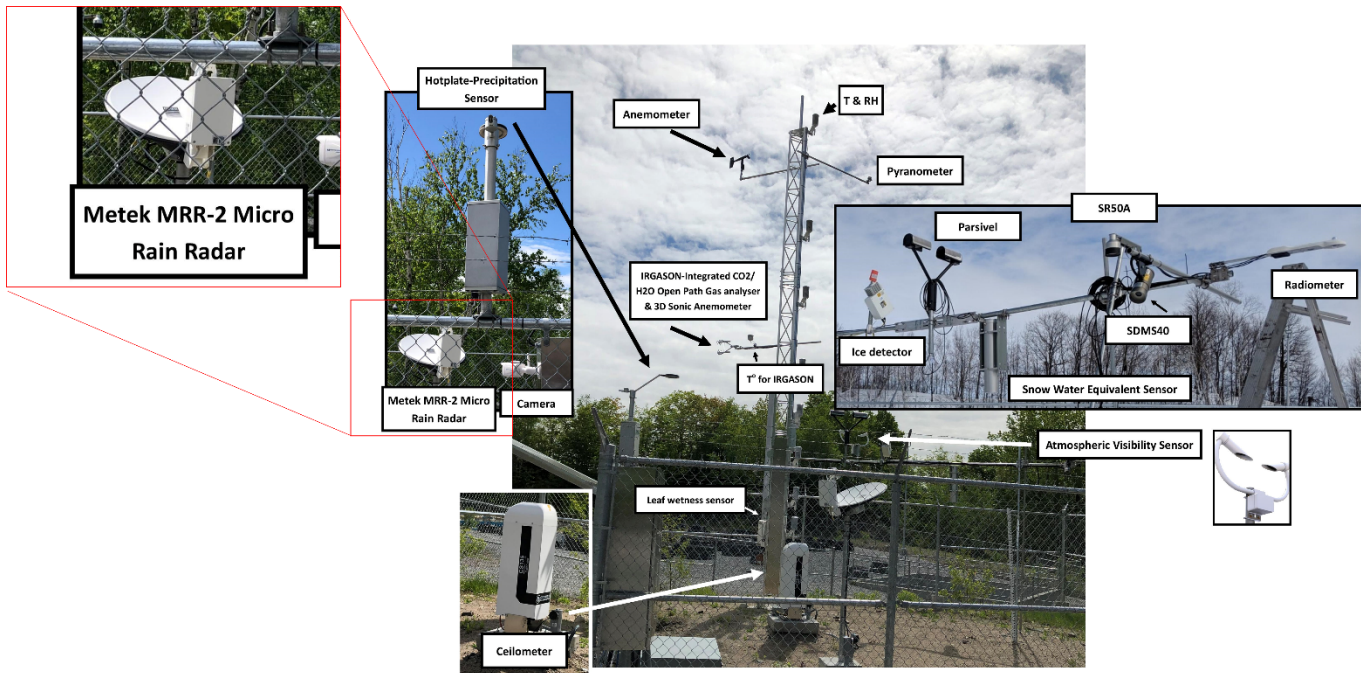

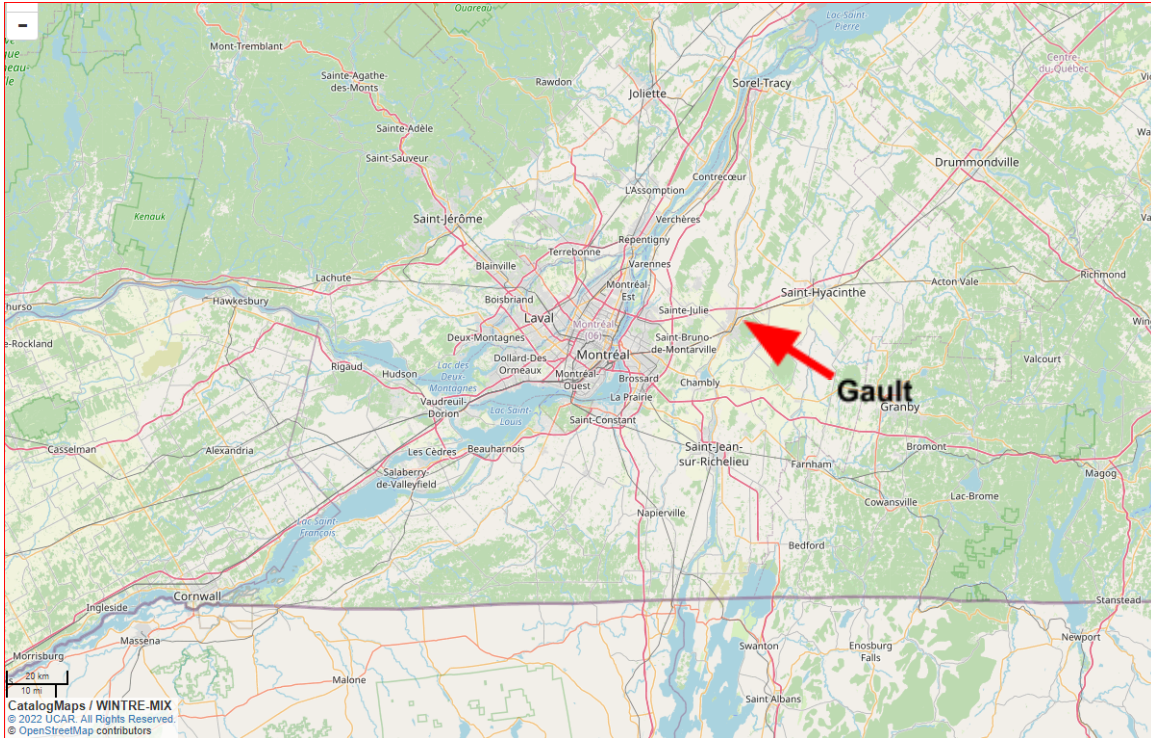*Fig. 1. Photos of the Gaul climate sentinel and the MRR-2.*

Fig. 2. Approximate location of the Gault Nature Reserve, QC MRR-2 radar (GAUL).

2.   Instrument Description

A METEK K-band FM-CW Micro Rain Radar-2 (MRR-2, http://metek.de/product/mrr-2/) is installed at the Gault Nature Reserve (Fig. 1). The attributes of the MRRs are summarized in Table 1. More detailed technical information on the MRR2 is available in METEK (2015, 2018).

Table 1: Technical specifications and configuration settings for the MRR-2

Parameter	Value
Transmit power	50 mW
Frequency	24 GHz
Number of range gates	32
Antenna heating	230 VAC / 24 VDC, 25 W
Beam width	2 degrees

Range resolution used	35 m (before 1900 UTC 19 Feb 2022)
	200 m (after 1900 UTC 19 Feb 2022)
Raw data collection frequency	10 s
Processed data frequency	10 s

3.   Data Collection and Processing

The MRR-2 was configured to collect data every 10 seconds with range gate spacing of 35-m (before 1900 UTC 9 Feb 2022) and 200-m (after 1900 UTC 9 Feb 2022) (Table 1). Antenna heating was used to prevent accumulation of snow and ice on the dish. MRR-2 raw data (.raw files) was logged onto a Windows PC using the METEK MRR Control Software as described in METEK (2018) and grouped into daily files.

Post-processing of the data is accomplished using version 0.102 of the IMProToo software (Maahn, 2020), with METEK .raw files as input. This processing reduces noise, improves the effective sensitivity of the radar, and provides velocity dealiasing. More information on the goals, basis, and methods of this post-processing procedure can be found in Maahn and Kollias (2012). The original .raw data files are archived separately in a companion dataset: CFI Climate Sentinels Gault MRR-2 raw data [McGill, UQAM].

4.   Data format

Files are daily, containing 24 hours of data, and are named with the following format: *GAUL_MRR2_YYYYMMDD.nc* where *YYYYMMDD* is the date of data collection in UTC.

The post-processed data is provided in netCDF4 format. The derived variables are listed in Table 2. Additional metadata is provided in the netCDF file.

