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The Winter Precipitation Type Multiscale Experiment

Overview and Initial Results

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1 University at Albany, State University of New York

2 McGill University

3 University of Wyoming

4 University of Colorado Boulder

5 Environment and Climate Change Canada / Environnement et Changement climatique Canada

6 FARM Flexible Array of Radars and Mesonets

7 UQÀM Université du Québec à Montréal

8 NRC·CNRC

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NCAR UCAR EOL Earth Observing Laboratory

https://www.eol.ucar.edu/field_projects/wintre-mix

NYS Mesonet University at Albany

NSF AGS-2113995

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Project Overview

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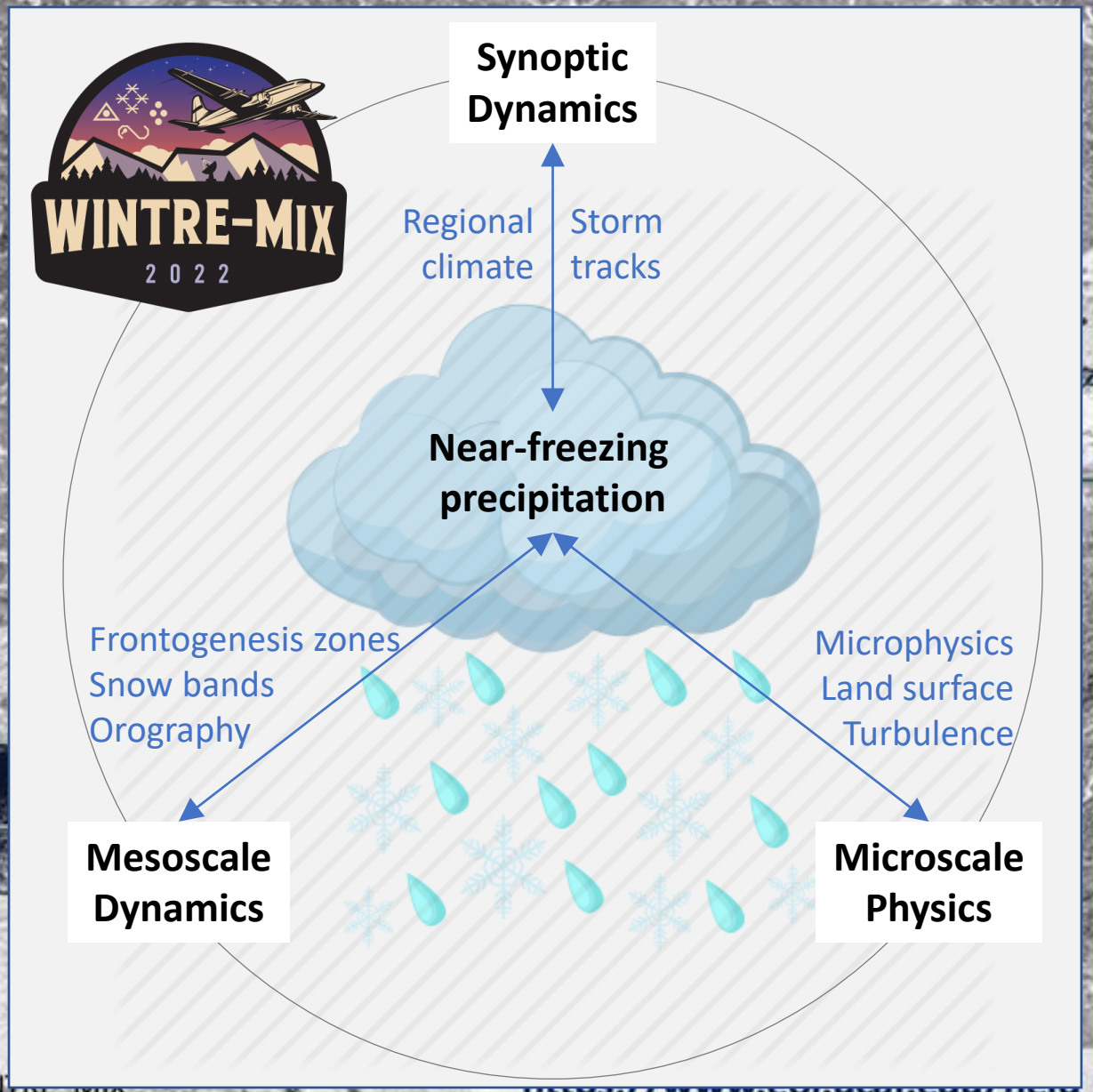
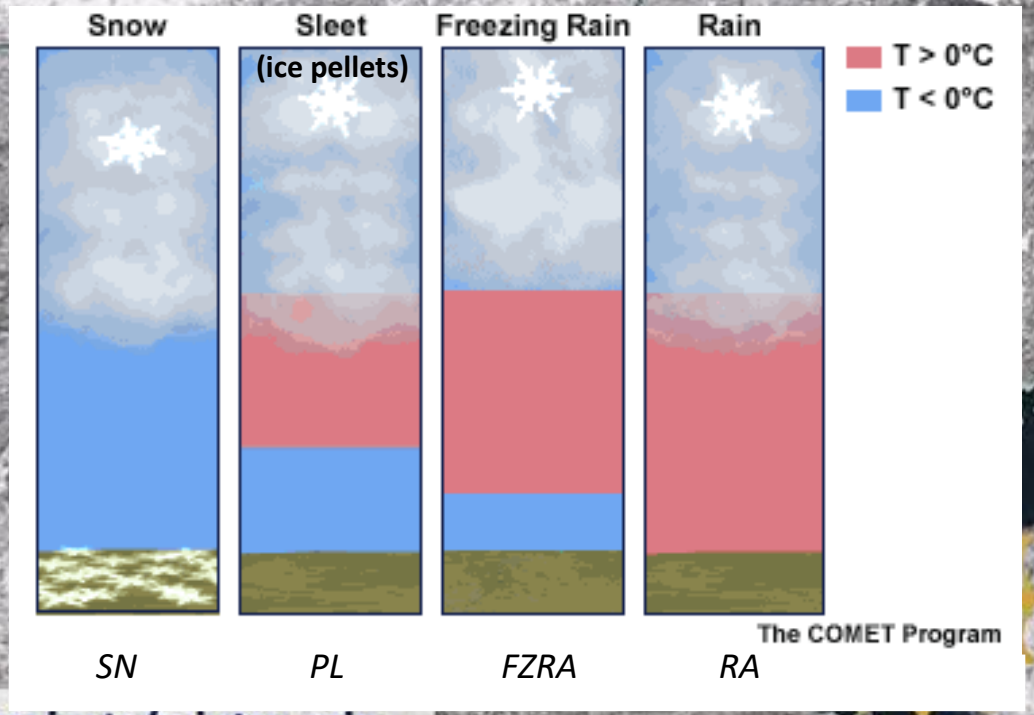
Winter Precipitation Type Research Multi-scale Experiment



Focus & Goal

To better understand how multi-scale processes influence the variability and predictability of precipitation type and amount under near-freezing surface conditions.



