WINTRE-MIX Field Catalog
Winter Precipitation Type Research Multi-scale Experiment
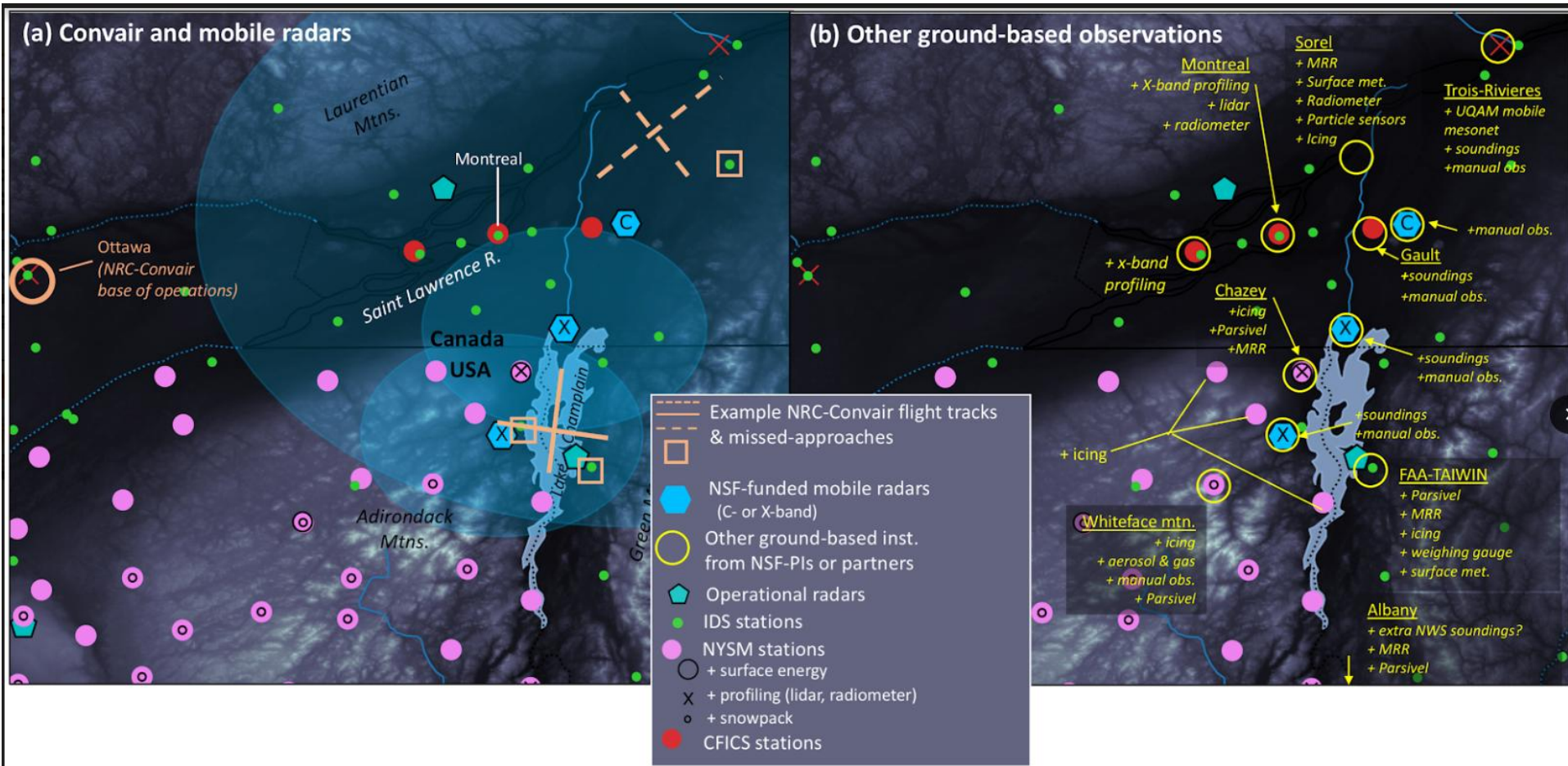
SUMMARY OF WINTRE-MIX FIELD CAMPAIGN:

Sorel Supersite

Ismail Gultepe, Zen Mariani, Daniel Michelson
June 14-2022 Workshop
Organized by University of Albany

PROJECT AREA

(a) Convair and mobile radars

(b) Other ground-based observations

Legend:
- ----- Example NRC-Convair flight tracks & missed-approaches
- ⬡ NSF-funded mobile radars (C- or X-band)
- ○ Other ground-based inst. from NSF-PIs or partners
- ⬟ Operational radars
- ● IDS stations
- ● NYSM stations
  - ○ + surface energy
  - X + profiling (lidar, radiometer)
  - ○ + snowpack
- ● CFICS stations

Operational Advanced Mesonet systems

Three advanced networks of automated weather stations operated by the New York State Mesonet (**NYSM**), the Canada Foundation of Innovation Climate Sentinels (**CFICS**), and **NCEI** Integrated Surface Database (IDS) will also be utilized (Fig. 1a).

