

CFI Climate Sentinels Gault Parsivel Disdrometer Data [GAUL]

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1 Data Set Description

1.1 Introduction: This dataset contains raw data collected from an OTT Parsivel² laser disdrometer installed at a climate sentinel (Gault) in the Saint Lawrence River Valley (see *Table 1*). The data is available from 1 Nov 2021 to 31 March 2022 (inclusive) to support the Winter Precipitation Type Research Multi-Scale Experiment (WINTRE-MIX). The instrument provides histograms of hydrometeor size and fallspeed. The Gault site is located behind Mont-Saint-Hilaire, about an hour's drive east of Montreal. Other sites also collected Parsivel 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, 09 September 2022

1.3 Time period covered: Given in *Table 1*. Note that times in this document are specified in the format 'HH:MM:SS dd.mm.yyyy'.

<u>Station full name</u>	<u>Station abby</u>	<u>Start date/time (UTC)</u>	<u>End date/time (UTC)</u>
Gault	GAUL	13:40:00 01.11.2021	23:59:00 31.03.2022

Table 1: Time period of availability for the disdrometer data.

1.4 Location data: The instrument is mounted next to other instruments at the site. The location information is given in Table 2. A map showing the sentinel location is given in *Figure 1*.

<u>Station</u>	<u>Latitude</u> <u>(degrees North)</u>	<u>Longitude</u> <u>(degrees</u> <u>East)</u>	<u>Elevation</u> <u>above</u> <u>mean sea-</u> <u>level (m)</u>
GAUL	45.535021	-73.149006	132

Table 2: Physical location data for stations containing disdrometer data.

1.5 Data frequency: minutely.

1.6 Website address references: Preliminary Parsivel 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.

2 Instrument Description

A Parsivel² laser disdrometers (Parsivel; <https://www.otthydromet.com/en/p-ott-parsivel-laser-present-weather-sensor/70.210.002.3.0>) was deployed at the Gault sentinel (see *Figure 2* for instrument photo). The Parsivel uses measured extinction of a laser beam by falling hydrometeors to classify each hydrometeor by its size and fall speed. The data are recorded as counts in 32 size bins and 32 fall speed bins. The instrument height and manual is provided in *Table 3*. The attributes of the Parsivel are summarized in *Table 4*. More detailed technical information on the Parsivel is available in OTT (n.d.) and Tokay et al. (2014).

<u>Station</u>	<u>Instrument name</u>	<u>Elevation of detector above ground-level (m)</u>	<u>Link to the manual</u>
GAUL	OTT Parsivel ² Disdrometer	3	https://www.fondriest.com/pdf/ott_parsivel2_manual.pdf

Table 3: Instrument information

<u>Parameter</u>	<u>Values</u>
Measuring surface	180 x 30 mm
Measuring range – liquid precipitation particle size	0.2 – 8 mm
Measuring range – solid precipitation particle size	0.2 – 25 mm
Measuring range – particle speed	0.2 – 20 m/s
Optical sensor laser diode – wavelength	650 nm
Optical sensor laser diode – output power	0.2 mW
Data collection frequency	60 s