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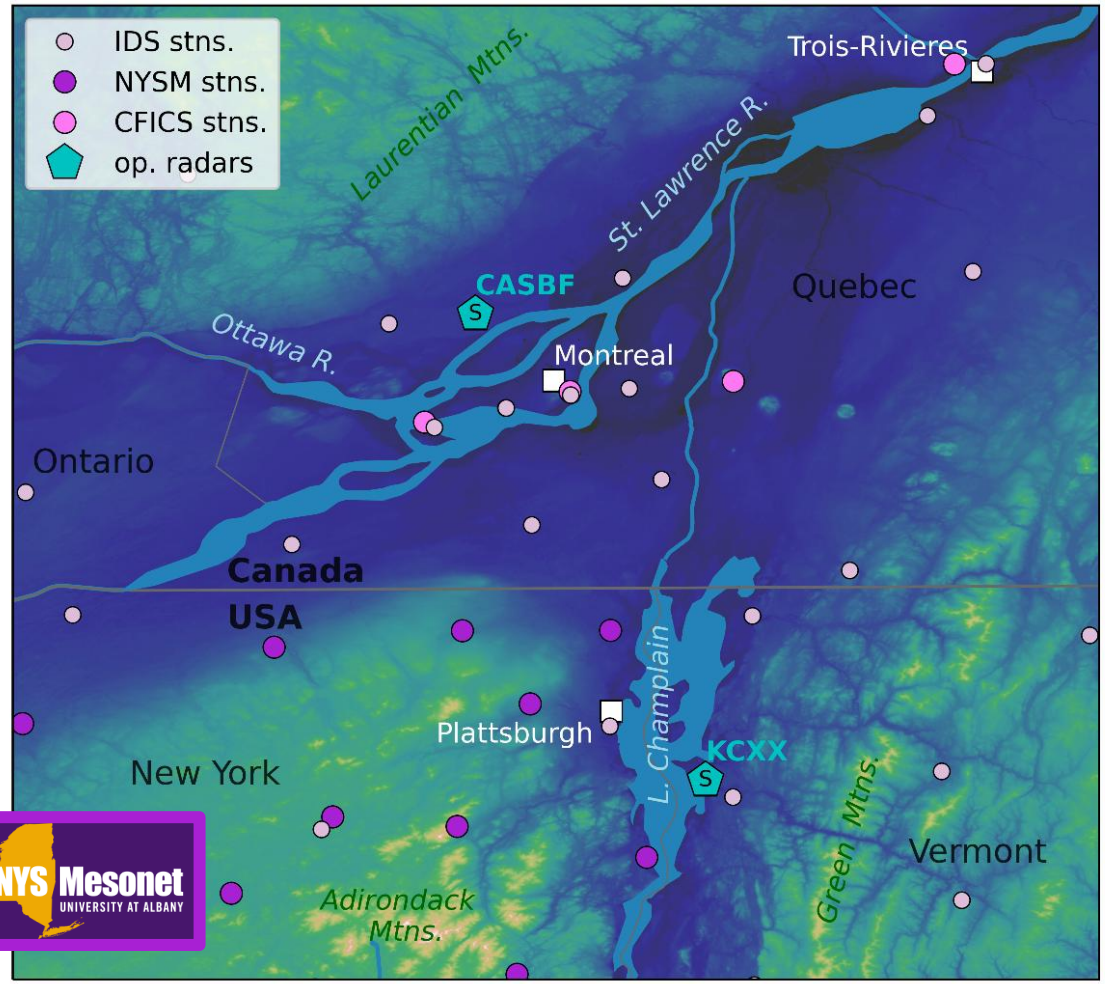
When & Where?



- US (NY) – CAN (QC) boarder region
- St. Lawrence / Champlain Valleys
- 1 February – 15 March 2022
- 11 intensive observing periods (IOPs)

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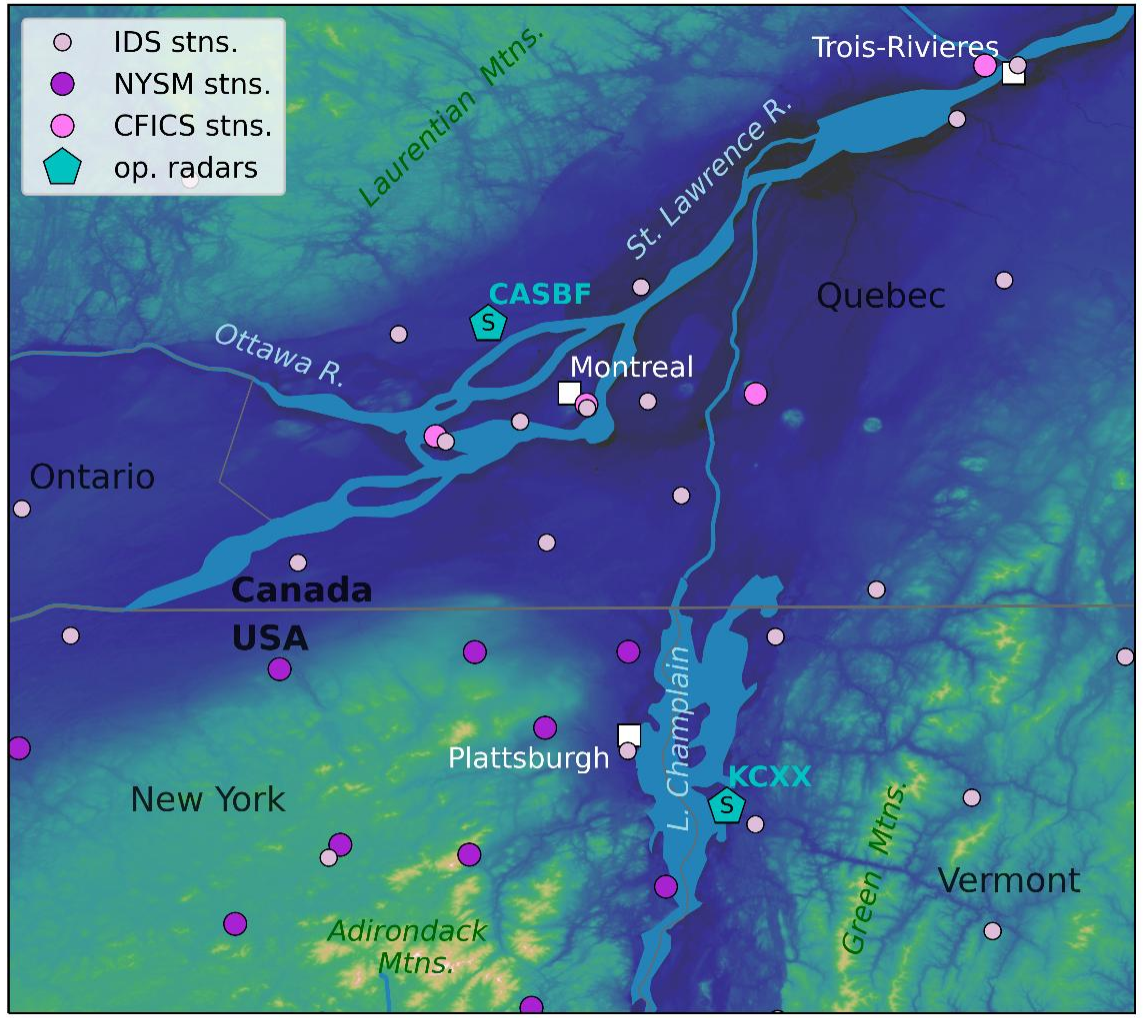
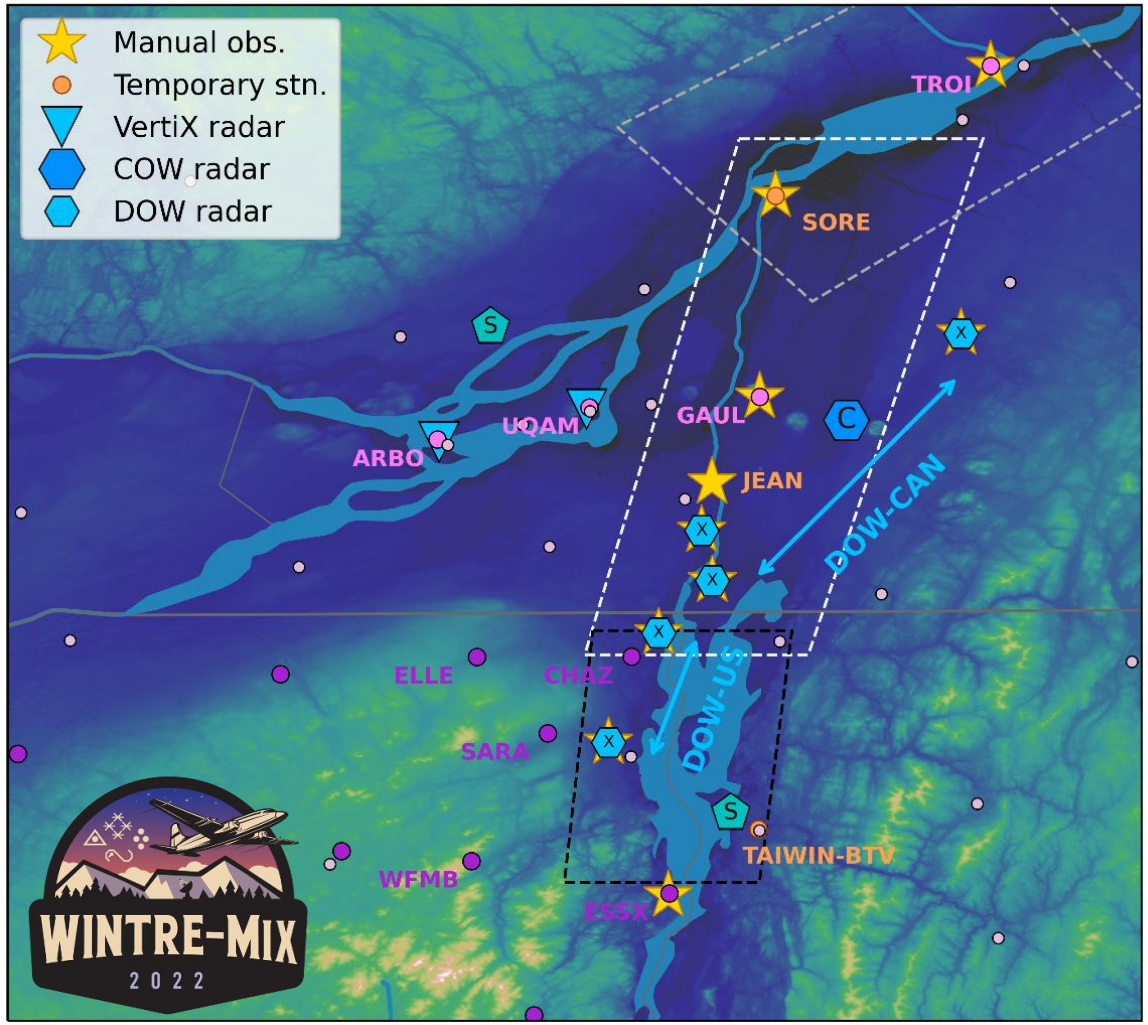
Deployment Overview