Table 1: Wintre-Mix IOP summary (Gultepe)

Date/Time UTC	IOP #	Location	Aircraft flts	Weather type	Objective	Notes
2022-02-02/03 020000	1	St. Chaplain-N-NY region	NRC-CV 0200-0630Z (F03) SE flight	Clipper system	RN/SN mixed precip event	-
2022-02-09 224300	2	St. Lawrence Valley,CA	na	SW-Low Pressure	LRN/SN	IMPACTS
2022-02-11/12 000000	3	St. Lawrence Valley,CA	NRC-CV NE-flight pattern 0021-0506Z (F12)	Clipper system	Wide area SN precipitation	TWAIN
2022-02-17/18 163000	4	S-QE/N-NY	NRC-CV S-flight pattern 0320-0704Z(F18)	Long duration mix precip	RN to FRZRN	IMPACTS
2022-02-22/23 160000	5	NW St. Lawrence Valley, CA	NRC CV NE-flight pattern 2344-0342Z(F22)	Mix precip, IP, Cross valley legs	FRZRN FRZ, RN along St. Lawrence Valley	Cold air erosion at surface/adv
2022-02-25 090000	6	Champlain V N-NY	NRC-CV 1456-1948Z(F25) Syracuse area	Clipper system	Mix-Precip, generating cells, melting layer	TWAIN/ IMPACTS
2022-02-29/01 160000	7	Champlain V St. Lawrence V	NRC-CV SE-pattern, 2045-0108Z(M02)	Cold Clipper system	Convergence zone and mix-precip	-
2022-03-05 100000	8	Sorel/Gault Great Lakes	NRC-CV N-St. Lawrence River	Low pressure system	FRZRN and FRZDRZ	-
2022-03-06 201500	9	Southern half of the project area	NRC-CV SE and NE-flights, 1310-1712Z(M06)	Multiscale mix-precip	SN-FRZRN/IP to RN-SN	-
2022-03-07 161100	F09	Southern half of the project area	NRC-CV; SE flight 1611-1903Z(M07) 2140-0139(M08)	Cyclone/C old front later	Early mixed precip, and cold front later	
2022-03-12 000000	10	Border area of project location	NRC-CV SE-flight pattern 0346-0751Z(M12)	Weak low pressure system	Light Mix-Precip/HSN BSN	-
2022-03-14/15 000000	11	Plattsburgh Project area	na	Frontal band	RA/SN; short transition	-

Ground based obs at Sorel (9 IOPs)

IN-SITU OBSERVATIONS   (Sorel Supersite)   I

* -Precipitation amount/rate/type (FD70/ParSiVel/Pluvio)
* -Manual particle measurements (UQAM)
* -PSD (FD70/ParSiVel)
* -Visibility and DSD (FD70)
* -Met parameters (WXT50)
* -Wind/Turbulence (WXT50)

