

Title: Sentinel MetData

Author(s):

Yeechian Low (lead author, corresponding author)
Ph.D. Candidate/Student
Department of Atmospheric and Oceanic Sciences
McGill University
yeechian.low@mail.mcgill.ca

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

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

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

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

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

1. Dataset Description:

1.1 Introduction: The Sentinel Radiation MetData provided in situ measurements of radiation fluxes.

1.2 Data version: v1.0

1.3 Time period covered by the data:

Table 1: Time period covered

Sites	Start	End
Gault	2021-11-01	2022-03-31
Arboretum	2021-11-01	2022-03-31
UQAM-PK	2022-01-26	2022-03-31
Trois-Rivières	2021-12-08	2022-03-31

1.4 Location of stations:

Table 2: Location and elevation of each site

Sites	Latitude	Longitude	Site elevation (MSL)
Gault	45.535021°N	73.149006°W	132 m
Arboretum	45.430065°N	73.942156°W	49 m
UQAM-PK	45.508594°N	73.568741°W	69 m*
Trois-Rivières	46.349835°N	72.581354°W	47 m

*Instruments are on a rooftop platform that is 69 m above mean sea-level. The building ground floor is 39 m above mean sea-level.

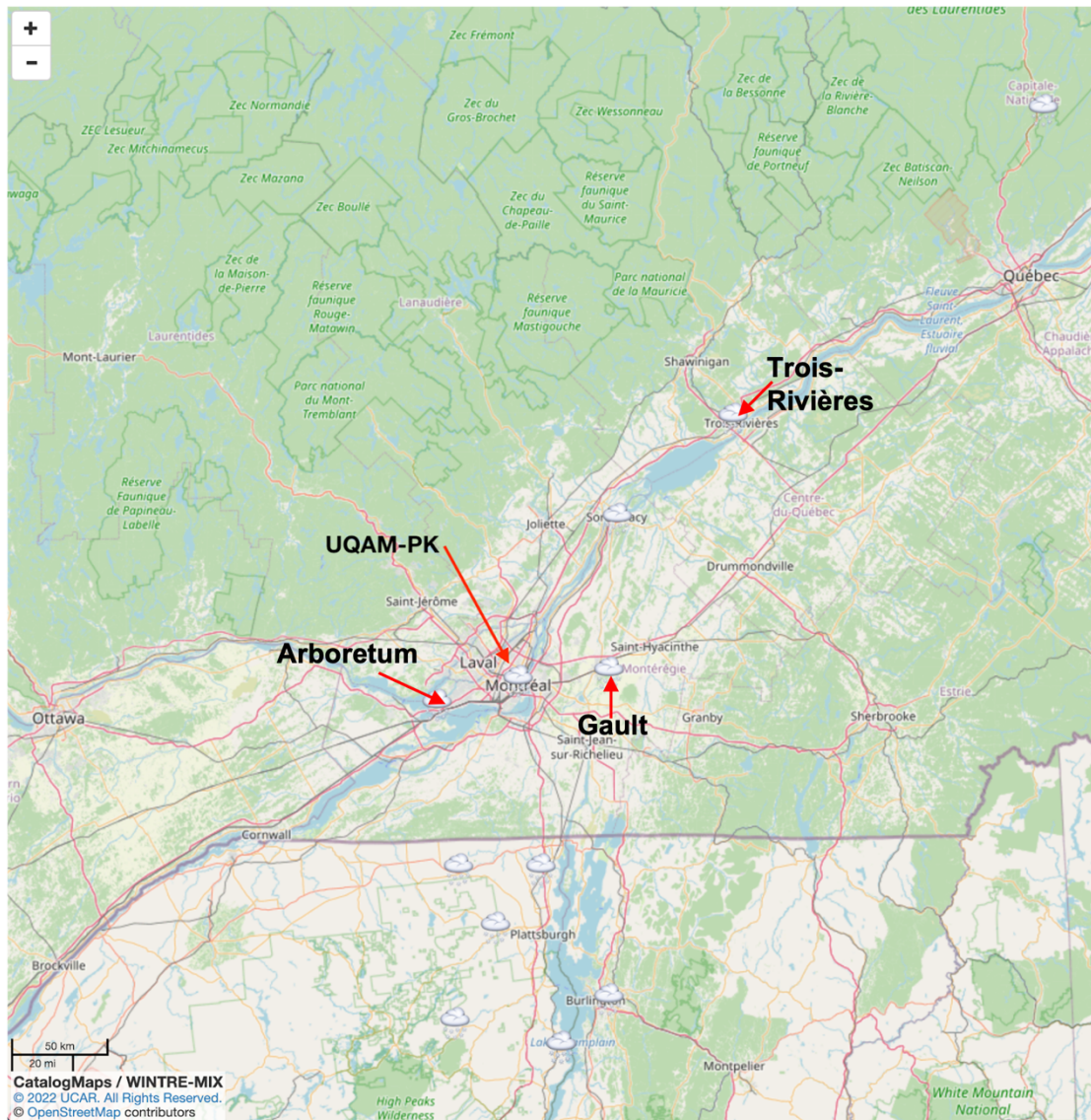


Figure 1: Map of site locations

