Sorel, QC Vaisala Forward Scatter Sensor Data [ECCC]

Authors

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1. **Data Set Description**
   1.1. **Introduction:** This dataset contains the raw data from the Vaisala Forward Scatter Sensor (FD71P) sited at Sorel-Tracy, QC for the Winter Precipitation Type Research Mult-Scale Experiment (WINTRE-MIX). Data was collected between October 20, 2021 and May 03, 2022. The FD71P utilizes forward scattering of a thin light sheet to detect particle sizes and fall speeds and deduce precipitation types, accumulations, and visibility. Sorel-Tracy is located at the northern end of the Champlain Valley, on the southern shore of the St. Lawrence River northeast of Montreal. The site was in a small park to the east of the Richelieu River. Several other instruments were also stationed at the site and will be available from the WINTRE-MIX data archive (https://data.eol.ucar.edu/master_lists/generated/wintre-mix/).
   1.2. **Data version number:** 1.0
   1.3. **Data version date:** 2022-03-16
   1.4. **Data Status:** Final
   1.5. **Time period covered by data:** 09:00 UTC October 20, 2021 to 12:00 UTC May 03, 2022
   1.6. **Latitude:** 46.030222°N
   1.7. **Longitude:** -73.110337°E
   1.8. **Elevation:** 19.0 m (http://geogratis.gc.ca/services/elevation/cdem/altitude?lat=46.030222&lon=-73.110337); 13.3m (http://geogratis.gc.ca/services/elevation/cdsm/altitude?lat=46.030222&lon=-73.11033)
   1.9. **Other (address):** Sorel-Tracy, QC, Canada (approximately behind 66 Rue de la Comtesse)
   1.10. **Data Frequency - Frequency of data collection:** 1 minute
   1.11. **Data source:** High Impact Weather Research, Environment and Climate Change Canada
   1.12. **Web address references:** https://www.eol.ucar.edu/field_projects/wintre-mix
   1.13. **Data set 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**
   2.1. **Description:** The Vaisala Forward Scatter Sensor (FD71P) utilizes forward scattering of a thin light sheet to detect particle sizes and fall speeds and deduce precipitation types,

accumulations and visibility. The size range of measurable precipitation particles is from 0.1 to 35 mm, with fall speeds from 0 to 10+m/s. Precipitation particles are categorized as: Drizzle, rain, snow, snow grains, ice crystals, ice pellets, freezing drizzle, freezing rain, snow pellets, and hail, as well as visibility obstructions like mist and haze. Both particle size and particle speed are measured and used for deriving parameters such as size spectrum, type of precipitation, kinetic energy, intensity of the precipitation, radar reflectivity, and visibility. The FD71P issues one data telegram every 15 seconds.