PROFILING AND RADARS

* -Radiosonde Balloons (UQAM)
* -MWR (UC)
* -MRR (Vd, Ze)
* -HALO lidar (Vd & Backscattering) Zen Mariani
* -Ceilometer (cloud base/top height)
* -S-band radar (Ze, PR) (Daniel Michelson) (CASBV: Blainville operational weather radar)
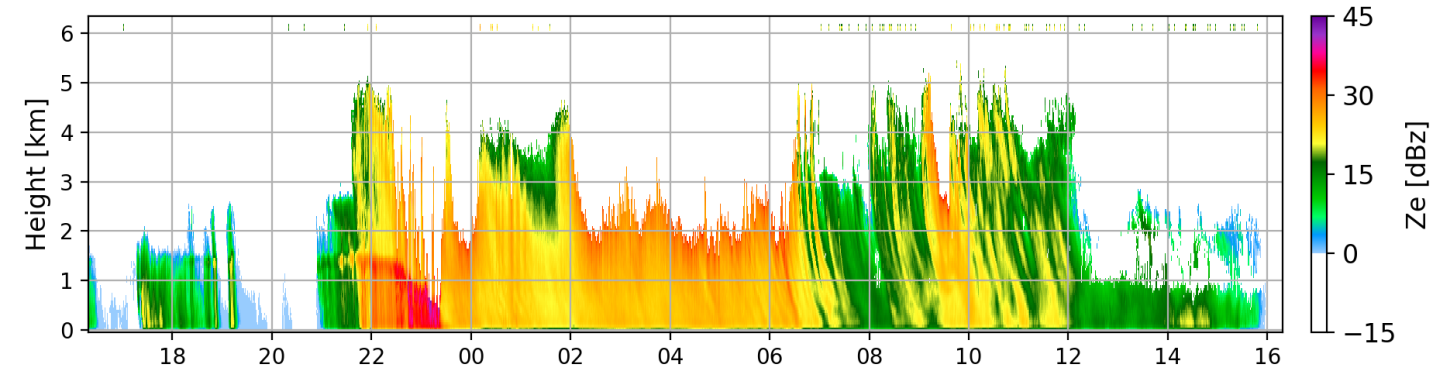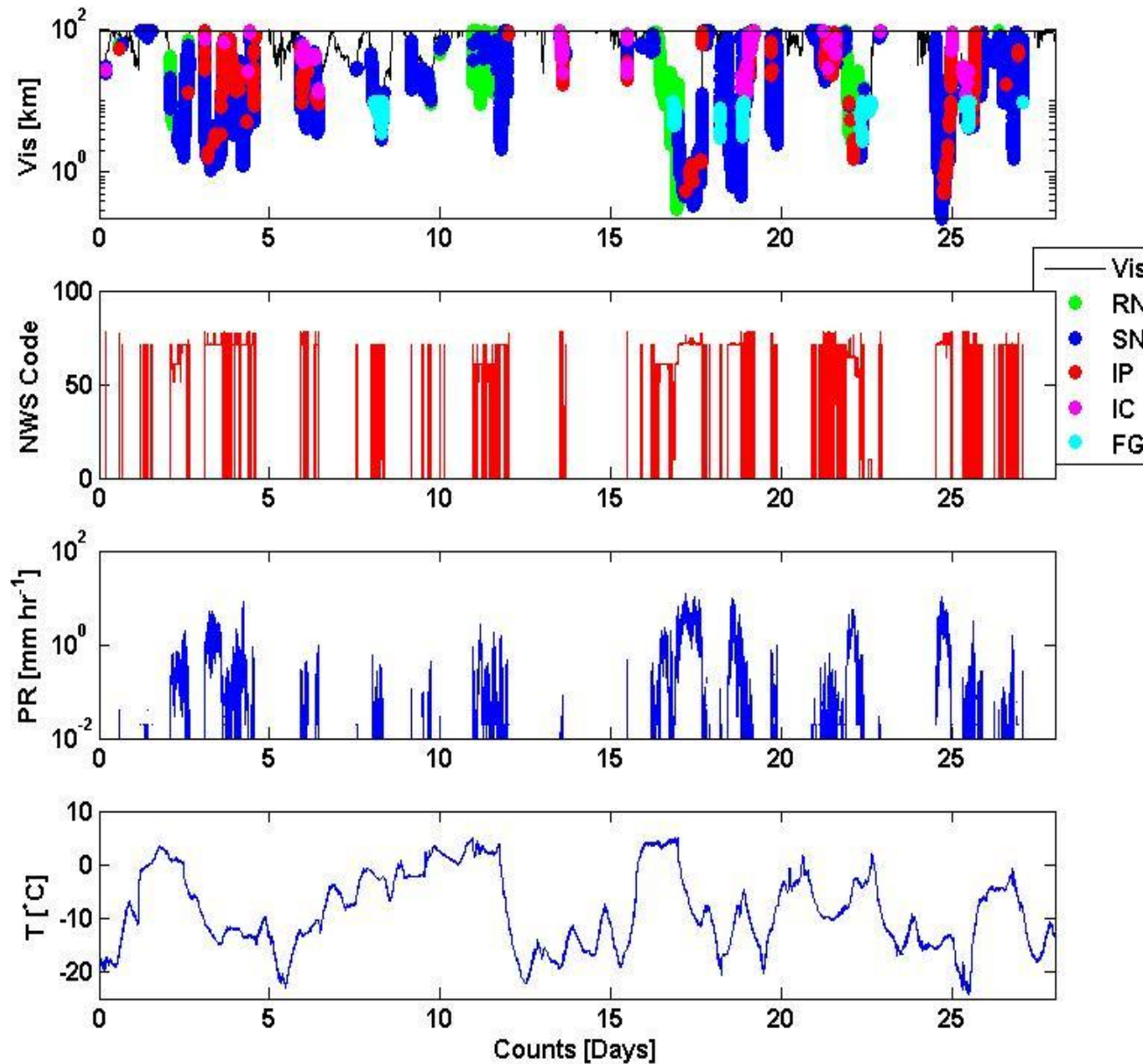