Table 4: Attributes

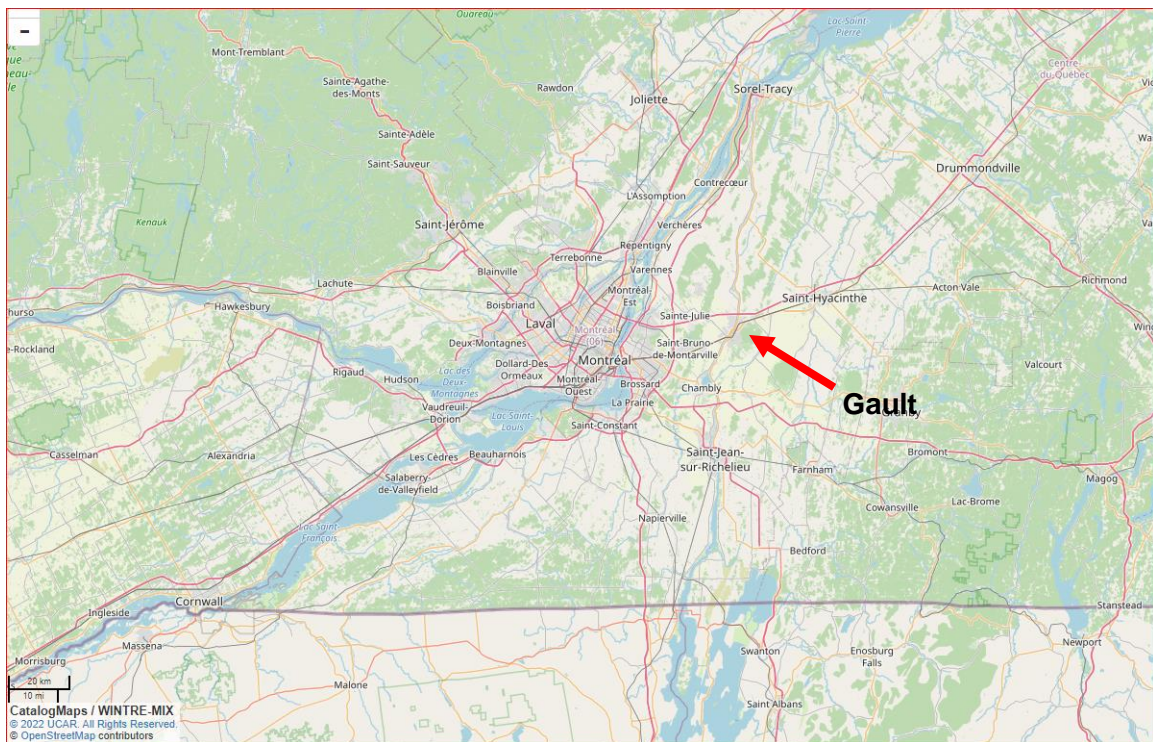


Figure 1: Physical location of the Gault sentinel

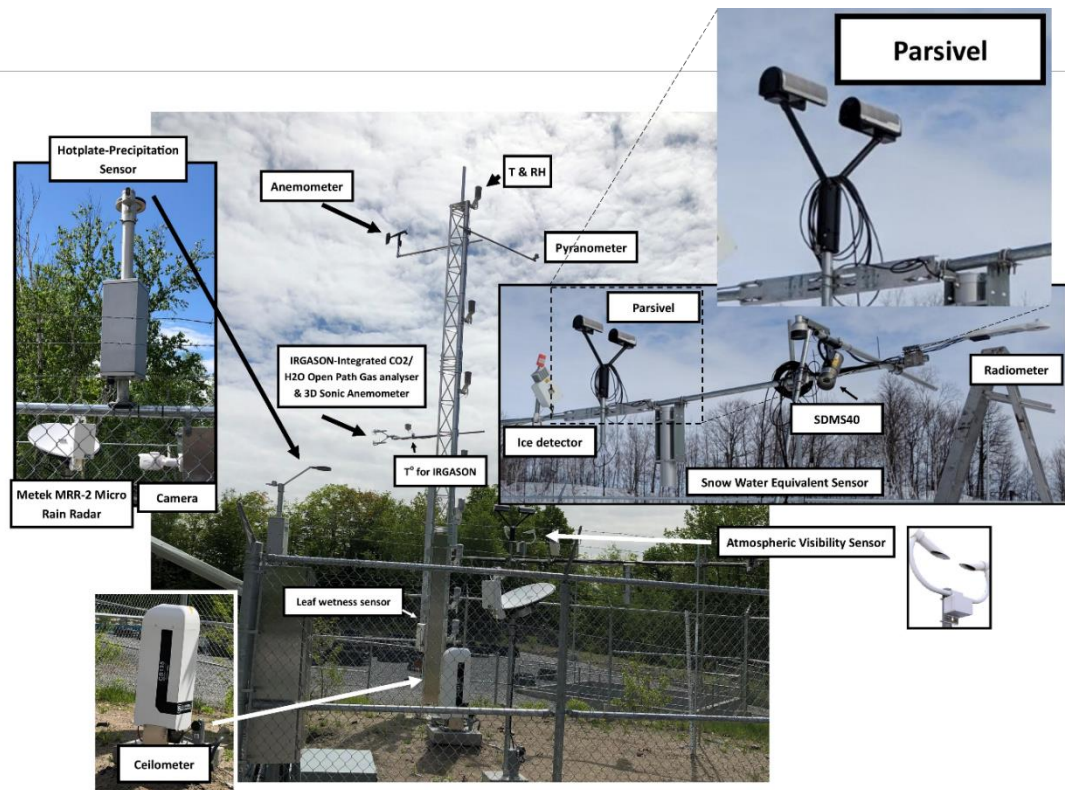


Figure 2: Parsivel disdrometer at the Gault site

3 Data Collection and Processing

3.1 Data collection: The Parsivel was configured to collect data every 60 seconds (Table 4). Heating was supplied to the sensor heads to prevent accumulation of snow and ice, using the default temperature threshold of 10°C. Data was logged onto a Windows PC using the OTT ASDO Software (ASDO Basic Version 1.15.0) as daily text files. These were converted into netCDF files with additional metadata added. No quality control checks were applied beyond those used in the routine OTT processing.

4 Data Format

4.1 Data structure and naming conventions: The data format is netCDF-4 (.nc). One file is produced, called 'CFI_Gault_Parsivel_Disdrodrometer_data_WINTRE-MIX.nc'. This file contains disdrodrometer data collected by the detector at the sentinel. The variables provided in the file is summarized in *Table 6*. Additional metadata is provided in the netCDF file.

4.2 Data format and layout: The dimensions of the variables are shown in *Table 5*.

<u>Dimension</u>	<u>Size</u>	<u>Description</u>
time	213744	The number of minutely observations between the start and end dates.
bin_diameters	32	The number of diameter classes.
bin_velocities	32	The number of velocity classes.

Table 5: Dimensions of disdrodrometer variables and their meanings.

4.3 Variables: List of dataset variables and their properties, as given in *Table 6*.

<u>Parameter</u>	<u>Value</u>	<u>Unit</u>
bin_velocities	Middle of velocity bin	m s ⁻¹
bin_diameters	Middle of diameter bins	mm
time	Measurement time in UTC	Timestamp
Prcp_Intensity	Intensity of precipitation	mm h ⁻¹
Prcp_Start	Precipitation since start of period	mm
Wx_Code_Synop	Synoptic Present Weather code	-
Wx_Code_METAR	METAR Special Weather code	-
Wx_Code_NWS	NWS Weather code	-
Reflectivity	Radar reflectivity	dBZ
Visibility	Meteorological Optical Range (MOR) visibility	m