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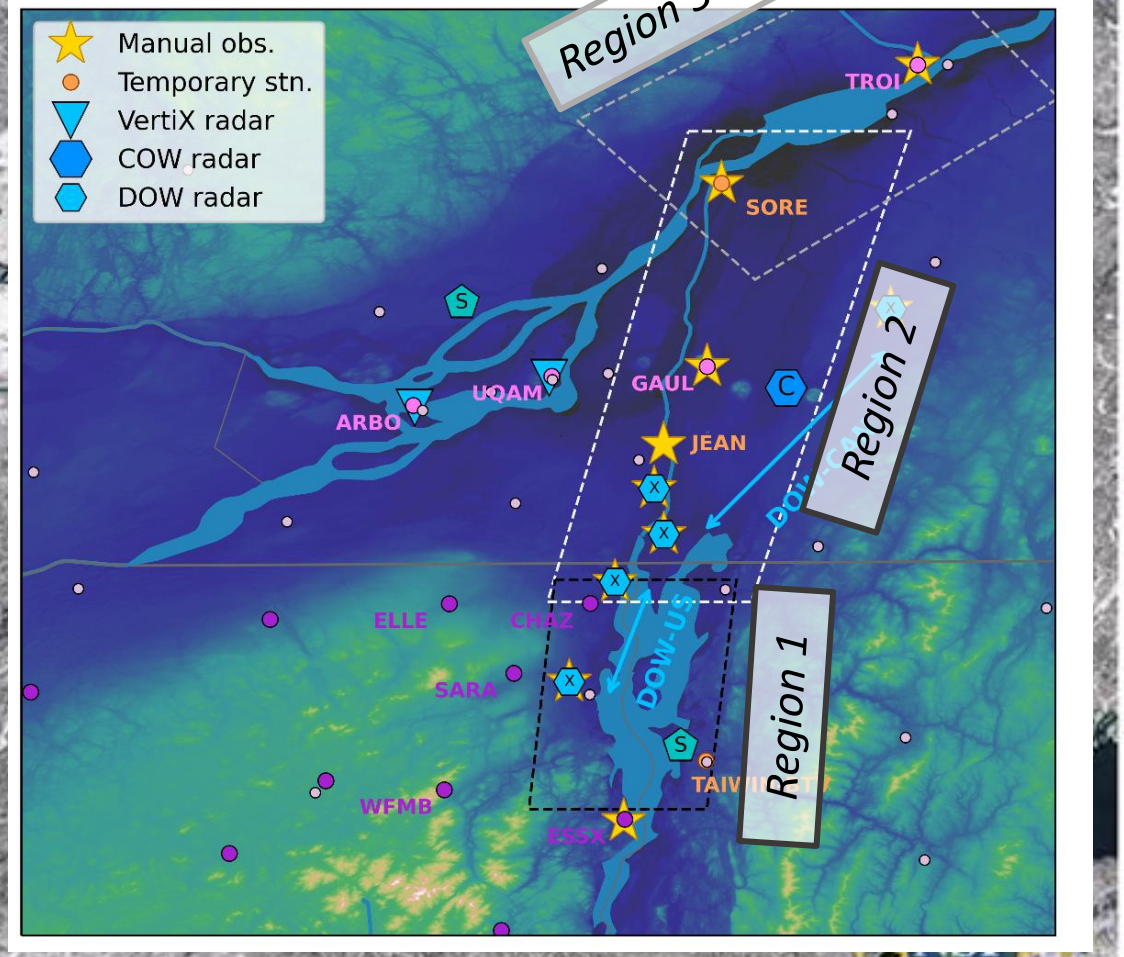
Observations: *Research aircraft*

NRC Convair-580

National Research Council Canada

- Thermodynamics, winds
- Rich array of in situ microphysics probes
- Profiling radar (W-, X-band) and lidar
- Capable of operating in icing conditions
- 9 research flights (~4 hours each)
- 3 regions of operation



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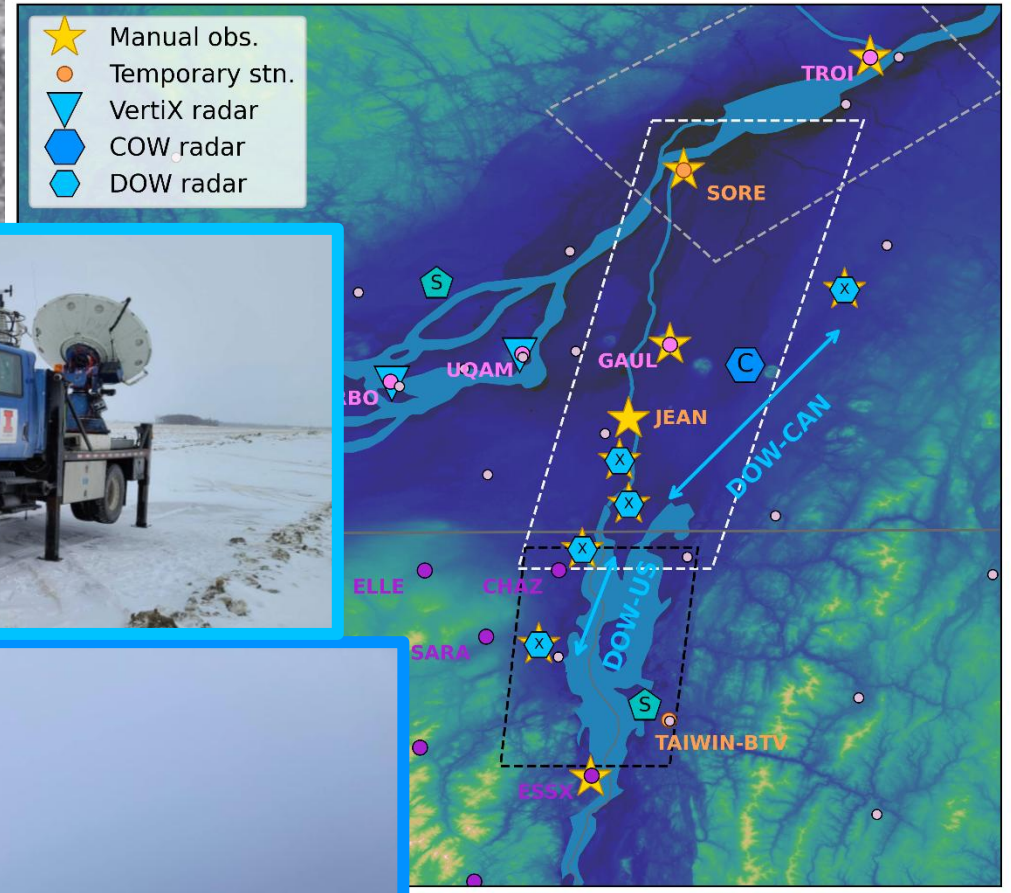
Observations: *Mobile radars*

Doppler on Wheels (DOW)
- x2 Mobile X-band scanning radars
- Dual-pol
- one in NY one in QC