ECCC SOREL SITE
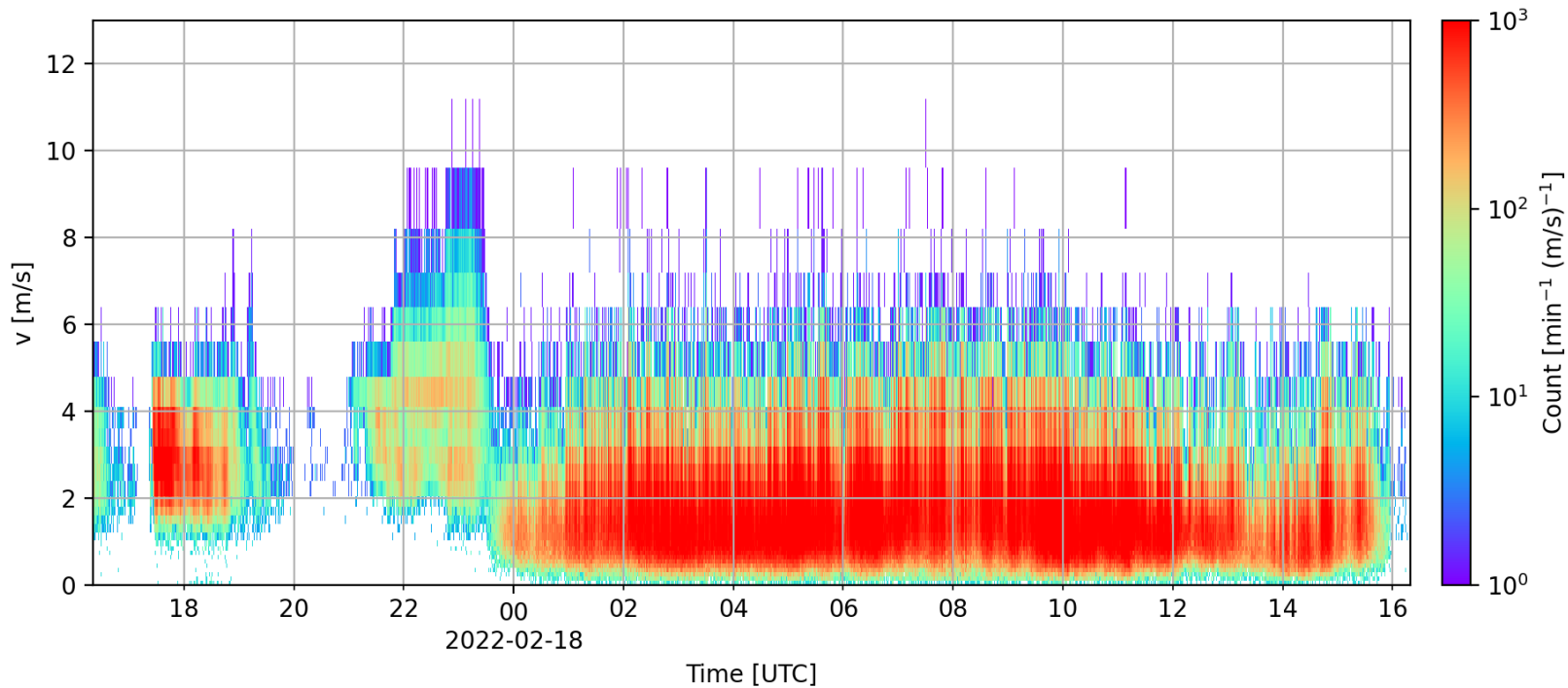
Instruments/P-type/Radiosonde; FEB17 2230 UTC RN+FG IOP4
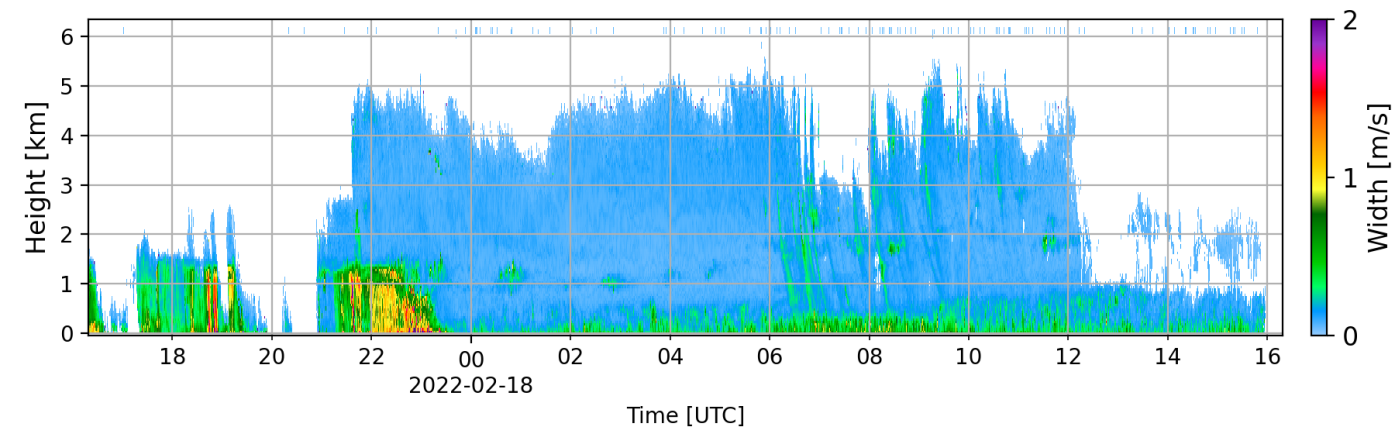