1.5 Data frequency: Once per minute

1.6 Data source: Adaptable Earth Observation System

1.7 Web address references:

Gault: <https://eos.meteo.mcgill.ca/stations/1/live-data>

Arboretum: <https://eos.meteo.mcgill.ca/stations/2/live-data>

(None for Trois-Rivières and UQAM-PK)

1.8 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.

2. Instrument Description: The instruments used to conduct measurements are shown in the following tables and figures:

2.1 Gault:

Table 3: Instruments used, height of instruments, and variables measured at Gault site

<u>Variable</u>	<u>Height above ground (m)</u>	<u>Instrument</u>	<u>Link to manual</u>
Solar insolation	9.5	CMP 10 pyranometer	https://eos.meteo.mcgill.ca/media/documents/cmp10-1.pdf
Solar insolation standard deviation	9.5	CMP 10 pyranometer	https://eos.meteo.mcgill.ca/media/documents/cmp10-1.pdf

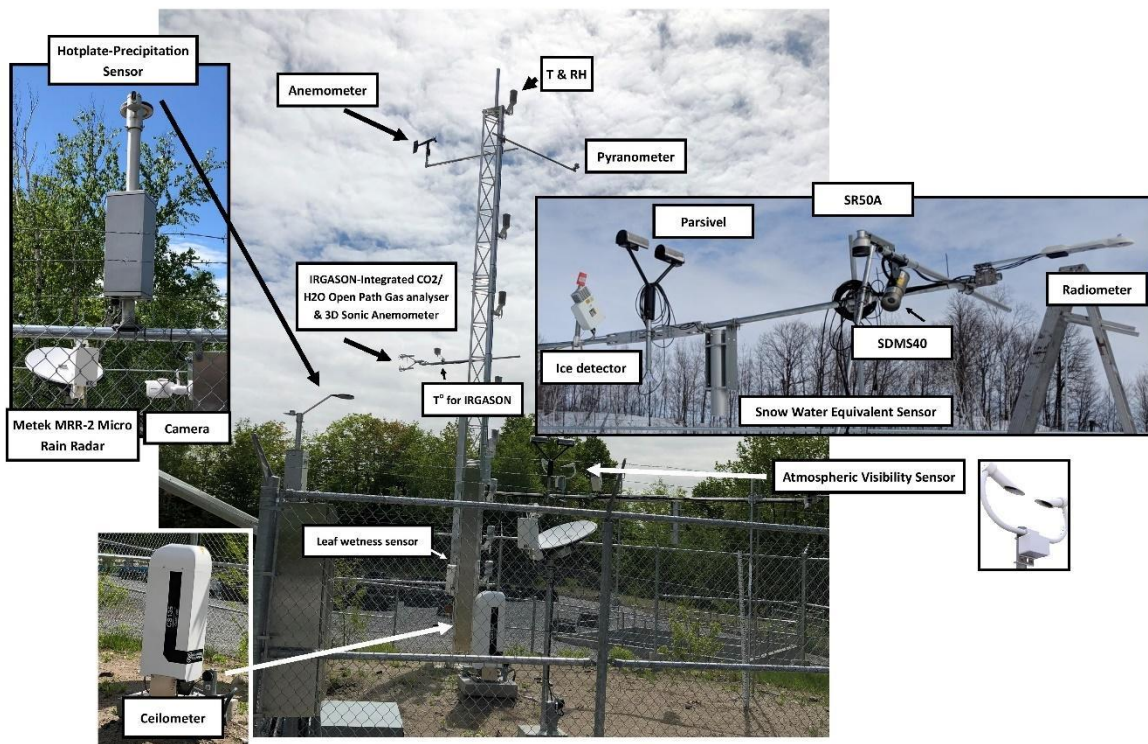


Figure 2: Photo of the Gault site

2.2 Arboretum:

Table 4: Instruments used, height of instruments, and variables measured at Arboretum site

<u>Variable</u>	<u>Height above ground (m)</u>	<u>Instrument</u>	<u>Link to manual</u>
Solar insolation	10	CMP 10 pyranometer	https://eos.meteo.mcgill.ca/media/documents/cmp10-L.pdf
Solar insolation standard deviation	10	CMP 10 pyranometer	https://eos.meteo.mcgill.ca/media/documents/cmp10-L.pdf