C-band on Wheels (COW)
- C-band scanning radar
- Dual-pol
- Deployed at fixed location in QC

FARM
Flexible Array of Radars and Mesonets



Scans
- PPIs, RHIs, vertical
- Synchronized for dual-Doppler analysis

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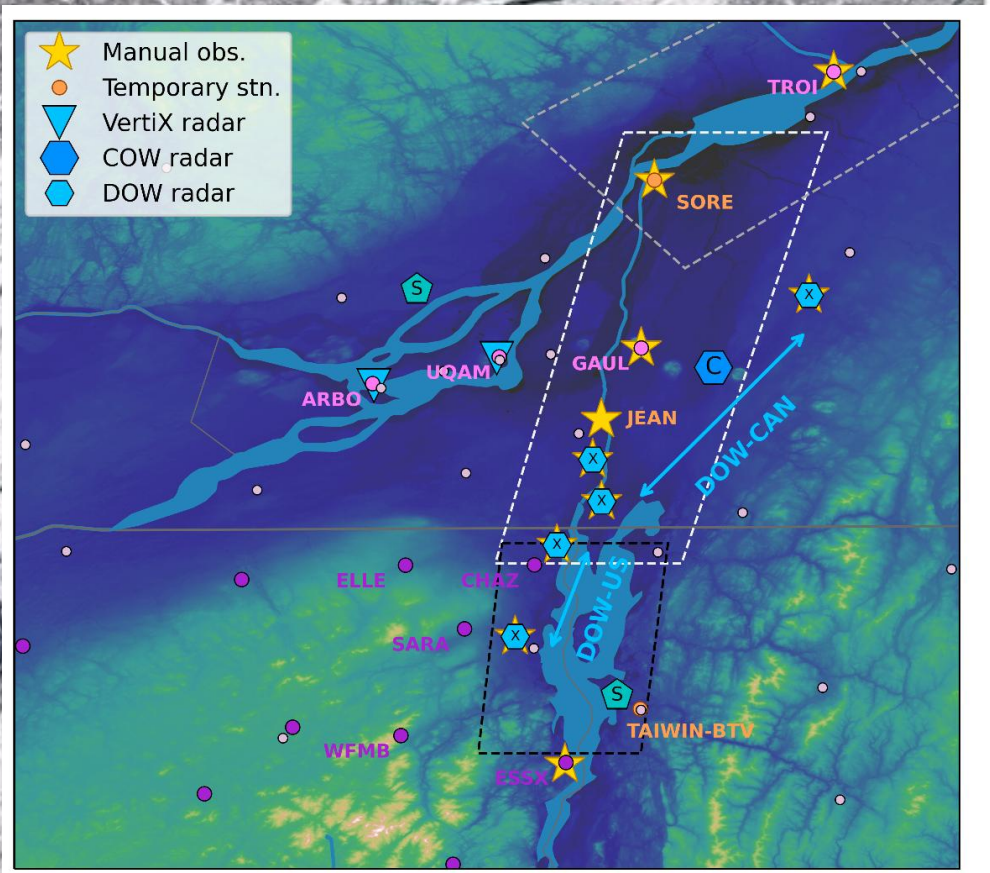
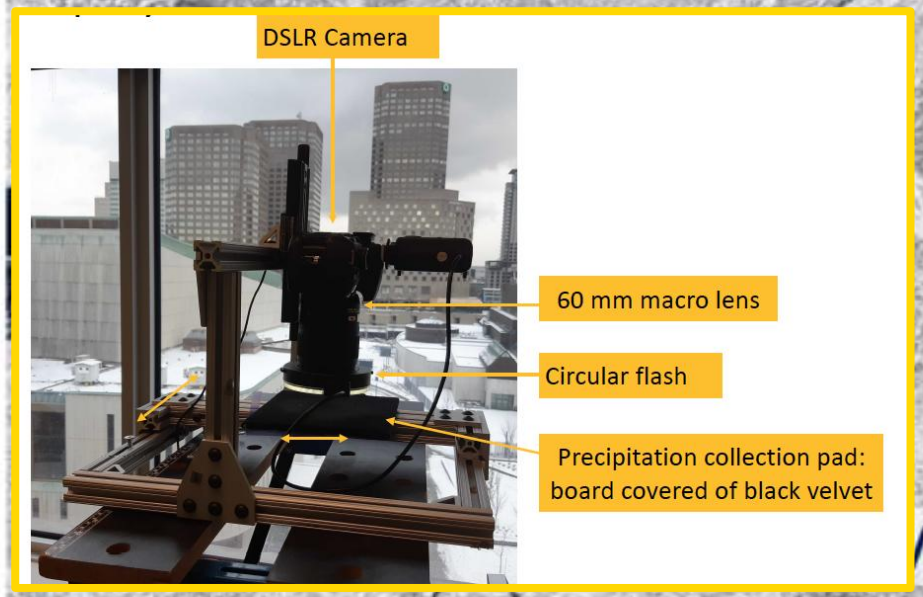
Observations:
Soundings & Manual precipitation observations

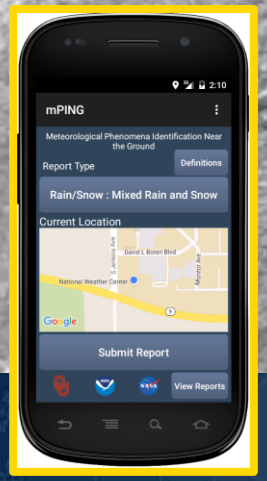
4 teams
- UAlbany, UQAM, CU, McGill
- Led by students/postdoc

Research soundings:
- ~200 sondes launched

Manual hydrometeor observations:
- Manual ID
- Photography
- Manual accumulation (snow & ice)







mPING
crowdsourcing weather reports

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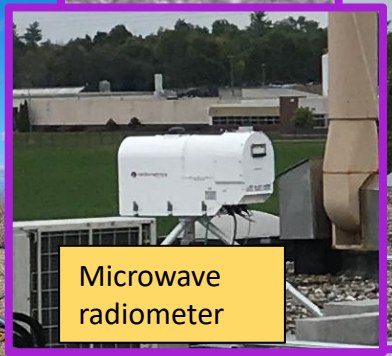
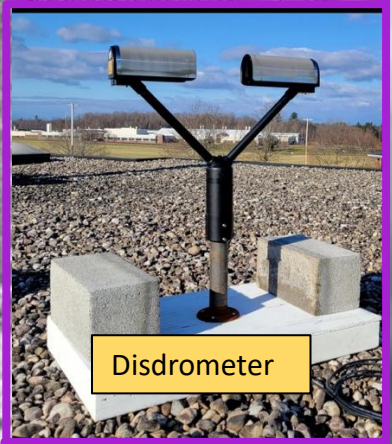
Observations:
Advanced surface stations