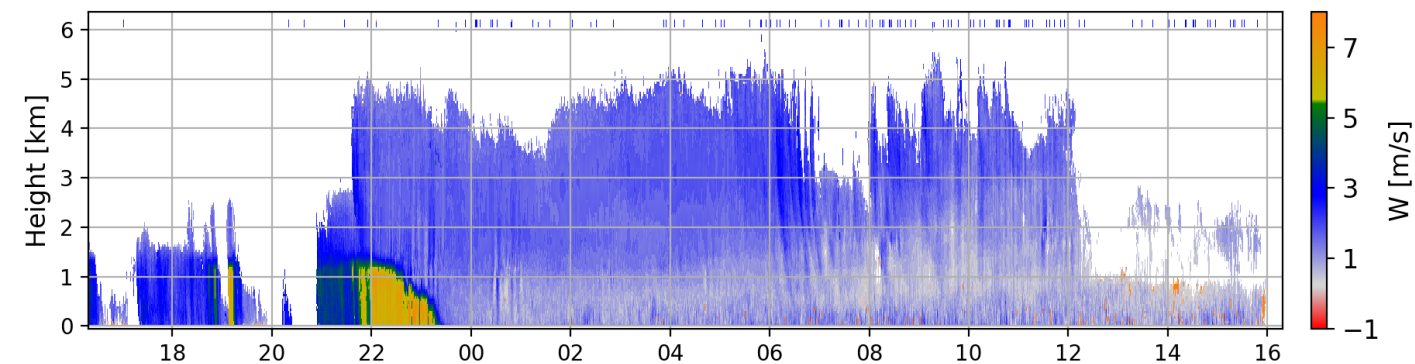
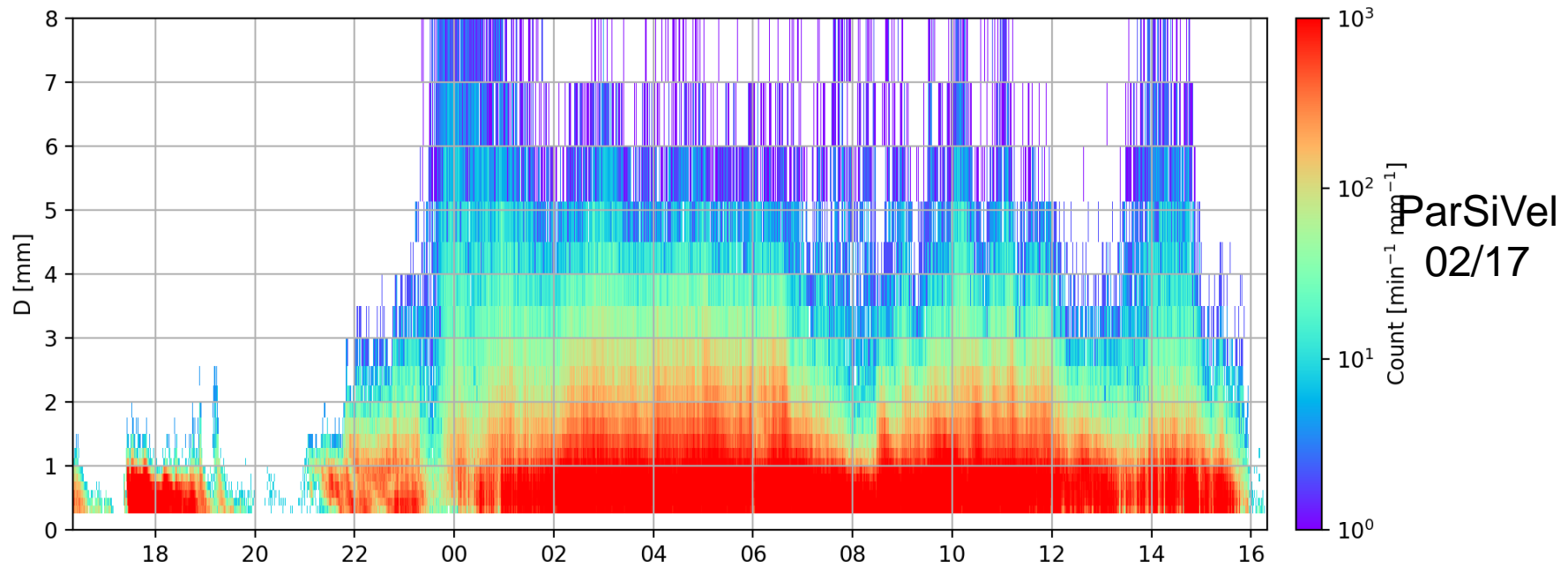**FD70P-Analysis (Feb 2022)**
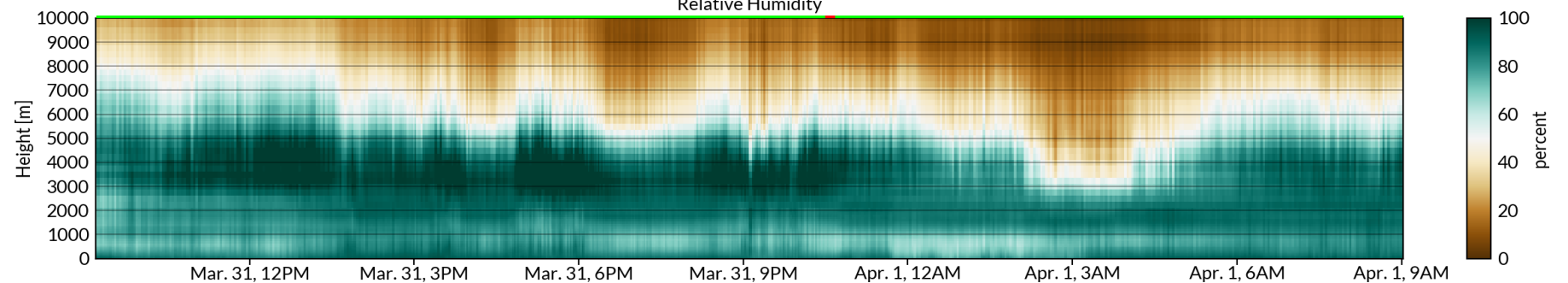
4-Panel Microwave Radiometer Plot for Chazy, NY