Figure 3: Photo of the Arboretum site

2.3 Trois-Rivières:

Table 5: Instruments used, height of instruments, and variables measured at Trois-Rivières site

<u>Variable</u>	<u>Height above ground (m)</u>	<u>Instrument</u>	<u>Link to manual</u>
-----------------	--------------------------------	-------------------	-----------------------

Downwelling shortwave radiation	2.73	CNR4	https://s.campbellsci.com/documents/ca/manuals/cnr4_man.pdf
Downwelling longwave radiation	2.73	CNR4	https://s.campbellsci.com/documents/ca/manuals/cnr4_man.pdf
Upwelling shortwave radiation	2.73	CNR4	https://s.campbellsci.com/documents/ca/manuals/cnr4_man.pdf
Upwelling longwave radiation	2.73	CNR4	https://s.campbellsci.com/documents/ca/manuals/cnr4_man.pdf







Figure 4: Photos of the Trois-Rivières site

2.4 UQAM-PK:

Table 6: Instruments used, height of instruments, and variables measured at UQAM-PK site

<u>Variable</u>	<u>Height above rooftop platform</u>	<u>Instrument</u>	<u>Link to manual</u>
Downwelling shortwave radiation	2.90	CNR4	https://s.campbellsci.com/documents/ca/manuals/cnr4_man.pdf
Downwelling longwave radiation	2.90	CNR4	https://s.campbellsci.com/documents/ca/manuals/cnr4_man.pdf

Upwelling shortwave radiation	2.90	CNR4	https://s.campbellsci.com/documents/ca/manuals/cnr4_man.pdf
Upwelling longwave radiation	2.90	CNR4	https://s.campbellsci.com/documents/ca/ca/manuals/cnr4_man.pdf





Figure 5: Photos of the UQAM-PK site

3. Data collection and processing:

The data was collected in real-time via a CR6-Wifi datalogger. This dataset contains the raw data, without any processing or derived parameters.

4. Data format:

Gault:

The Gault dataset is in the Gault_Rad_Met_Data.nc netCDF4 file, which includes the time dimension (length 217440: -2 to 217437 representing the number of minutes since 2021-11-01 00:00, or the time period 2021-10-31 23:58 to 2022-03-31 23:57) and the following data variables (the dimensions are listed between the parentheses):

- latitude (none)
- longitude (none)
- height_above_mean_sea_level (none)

- solar_insolation (time)
- solar_insolation_stddev (time)

Table 7: Parameters of variables included for Gault site

<u>Variable</u>	<u>Description</u>	<u>Units</u>	<u>Expected daily uncertainty</u>	<u>Frequency</u>	<u>Averaging or reporting interval</u>	<u>Start time (UTC)</u>	<u>End time (UTC)</u>
solar_insolation	Solar insolation	W/m ²	±<2%*	1 min	1 min average	2021-10-31 23:58	2022-03-31 23:57
solar_insolation_stddev	Solar insolation standard deviation	W/m ²	±<2%*	1 min	1 min standard deviation	2021-10-31 23:58	2022-03-31 23:57

*The sensor has a CNF4 attachment. Refer to the operating manual for further information regarding the accuracy of individual measurements.

Arboretum:

The Arboretum dataset is in the Arboretum_Rad_Met_Data.nc netCDF4 file, which includes the time dimension (length 217446: -5 to 217440 representing the number of minutes since 2021-11-01 00:00, or the time period 2021-10-31 23:55 to 2022-04-01 00:00) and the following data variables (the dimensions are listed between the parentheses):

- latitude (none)
- longitude (none)
- height_above_mean_sea_level (none)
- solar_insolation (time)
- solar_insolation_stddev (time)

Table 8: Parameters of variables included for Arboretum site

<u>Variable</u>	<u>Description</u>	<u>Units</u>	<u>Expected daily uncertainty</u>	<u>Frequency</u>	<u>Averaging or reporting interval</u>	<u>Start time (UTC)</u>	<u>End time (UTC)</u>
solar_insolation	Solar insolation	W/m ²	±<2%*	1 min	1 min average	2021-10-31 23:55	2022-04-01 00:00

solar_insolation_stddev	Solar insolation standard deviation	W/m ²	±<2%*	1 min	1 min standard deviation	2021-10-31 23:55	2022-04-01 00:00
-------------------------	-------------------------------------	------------------	-------	-------	--------------------------	------------------	------------------

*The sensor has a CNF4 attachment. Refer to the operating manual for further information regarding the accuracy of individual measurements.