MRR-2 radar


Microwave radiometer

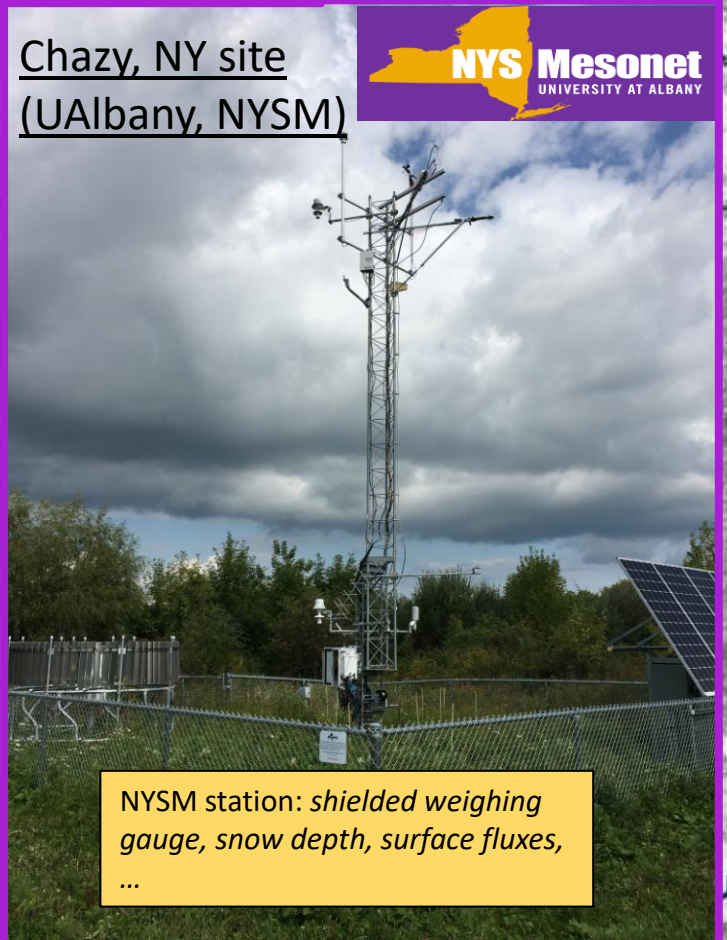

Doppler lidar

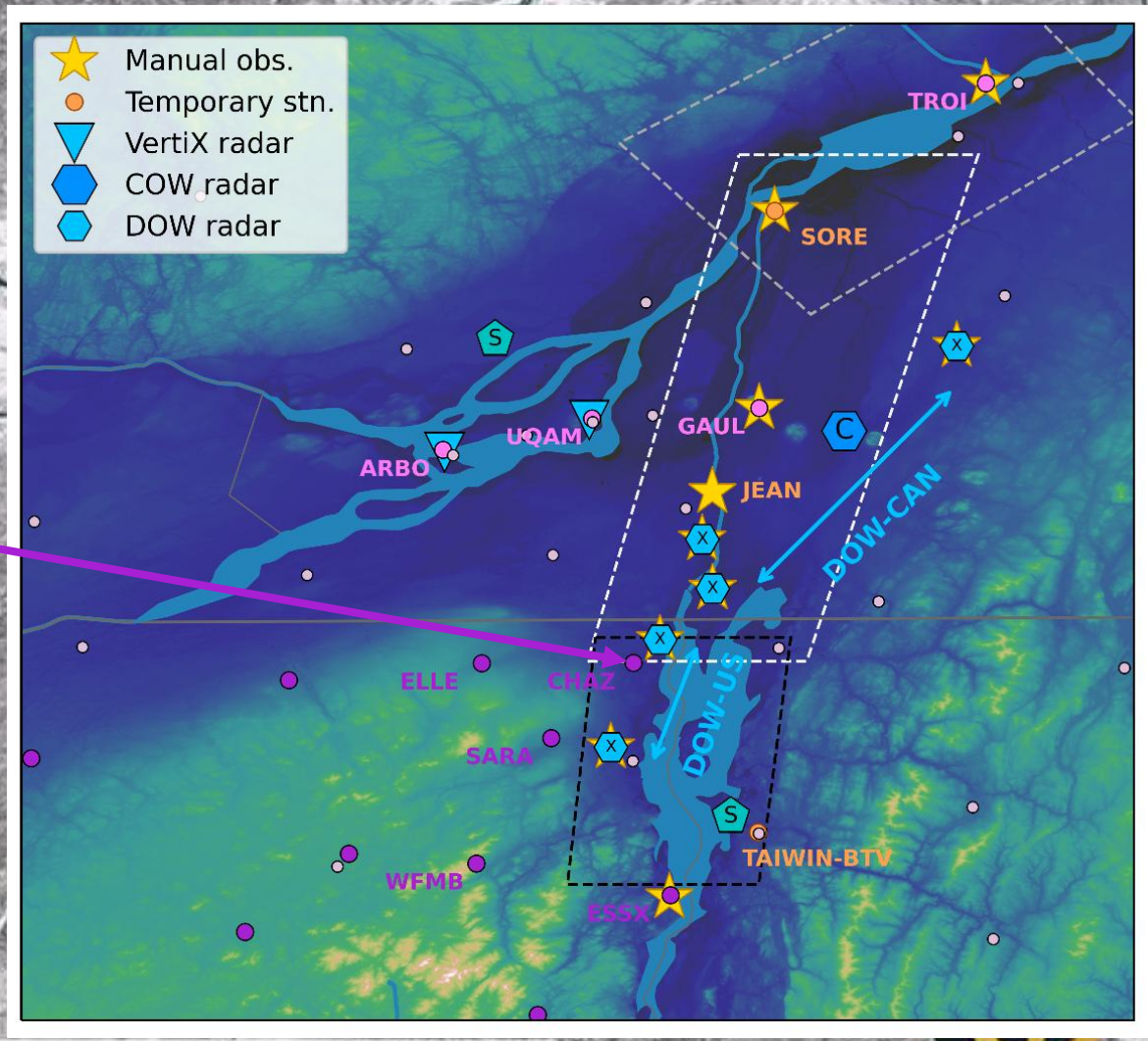

Disdrometer


Ice detector

Chazy, NY site (UAlbany, NYSM)

NYS Mesonet UNIVERSITY AT ALBANY


NYSM station: *shielded weighing gauge, snow depth, surface fluxes, …*



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Example results

Intensive observing period #5 (IOP5)

- 22–23 February 2022
- Warm air advection over persistent shallow cold air in St. Lawrence Valley
- (PL to) FZRA to RA transition

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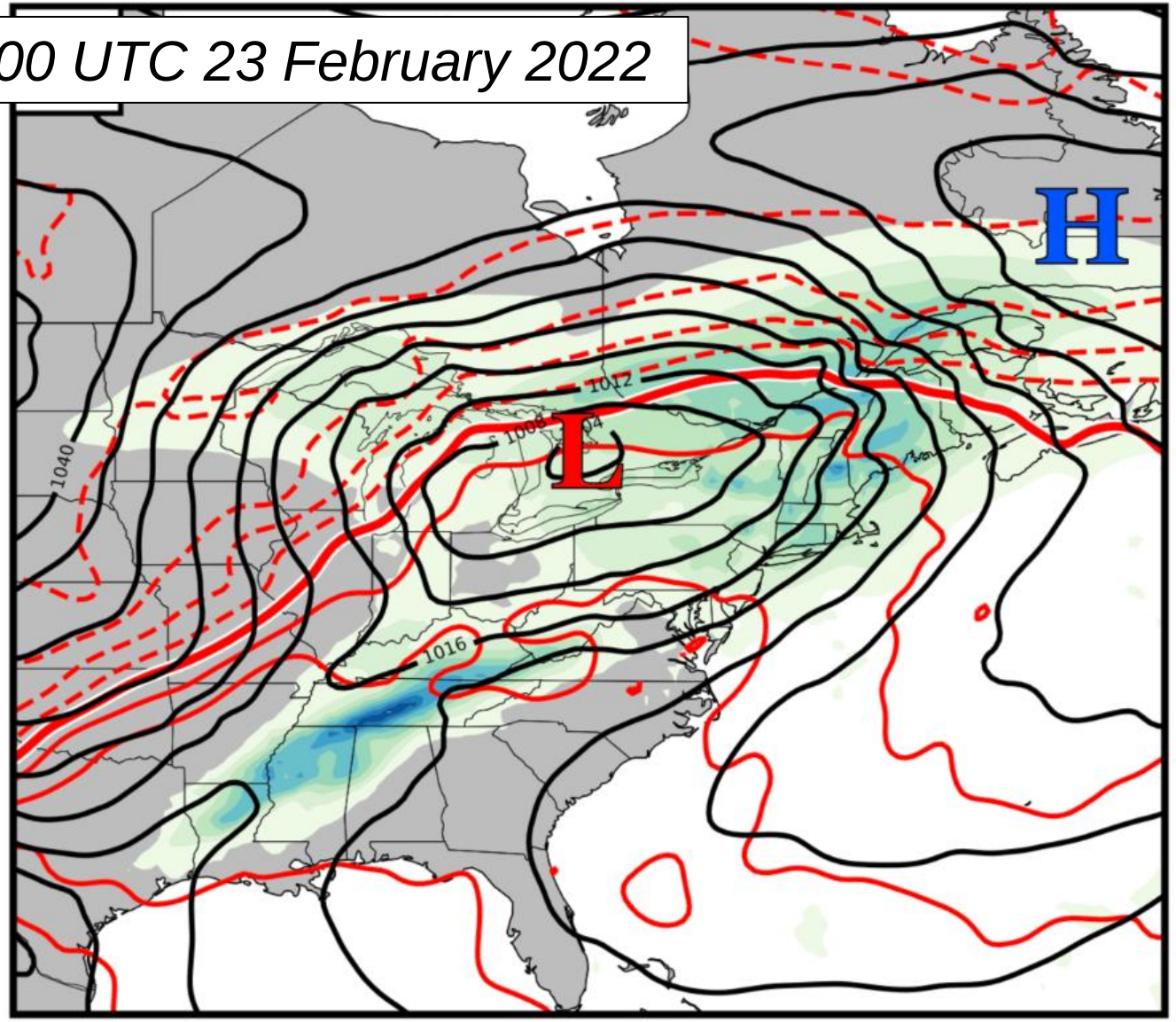
IOP5:
Synoptic environment (ERA-5)