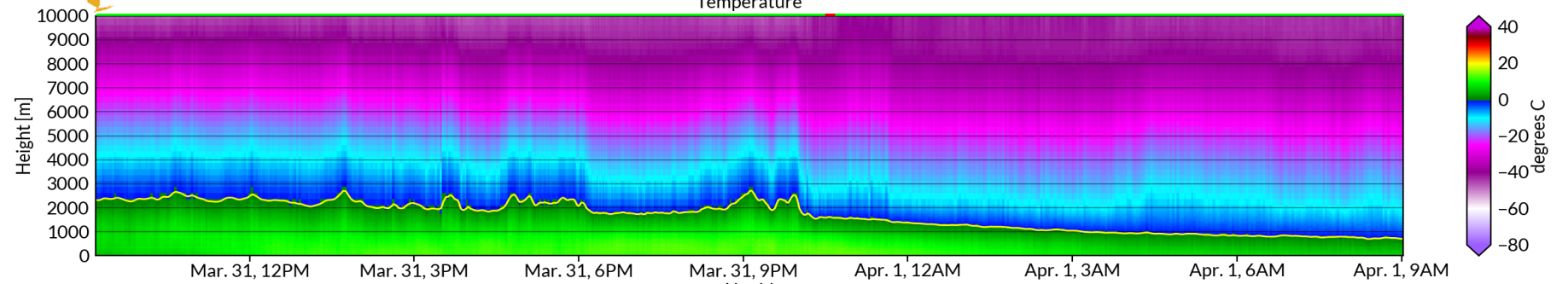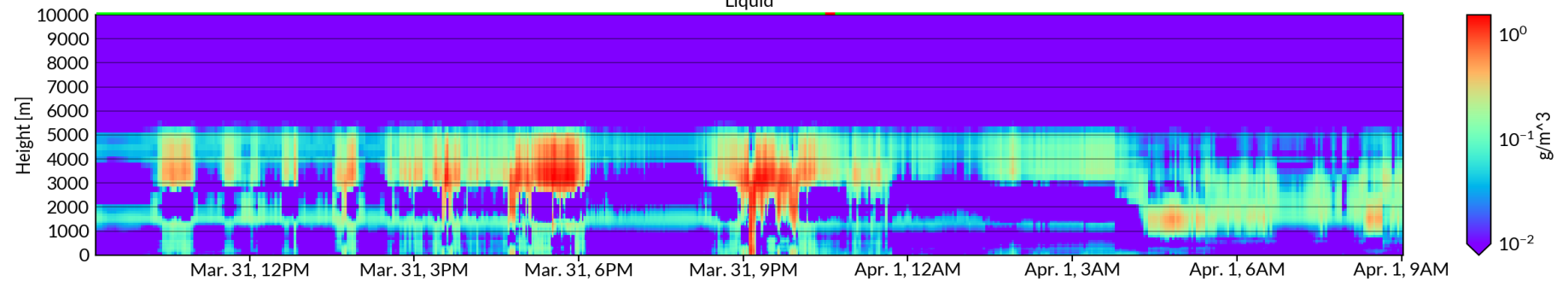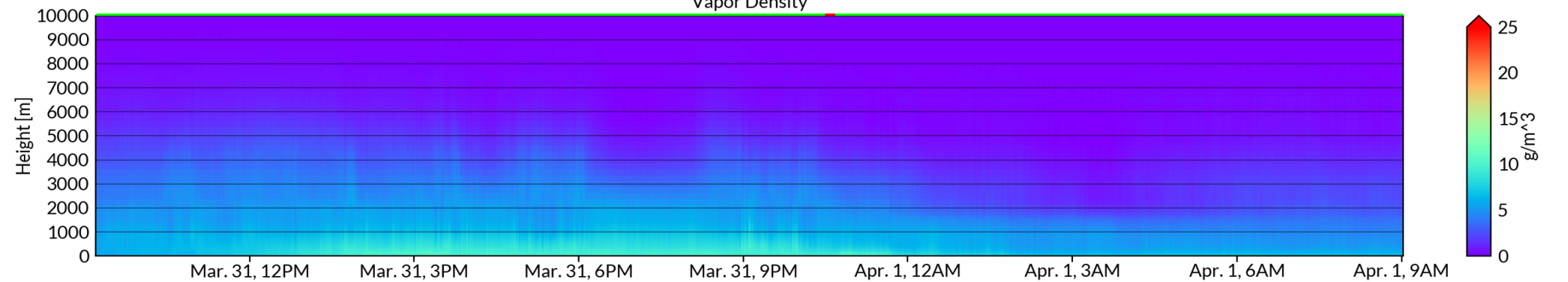
Zen Mariani (HALO LIDAR)

