MRR-2 profiling radar data (Montreal, Quebec) – post-processed [UQAM-PK]

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1. Data Set Description

1.1. Introduction: This dataset contains raw data from a METEK vertically profiling K-band Micro Rain Radar (MRR-2) permanently installed on the rooftop of UQAM President-Kennedy building in Montréal downtown, Québec. The instrument provides vertical profiles of reflectivity, Doppler velocity, and spectrum width. The site sits in the St. Lawrence River Valley. 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, 8 June 2022

1.3. Time period covered: 1 November 2022 – 22 April 2022

1.4. Location:

- The MRR-2 is mounted on a vertical structure on the rooftop of UQAM President-Kennedy (UQAM-PK) building (Fig. 1), co-located with other meteorological instruments. The approximate location is shown in Fig. 2. The building is 39 m high and the station is 69 m above sea level. The MRR-2 is mounted 2 m above the station platform.
- Latitude: 45.508594°
- Longitude: -73.568741°
- Elevation: 71 m MSL

1.5. Data frequency: 10 seconds

1.6. Web address: https://doi.org/10.26023/Q8Y1-RNBD-YR0D**.** 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 UQAM-PK weather station and MRR-2.

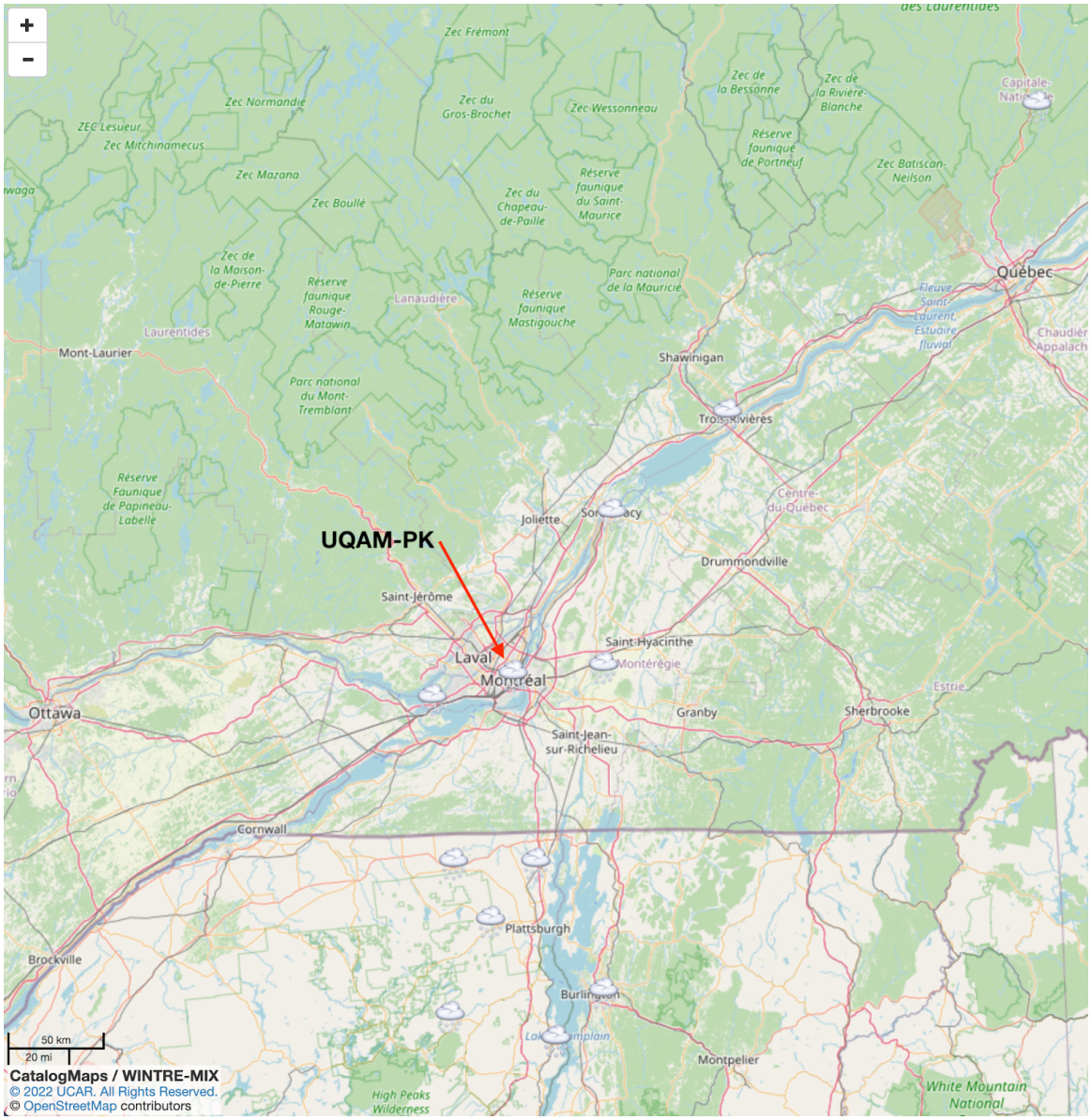

Fig. 2. Approximate location of UQAM-PK, QC MRR-2 radar (UQAM).

2. Instrument Description

A METEK K-band FM-CW Micro Rain Radar-2 (MRR-2, http://metek.de/product/mrr-2/) is installed on the rooftop of UQAM President-Kennedy Building (Fig. 1). The attributes of the MRRs are summarized in Table 1. More detailed technical information on the MRR2 is available in METEK (2015, 2021).

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	200 m
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 a 200-m range gate spacing (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 (2021) and grouped into daily files.

Post-processing of the data is accomplished using version 0.102 of the IMProToo software (Maahn, 2021), 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 UQAM-PK MRR-2 raw data [UQAM].

4. Data format

Files are daily, containing 24 hours of data, and are named with the following format: *UQAM_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. Only 2 long interruptions occurred from1 Feb 2022 - 15 March 2022, during the field campaign. They are highlighted in yellow. Most interruptions are due to construction on the rooftop station during winter 2021-2022.

Table 3: Summary of missing data

Interruption length [hours]	Start	End
8.2	2021-11-18 08:20	2021-11-18 16:30
96.3	2021-11-25 17:49	2021-11-29 18:07
99.8	2021-12-01 21:32	2021-12-06 01:19
30.9	2021-12-12 11:18	2021-12-13 18:10
7.9	2021-12-14 14:38	2021-12-14 22:33
375.1	2021-12-26 22:11	2022-01-11 13:15

16.9	2022-01-31 20:43	2022-02-01 13:37
13.6	2022-02-14 00:13	2022-02-14 13:46
14.4	2022-03-02 05:56	2022-03-02 20:18
11.5	2022-03-18 02:03	2022-03-18 13:34
26.4	2022-03-24 14:41	2022-03-25 17:02
42.8	2022-03-26 22:18	2022-03-28 17:09
30.4	2022-03-31 12:07	2022-04-01 18:32
30.0	2022-04-05 07:59	2022-04-06 14:00
56.6	2022-04-10 10:06	2022-04-12 18:45
15.9	2022-04-13 20:38	2022-04-14 12:32

6. Acknowledgment

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7. References

Maahn, M., 2021: IMProToo Improved Mrr Processing Tool. Version 0.102, https://github.com/maahn/IMProToo

*METEK, 2021: 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