SLP (black contours)
850-hPa T (red, dashed where <0°C)
Event-total precipitation (shaded)

0000 UTC 23 February 2022



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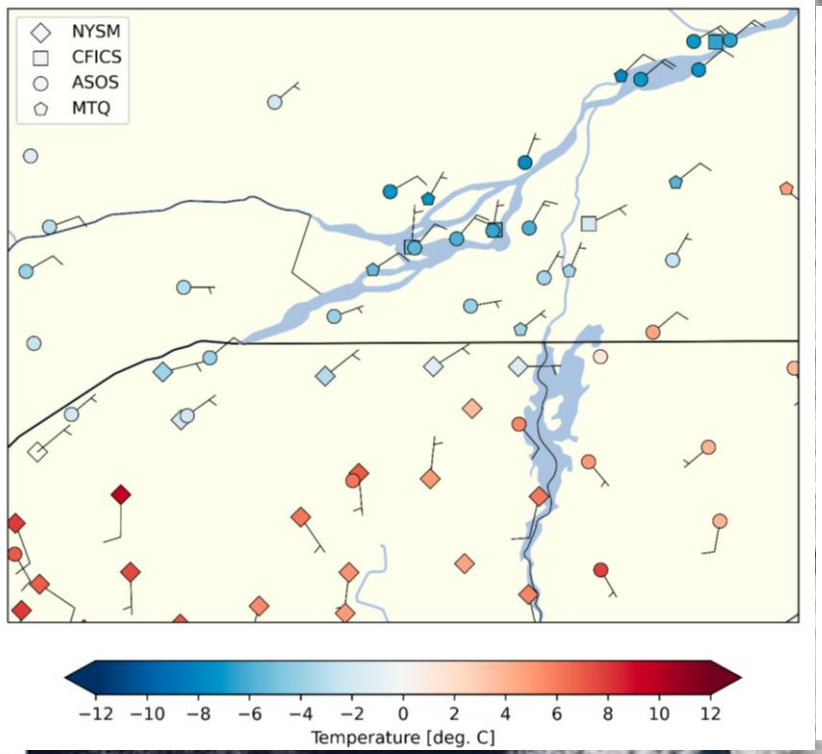
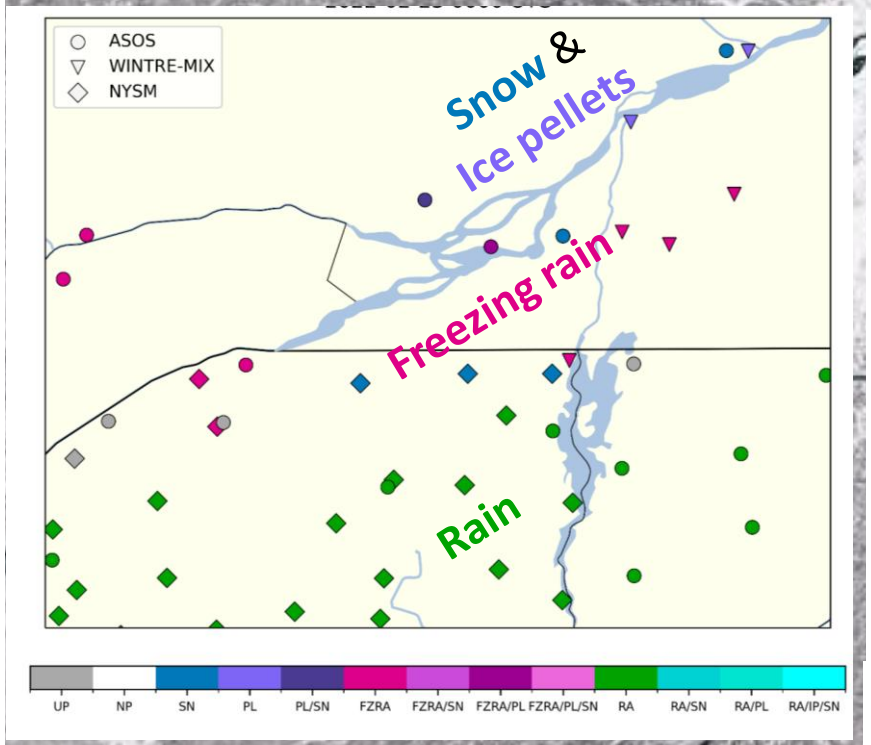
IOP5: *Mesoscale overview*

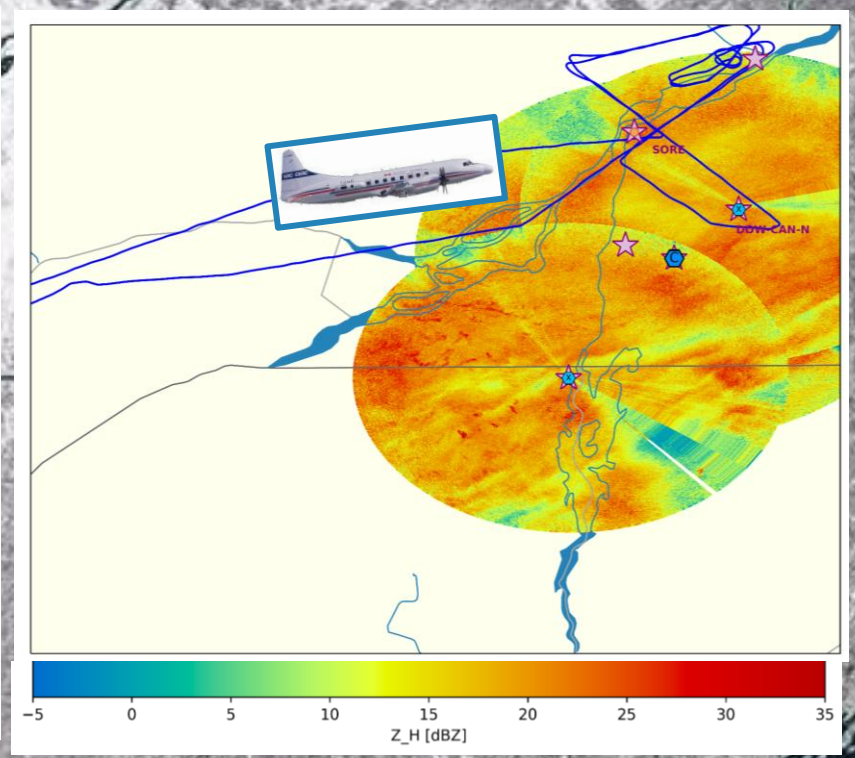
0000 UTC 23 February 2022



2-m Temperature
10-m winds (full barb = 5m/s)



Observed/diagnosed p-type



DOW & COW refl. (2° PPI)
Convair flight track (blue line)

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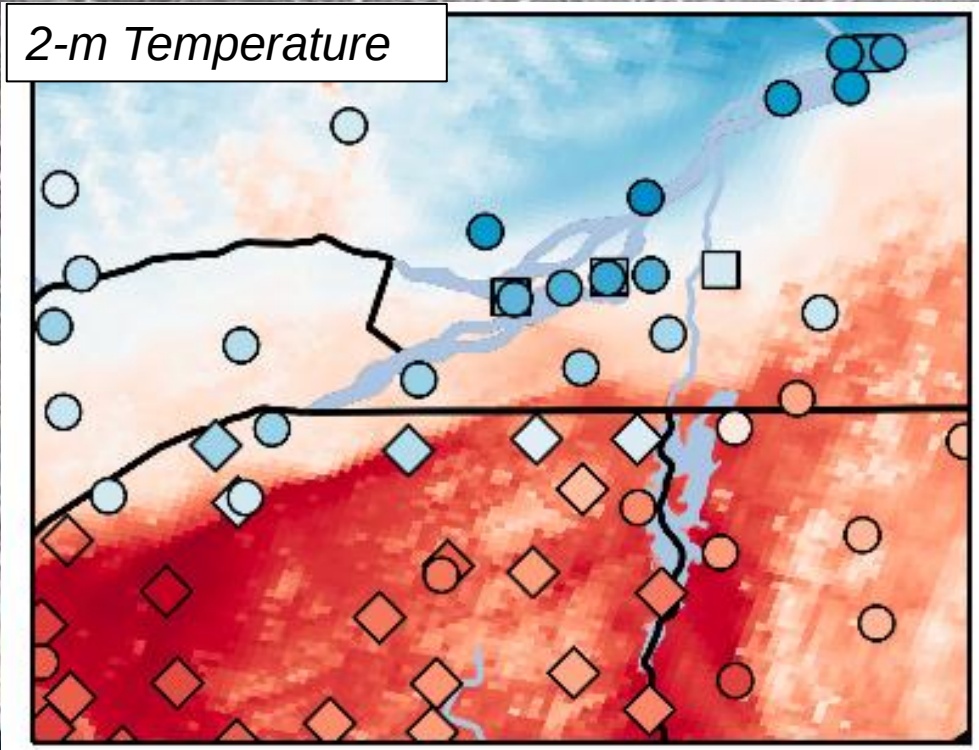
IOP5: ***HRRR Model evaluation***