Table 2: Variables recorded in processed data files

Field Name	**Description**	**Unit**
eta	Spectral reflectivities*	mm^6/m^3
eta_noDA	Spectral reflectivities NOT dealised	mm^6/m^3

etaMask	Noise mask of eta 0: signal 1: noise	-
etaMask_noDA	Noise mask of eta NOT dealised 0: signal 1: noise	-
etaNoiseAve	Mean noise of one Doppler spectrum in the same units as eta, never dealised	mm^6/m^3
etaNoiseStd	Standard deviation of noise of one Doppler spectrum in the same units as eta, never dealised	mm^6/m^3
height	Height above instrument	m
kurtosis	Kurtosis of the most significant peak	m/s
kurtosis_noDA	Kurtosis of the most significant peak, not dealised	m/s
leftSlope	Slope at the left side of the peak	dB/(m/s)
leftSlope_noDA	Slope at the left side of the peak, not dealised	dB/(m/s)
peakVelLeftBorder	Doppler velocity of the left border of the peak	m/s
peakVelLeftBorder_noDA	Doppler velocity of the left border of the peak, not deliased	m/s
peakVelRightBorder	Doppler velocity of the right border of the peak	m/s
peakVelRightBorder_noDA	Doppler velocity of the right border of the peak, not dealised	m/s
quality	Data quality flag. See netCDF file metadata for a detailed description.	-
range	Range bins	-
rightSlope	Slope at the right side of the peak	dB/(m/s)
rightSlope_noDA	Slope at the right side of the peak, not dealised	dB/(m/s)

skewness	Skewness of the most significant peak	m/s
skewness_noDA	Skewness of the most significant peak, not dealised	m/s
SNR	Signal-to-noise ratio of the most significant peak, never dealised	dB
spectralWidth	Spectral width of the most significant peak	m/s
spectralWidth_noDA	Spectral width of the most significant peak, not dealised	m/s
TF	Transfer function	-
time	Measurement time	Seconds since 1970-01-01
velocity	Doppler velocity bins. If dealiasing is applied, the spectra are triplicated.	m/s
velocity_noDA	Original, non-dealiased, Doppler velocity bins	m/s
W	Mean Doppler velocity of the most significant peak	m/s
W_noDA	Mean Doppler velocity of the most significant peak, not dealiased	m/s
Ze	Reflectivity of the most significant peak	dBZ
Ze_noDA	Reflectivity of the most significant peak, not dealiased	dBZ

* If dealiasing is applied, the spectra are triplicated, thus up to three peaks can occur from -12 to +24 m/s. However, only one peak is not masked in etaMask.

5.   Data Remarks

No major data artifacts were noticed in review of the data. Some spurious weak echos are occasionally found above 5 km MSL in the data, perhaps associated with local sources of microwave interference. Table 3 summarizes MRR-2 interruptions > 1 h. <mark>Yellow</mark> shading indicates that the gap occurred during the WINTRE-MIX field campaign.

Table 3: Summary of missing data

Length of interruption [hours]	Start	End
4.0	2021-11-02 15:37	2021-11-02 19:37
22.2	2021-11-18 23:59	2021-11-19 22:16
5.0	2021-11-20 16:15	2021-11-20 21:16
23.8	2021-11-20 23:58	2021-11-21 23:46
5.0	2021-11-22 15:45	2021-11-22 20:45
20.8	2021-12-22 23:59	2021-12-23 20:47
5.0	2021-12-24 14:46	2021-12-24 19:46
2.2	2022-03-05 18:47	2022-03-05 21:01
24.6	2022-04-12 17:35	2022-04-13 18:13
3.0	2022-04-13 19:14	2022-04-13 22:12
1.0	2022-04-13 22:12	2022-04-13 23:15
1.22	2022-04-20 11:59	2022-04-20 13:13
2.92	2022-04-20 15:12	2022-04-20 18:08
1.1	2022-04-20 18:08	2022-04-20 19:13

6.   Acknowledgment

7. References

Maahn, M., 2020: IMProToo Improved Mrr Processing Tool. Version 0.102, https://github.com/maahn/IMProToo

Minder, J., et al. 2022. NYSM Chazy, NY MRR-2 Processed Data. Version 1.0. UCAR/NCAR - Earth Observing Laboratory. https://doi.org/10.26023/99NP-A50Y-V60F. Accessed 20 Sep 2022.

 *METEK, 2018: MRR-2 Micro Rain RADAR User Manual. *METEK GmbH.*

 *METEK, 2015: MRR Physical Basics. *METEK GmbH.*

* *Metek MRR manuals are provided as attachments.*

8. Appendix

Suggested GCMD keywords to accompany this dataset are provided below in no particular order:

- Solid precipitation
- Frozen precipitation
- Precipitation profiles
- Melting layer height
- Rain
- Freezing rain
- Drizzle
- Freezing drizzle
- Ice pellets
- Snow
- Ice storms
- Snow storms
- Extratropical cyclones
- Radar
- Doppler velocity
- Radar reflectivity
- Spectrum width