Signal_Ampl	Signal amplitude of laserband	-
Num_Particles	Number of detected particles	-
Sensor_Temp	Temperature in sensor	°C

Heating_Current	Heating current	A
Sensor_Voltage	Sensor voltage	V
Kinetic_Energy	Kinetic Energy	$\text{J m}^{-2} \text{h}^{-1}$
Snow_Intensity	Snow Intensity	mm h^{-1}
Nd_Spectra	Particle number concentration in each diameter bin	$\log_{10} (\text{m}^{-3} \text{mm}^{-1})$
Vd_Spectra	Average particle speed in each diameter bin	m s^{-1}
Raw_Data	Number of counts in each combined velocity, diameter bins	-
latitude	Latitude of Parsivel	$^{\circ}\text{N}$
longitude	Longitude of Parsivel	$^{\circ}\text{W}$
height_above_mean_sea_level	Elevation of Parsivel	m above mean sea level
bin_diameters_width	Width of diameter bins	mm
bin_velocities_width	Width of velocity bins	m s^{-1}

Table 6: List of disdrometer variables and their properties.

Description of selected variables and constants in the dataset:

“time”: The time of an observation expressed in the following format: minutes since 13:40:00 01.11.2021.

“Raw_Data”: Precipitation particles are partitioned into one of 32 diameter and one of 32 velocity classes, for a total of 1024 possible classifications. Class tables are provided in the .nc file, and are given in the manual and reproduced in **Appendix A** for convenience

Meaning of NaN elements: NaN values indicate when data is unavailable.

5 Data Remarks

Note 1: The two smallest size bins are outside the measurement range of the instrument and are not used. The Parsivel appears to systematically undercount drops in the third smallest size bin. Thus, drops with diameters < 0.37 mm are likely poorly characterized by this instrument.

Note 2: “Non-matching duplicate data”: Users should be aware that there are a few periods with duplicate timestamps containing non-matching data. The cause of this problem has not yet been addressed. The periods of concern are shown in *Table 7*. Yellow shading indicates that the gap occurred during the WINTRE-MIX campaign. Please use caution when analysing data during these periods.