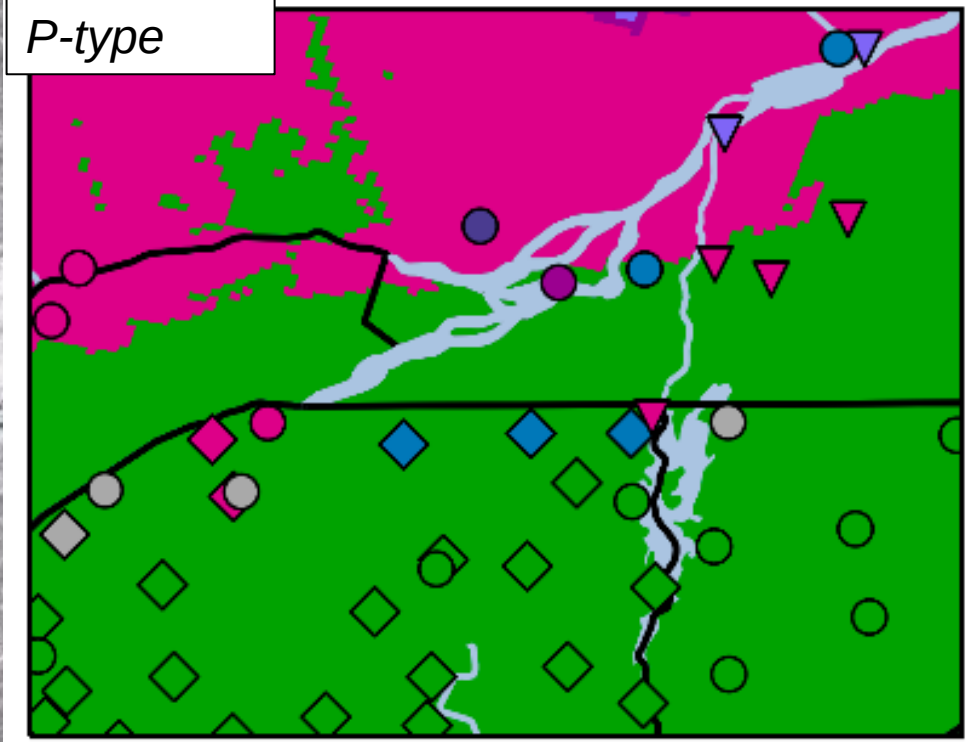
0000 UTC 23 February 2022

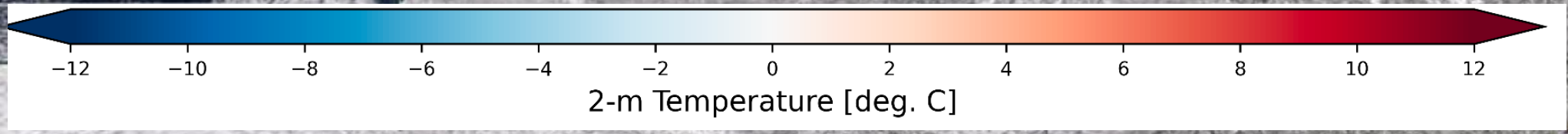
HRRR 12-h forecast (shaded), obs. (markers)

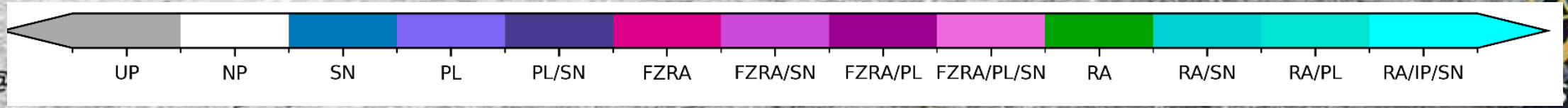
2-m Temperature



P-type







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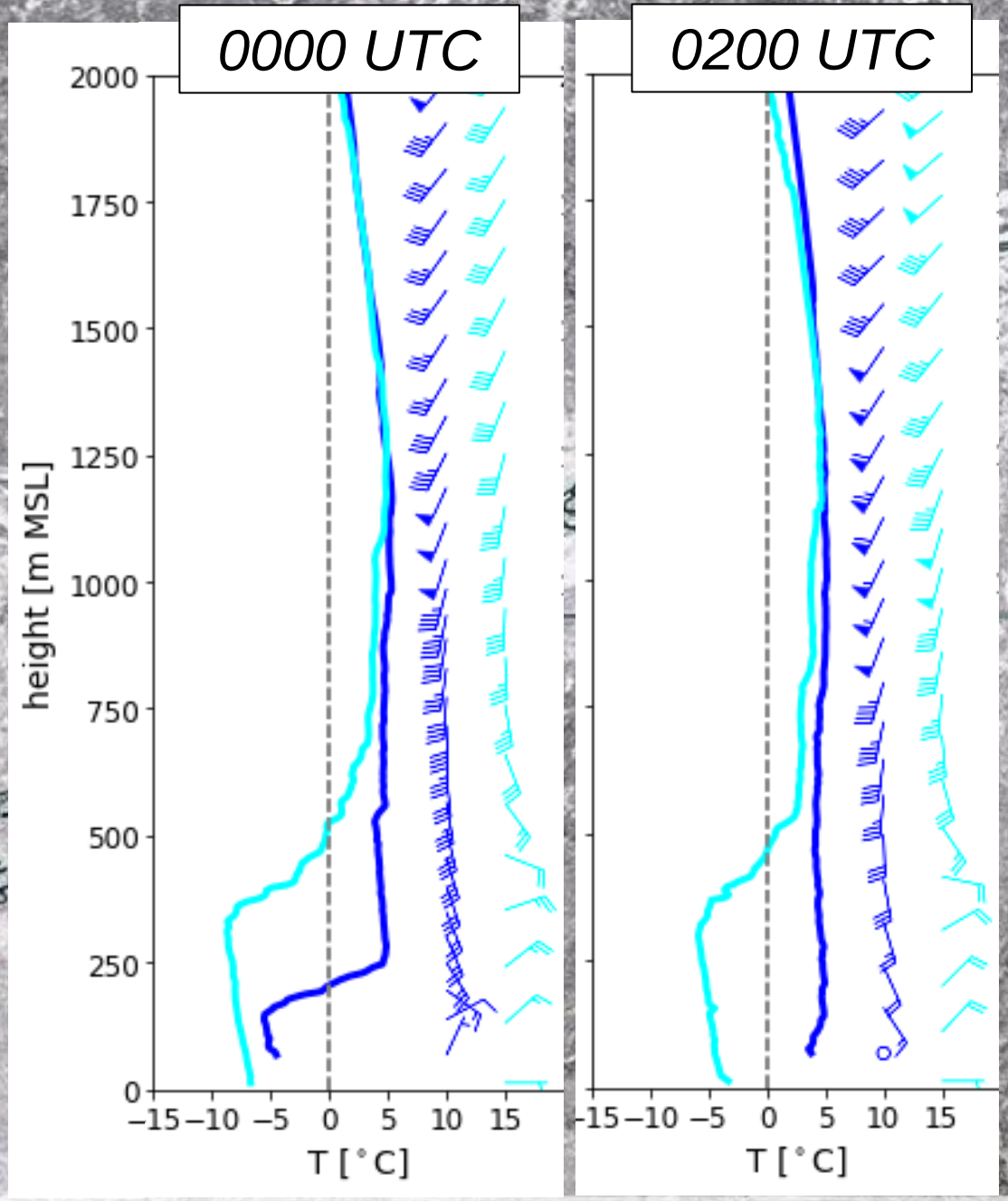
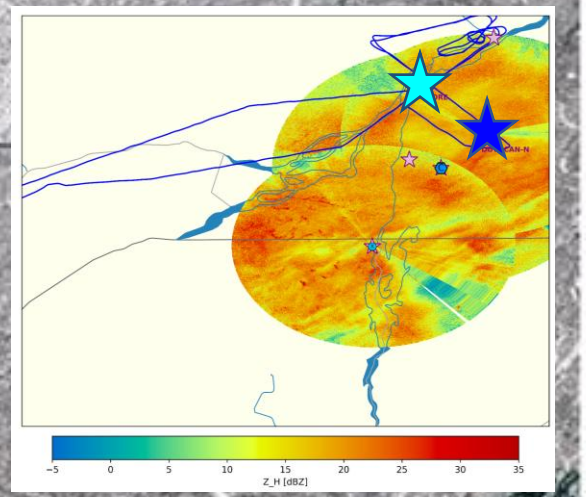
IOP5: ***Soundings***