For these datasets, a FD71P weather sensor was located in Sorel-Tracy, Quebec, Canada.
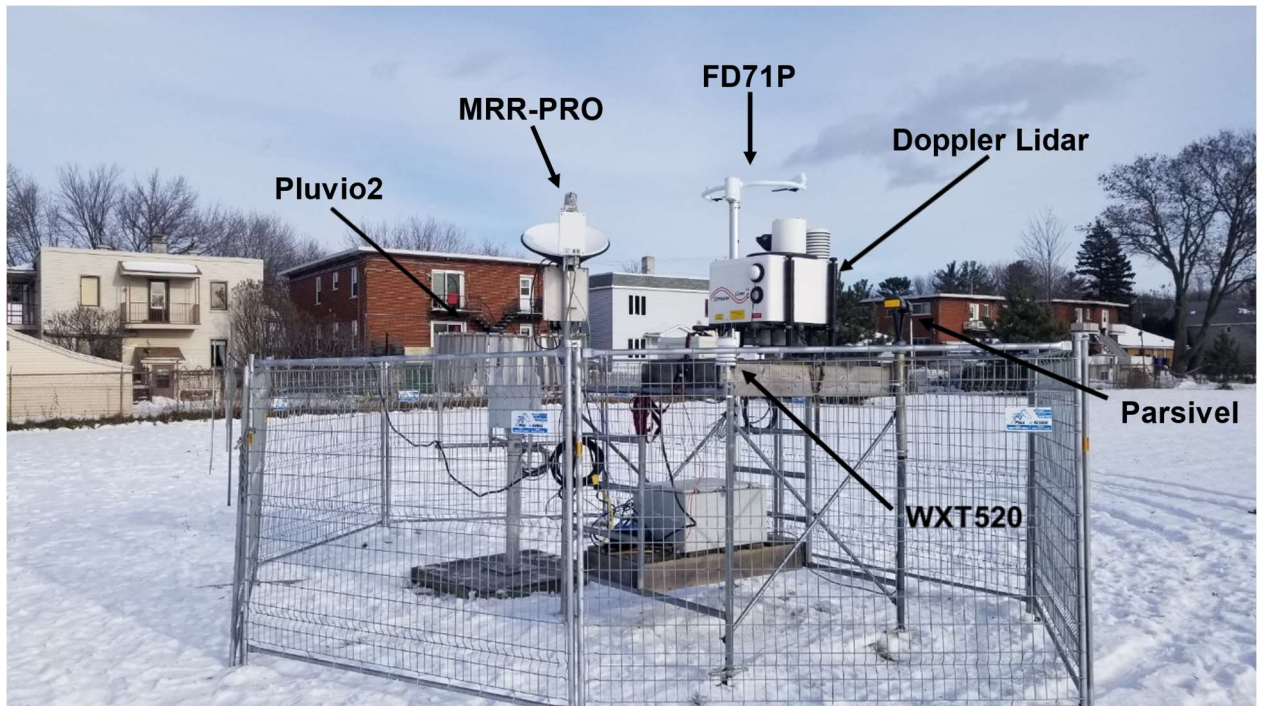

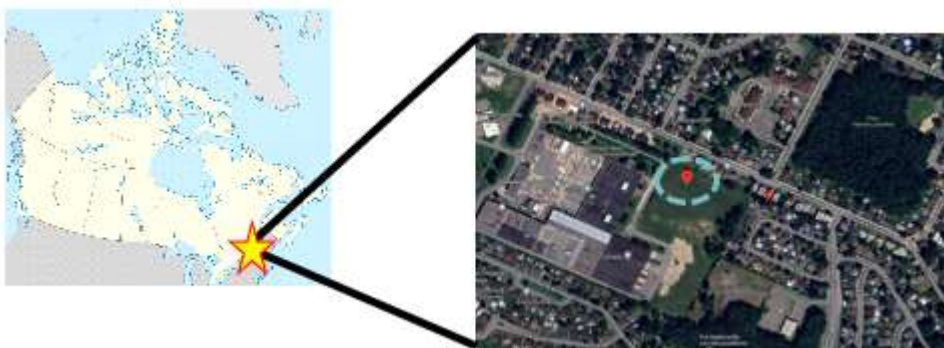Figure 1 - Photograph of the Sorel-Tracy meteorological instrument site.

Figure 2 - Google Maps map of the location of the Sorel-Tracy site.

3. Data Collection and Processing

3.1. Description of data collection: The FD71P was configured to collect a FD70 Message 8 (MES8) every 15 seconds. The MES8 is defined in 4.0 Data Format. The data was logged on a Windows PC using a RubberDAQy data logging program. This program prepended a UTC date/time stamp to the MES8 output and appended it with a Status Word Message. These multi-line messages were also turned into single line records by replacing all internal <CR><LF> with <space>. Messages were collected into daily text files. No quality control has been done beyond the internal FD71P processing.