Note 3: The variable “Sensor_Temp” represents the temperature in the disdrometer sensor. The sensor contains a heater that is designed to activate when the outside temperature drops below a specified value to prevent ice buildup. The default value for the disdrometer is 10°C. The sensor temperature at the Gault sentinel is found to differ from the outside temperature (as determined by the 2-m air temperature, available in the file ‘Gault_Non-Rad_Met_Data.nc’) by over 15°C at times. At times, the sensor temperature is occasionally more than 5°C colder than the outside temperature. Caution should be exercised when analysing this temperature sensor data.

<u>Station</u>	<u>Length of duplicate data</u>	<u>Start of duplicate data</u>	<u>End of duplicate data</u>
GAUL	4h31m	22:18:00 19.11.2021	02:49:00 20.11.2021
	4h45m	23:58:00 21.11.2021	04:43:00 22.11.2021
	3h56m	20:48:00 23.12.2021	00:44:00 24.12.2021
	2h10	13:51:00 05.03.2022	16:01:00 05.03.2022

Table 7: Periods with duplicate times with non-matching data.

5.1 Missing data periods: See *Table 8*. Only major gaps, defined as at least one consecutive hour of missing data, are shown. Yellow shading indicates that the gap occurred during the WINTRE-MIX campaign.

<u>Station</u>	<u>Length of data gap</u>	<u>Start of gap</u>	<u>End of gap</u>
GAUL	5h01m	16:16:00 20.11.2021	21:17:00 20.11.2021
	5h01	14:47:00 24.12.2021	19:47:00 24.12.2021
	12h25m	12:53:00 29.01.2022	01:18:00 30.01.2022
	18h14	18:24:00 05.03.2022	12:38:00 06.03.2022

Table 8: Occurrences of significant data gaps in the disdrometer variables.

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7 References

Minder, J., N. Bain, W. Bartolini, Jr., K., and S. McKim, 2022: NYSM Chazy, NY Parsivel Disdrometer Data. Version 1.0. <https://doi.org/10.26023/KRFX-TMZW-JJ0W> .

Tokay, A., Wolff, D. B., & Petersen, W. A. (2014). Evaluation of the New Version of the Laser-Optical Disdrometer, OTT Parsivel2. *Journal of Atmospheric and Oceanic Technology*, 31, 1276-1288. <https://doi.org/10.1175/JTECH-D-13-00174.1>

*OTT, n.d: Operating instructions – Present Weather Sensor Parsivel 2 . OTT Hydromet GmbH, document number: 70.210.001.BE.

* *OTT Parsivel manual is provided as an attachment.*

8 Appendix

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

- Solid precipitation
- Frozen precipitation
- Rain
- Freezing rain
- Drizzle
- Freezing drizzle
- Ice pellets
- Snow
- Droplet size
- Ice storms
- Snow storms
- Extratropical cyclones

Appendix A – Disdrometer Size Classes

Particle diameter and velocity classes				
Class	Diameter (mm)	Width (mm)	Velocity (m/s)	Width (m/s)
1	0.062	0.125	0.05	0.1
2	0.187	0.125	0.15	0.1
3	0.312	0.125	0.25	0.1
4	0.437	0.125	0.35	0.1
5	0.562	0.125	0.45	0.1
6	0.687	0.125	0.55	0.1
7	0.812	0.125	0.65	0.1
8	0.937	0.125	0.75	0.1
9	1.062	0.125	0.85	0.1
10	1.187	0.125	0.95	0.1
11	1.375	0.25	1.1	0.2
12	1.625	0.25	1.3	0.2
13	1.875	0.25	1.5	0.2
14	2.125	0.25	1.7	0.2
15	2.375	0.25	1.9	0.2
16	2.75	0.5	2.2	0.4
17	3.25	0.5	2.6	0.4
18	3.75	0.5	3.0	0.4
19	4.25	0.5	3.4	0.4
20	4.75	0.5	3.8	0.4
21	5.5	1.0	4.4	0.8
22	6.5	1.0	5.2	0.8
23	7.5	1.0	6.0	0.8
24	8.5	1.0	6.8	0.8
25	9.5	1.0	7.6	0.8
26	11.0	2.0	8.8	1.6
27	13.0	2.0	10.4	1.6
28	15.0	2.0	12.0	1.6

29	17.0	2.0	13.6	1.6
30	19.0	2.0	15.2	1.6
31	21.5	3.0	17.6	3.2
32	24.5	3.0	20.8	3.2