Doppler Lidar: winds and aerosols

- Autonomous, ground-based scanning lidar that measures the Doppler shift of aerosols in the lower atmosphere.

- Processes Doppler shift to provide Doppler velocity measurements, which are used to generate vertical wind speed & direction (u, v, w) profiles.

- MRD has 7 HALO Doppler lidars currently deployed (MSC has 3 Leosphere lidars with similar specs as below):

Essential Parameters				
Meteorological parameter measured	Vertical Resolution	Highest Temporal Resolution	Maximum Vertical Range	Measurement accuracy (+/-)
Wind Profile (UU, VV)	3 m	5 min (customizable)	2 - 4 km	< 0.3 m/s
Vertical Velocity (WW)	3 m	2 sec	2 - 4 km	< 0.3 m/s
Aerosol backscatter (Beta)	3 m	2 sec	10 km	N/A
Cloud microphysics (depolarization ratio %)	3 m	5 min (customizable)	2 - 4 km	N/A

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Lidar Scan Modes

- All scan modes are fully customizable (can increase temporal resolution):
- Stare scan (zenith-viewing)
  - Vertical updraft/downdraft velocities up to the Planetary Boundary Layer (PBL)
  - Depolarization ratio

- Plan Position Indicator (PPI)
  - Horizontal scan produces wind maps
  - Scan at specified elevation (near the surface)

- Range Height Indicator (RHI)
  - Vertical scans (vertical slice of the atm.)
  - Scan at specified azimuth

- Wind Profiles
  - 3D wind profile above the Lidar up to the PBL
  - Velocity-azimuth display (VAD) technique

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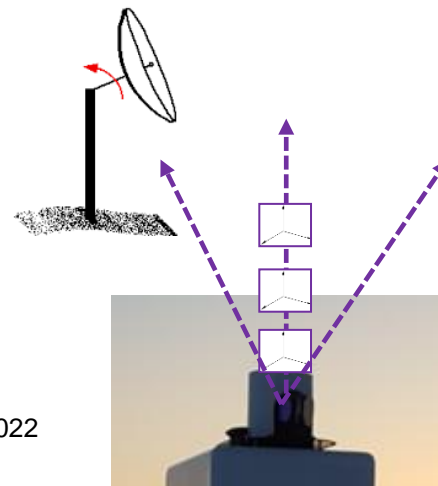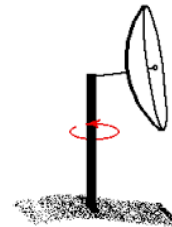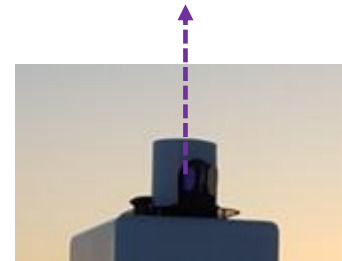
Scans during WINTRE-MIX

- 4° PPI

- Over-the-top RHI at 215° (along the valley) and 305° (across the valley) AZ

- ~10-min Vertical wind velocity (w)

- Vertical wind profile VAD scan (u, v)

- 15 min repeat cycle

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Data Format

- Data management
  - 1 file produced per scan type
  - Data and processing codes (python) available
  - **Can produce & FTP quicklook plots in real time**

1. Raw data files (.txt)
   - Each file is ~1-30 MB (depending on scan)
   - Totals ~9 GB / day / Lidar
   - Provides wind speed, SNR, backscatter, etc.
   - Not quality-controlled

2. Quality-controlled processed products
   - Images are small .png files (< 1 MB / image)
   - Files are text or netCDF format
   - Text files are ~20 KB / profile
   - Totals ~ 80 MB / day / Lidar
   - Processed products can be customized and delivered in near-real time

Raw file

```
Altitude of measurement (center of gate) = (range gate + 0.5) *
Gate length
Data line 1: Decimal time (hours)  Azimuth (degrees)  Elevation
(degrees)
f9.6,1x,f6.2,1x,f6.2
Data line 2: Range Gate  Doppler (m/s)  Intensity (SNR + 1)
Beta (m-1 sr-1)
i3,1x,f6.4,1x,f8.6,1x,e12.6 - repeat for no. gates
****
11.314028 360.00   5.00
  0 0.0586 1.028371  1.278988E-6
  1 0.0204 1.022436  1.011577E-6
  2 -0.0560 1.050414  2.273369E-6
  3 -0.1325 1.093190  4.202924E-6
  4 -0.2089 1.079488  3.585568E-6
  5 -0.4000 1.087576  3.951063E-6
  6 -0.6675 1.077326  3.489277E-6
  7 -1.0115 1.068448  3.089220E-6
  8 2.0843 1.062682  2.829522E-6
  9 2.5048 1.062351  2.815147E-6
```

Processed file

```
Height[m], Dir[deg], Vel[m/s]
60.0       287.0      0.4
63.0       283.0      0.5
66.0       283.0      0.4
69.0       282.0      0.4
72.0       297.0      0.4
75.0       297.0      0.4
78.0       297.0      0.4
81.0       291.0      0.5
84.0       291.0      0.5
87.0       302.0      0.6
90.0       286.0      0.7
93.0       294.0      0.8
96.0       294.0      0.8
99.0       301.0      0.8
102.0      301.0      0.8
```

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