3.2. Description of derived parameters/processing techniques: See Vaisala FD70 manual.

3.3. Description of quality assurance/control procedures: See Vaisala FD70 manual.

4. **Data format**

   4.1. Data file structure and file naming conventions: Measurements were retrieved as comma delimited ASCII (OTT Telegram Message 8 including drop size distribution and status word) messages every 15 seconds and prepended with Datetime stamp + "FD". The records are <space> delimited and internal <CR><LF> characters have been replaced with <space> characters. Note: This results in some values (e.g. METAR values) may be <space> or 0 characters long. Also note: The FD clock was not set – do not use. It gives incorrect values – use the DAS Datetime instead. File names are of the form: FD17PYYMMDD.txt where YY=year(e.g. 22), MM=month(02 or 03), DD=day

   4.2. Data format and layout: Daily space delimited ASCII data files with a single header line.

   4.3. List of parameters:

Table 1: List of Parameters

Parameter	Format	Unit
DAS DateTime	YYYY/MM/DD hh:mm:ss	UTC
FD	FD	
FD Timestamp	YYYY-MM-DDThh:mm:ssZ	UTC
Overall Alert		
MOR, 1-minute average		meters
MOR, 10-minute average		meters
Precipitation type with intensity (NWS code)		
Reserved	///	
Reserved	///	
Present weather instant (SYNOP)	WMO 4680	$w_a w_a$
Present weather 15 min (SYNOP)	WMO 4680	$w_a w_a$
Present weather 1 h (SYNOP)	WMO 4680	$w_a w_a$
Precipitation intensity		mm/h
Precipitation accumulation		mm
Snow accumulation		mm
Temperature		°C
Dew Point		°C
RH		%
Background luminance		cd/m^2
Present METAR	WMO 4678	W'W'

Recent METAR	WMO 4678	W'W'
Reflectivity		dBZ
Droplet size distribution in size classes 1-41	(see Table 2 for bin sizes)	#
Kinetic Energy		J/m²h
Fall speed distribution in 26 speed classes	Bin width 0.4 m/s	#
Status Word Message		

Table 2: Dropsize bins

Bin #	Mean Diameter (mm)	Bin Width (mm)
1	0.12	0.02
2	0.14	0.02
3	0.17	0.03
4	0.2	0.03
5	0.23	0.04
6	0.27	0.05
7	0.32	0.05
8	0.38	0.06
9	0.45	0.07
10	0.53	0.09
11	0.62	0.1
12	0.73	0.12
13	0.86	0.15
14	1.02	0.16
15	1.14	0.08
16	1.23	0.09
17	1.32	0.09
18	1.41	0.1
19	1.52	0.11
20	1.63	0.12
21	1.75	0.12
22	1.88	0.14
23	2.02	0.14
24	2.16	0.15
25	2.32	0.17
26	2.49	0.17
27	2.68	0.19
28	2.87	0.21
29	3.08	0.22
30	3.31	0.23
31	3.55	0.25

32	3.82	0.27
33	4.1	0.29
34	4.4	0.32
35	4.72	0.33
36	5.07	0.36
37	5.44	0.39
38	5.84	0.41
39	6.27	0.45
40	6.73	0.47
41	> 7	

5. Data Remarks

5.1. Missing data periods:

No significant (> 1h) missing data periods except:

Table 3: List of Data Gaps

Gap Start	Gap End	Length
2021/11/10 12:35	2021/11/24 13:56	14d 01h 21m
2021/11/24 17:49	2021/12/07 17:04	12d 23h 15m
2021/12/15 17:29	2021/12/17 16:48	01d 23h 19m

Note: No missing data periods during the WINTRE-MIX campaign

6. Acknowledgment

This README was inspired by CFI Climate Sentinels Gault MRR-2 Processed Data (Lachapelle *et. al.*, 2022).

7. References

Lachapelle *et. al.*. 2022: CFI Climate Sentinels Gault MRR-2 Processed Data. Version 1.0. UCAR/NCAR - Earth Observing Laboratory. https://doi.org/10.26023/AKWD-BRV8-R80D. Accessed 20 April 2023.

Vaisala web site: https://www.vaisala.com/en Accessed 20 April 2023.

Vaisala, 2021: Configuration and Maintenance Guide - Vaisala Forward Scatter Sensor FD70. Vaisala Oyj. Document number M212222EN-D.

Vaisala, 2021: Vaisala Forward Scatter Sensor FD70 - Software release notes, SW v2.2. Vaisala Oyj. Document number DOC247176.

Vaisala, 2021: Technical Reference – Message Description FD70. Vaisala Oyj. Document number M212373EN-C.

8. Appendix

Suggested GCMD keywords (no particular order):

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