Trois-Rivières:

The Trois-Rivières dataset is in the Trois_Rivieres_Rad_Met_Data.nc netCDF4 file, which includes the time dimension (length 162915: 54526 to 217440 representing the number of minutes since 2021-11-01 00:00, or the time period 2021-12-08 20:46 to 2022-04-01 00:00) and the following data variables (the dimensions are listed between the parentheses):

- latitude (none)
- longitude (none)
- height_above_mean_sea_level (none)
- short_wave_downwelling (time)
- long_wave_downwelling (time)
- short_wave_upwelling (time)
- long_wave_upwelling (time)

Table 9: Parameters of variables included for Trois-Rivières site

<u>Variable</u>	<u>Description</u>	<u>Units</u>	<u>Expected accuracy for daily totals</u>	<u>Frequency</u>	<u>Averaging or reporting interval</u>	<u>Start time (UTC)</u>	<u>End time (UTC)</u>
short_wave_downwelling	Downwelling shortwave radiation	W/m ²	±10%*	1 min	1 min average	2021-12-08 20:46	2022-04-01 00:00
long_wave_downwelling	Downwelling longwave radiation	W/m ²	±10%*	1 min	1 min average	2021-12-08 20:46	2022-04-01 00:00
short_wave_upwelling	Upwelling shortwave radiation	W/m ²	±10%*	1 min	1 min average	2021-12-08 20:46	2022-04-01 00:00
long_wave_upwelling	Upwelling longwave radiation	W/m ²	±10%*	1 min	1 min average	2021-12-08 20:46	2022-04-01 00:00

*The sensor has a CNF4 attachment. Refer to the operating manual for further information regarding the accuracy of individual measurements.

UQAM-PK:

The UQAM-PK dataset is in the UQAM_Rad_Met_Data.nc netCDF4 file, which includes the time dimension (length 93281: 124160 to 217440 representing the number of minutes since 2021-11-01 00:00, or the time period 2022-01-26 05:20 to 2022-04-01 00:00) and the following data variables (the dimensions are listed between the parentheses):

- latitude (none)
- longitude (none)
- height_above_mean_sea_level (none)
- short_wave_downwelling (time)
- long_wave_downwelling (time)
- short_wave_upwelling (time)
- long_wave_upwelling (time)

Table 10: Parameters of variables included for UQAM-PK site

<u>Variable</u>	<u>Description</u>	<u>Units</u>	<u>Expected accuracy for daily totals</u>	<u>Frequency</u>	<u>Averaging or reporting interval</u>	<u>Start time (UTC)</u>	<u>End time (UTC)</u>
short_wav e_downw elling	Downwelli ng shortwave radiation	W/m ²	±10%*	1 min	1 min average	2022-0 1-26 05:20	2022-0 4-01 00:00
long_wav e_downw elling	Downwelli ng longwave radiation	W/m ²	±10%*	1 min	1 min average	2022-0 1-26 05:20	2022-0 4-01 00:00
short_wav e_upwelli ng	Upwelling shortwave radiation	W/m ²	±10%*	1 min	1 min average	2022-0 1-26 05:20	2022-0 4-01 00:00
long_wav e_upwelli ng	Upwelling longwave radiation	W/m ²	±10%*	1 min	1 min average	2022-0 1-26 05:20	2022-0 4-01 00:00

*The sensor has a CNF4 attachment. Refer to the operating manual for further information regarding the accuracy of individual measurements.

5. Data remarks:

Table 11: Missing data periods (only >1-hr periods, times in UTC)

<u>Gault</u>	<u>Arboretum</u>	<u>UQAM-PK</u>
2021-12-09 23:58 to 2021-12-10 15:20	2021-11-07 23:57 to 2021-11-08 19:42	2022-02-24 17:02 to 2022-02-24 18:44
2021-12-18 23:58 to 2021-12-19 06:00	2021-11-30 12:27 to 2021-11-30 18:07	2022-03-06 17:30 to 2022-03-06 18:40
2021-12-21 23:58 to 2021-12-22 14:07	2021-12-09 23:57 to 2021-12-10 15:31	
2022-01-13 23:58 to 2022-01-15 01:09	2021-12-12 04:21 to 2021-12-12 05:38	
	2022-01-13 00:02 to 2022-01-13 18:07	

- There are no >1 hr periods of missing data for the Trois-Rivières data.

6. Acknowledgement

Financial support was provided by Canada Foundation for Innovation (CFI), Canada Research Chair (CRC), Natural Sciences en Engineering Research Council (NSERC) of Canada, Department of Atmospheric and Oceanic Sciences, Département des Sciences de la Terre et l'atmosphère de l'UQAM, and the Fonds de Recherche du Québec Nature et Technologies (FRQNT). We also thank Calin Giurgiu, Guillaume Dueymes, George Huard and Frédéric Toupin who provided technical support.