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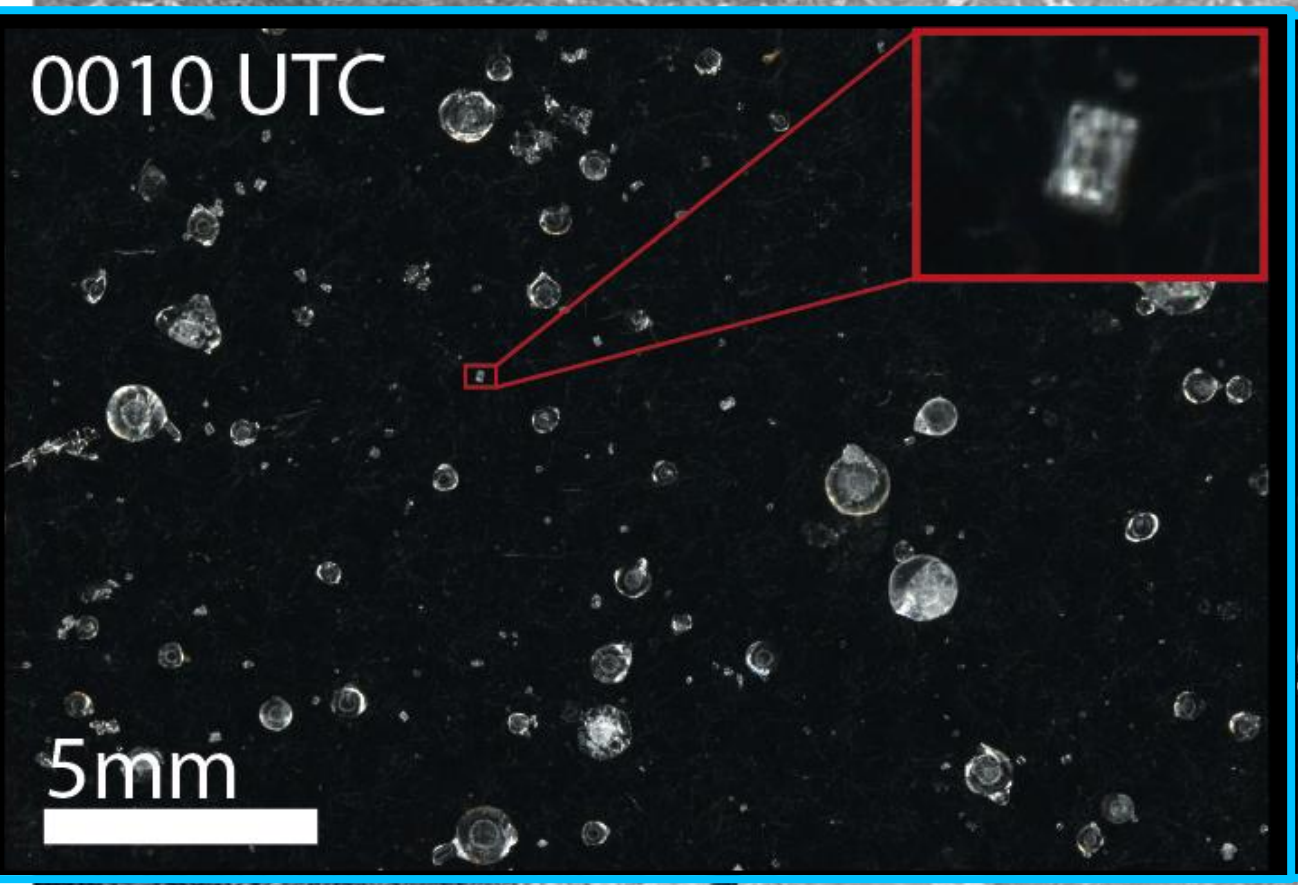
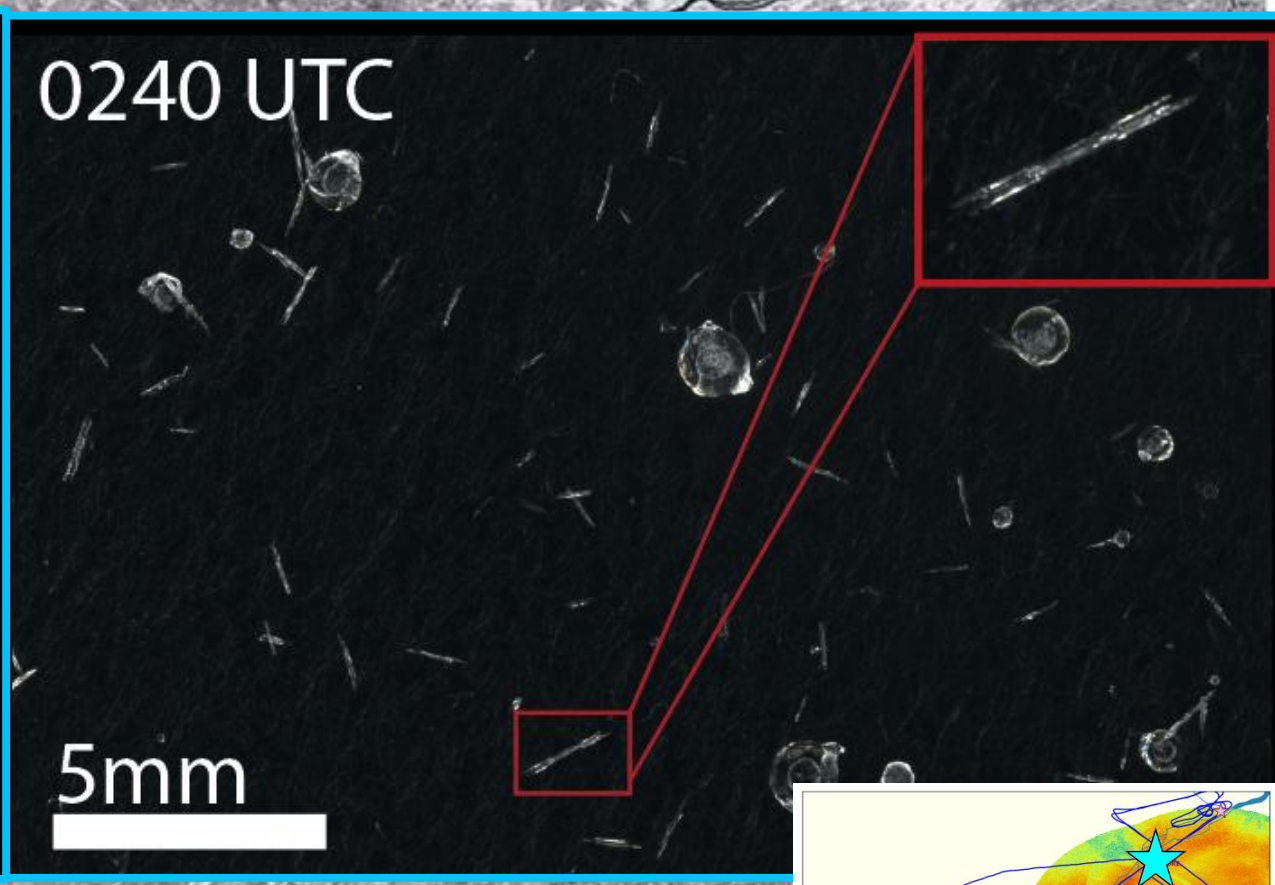
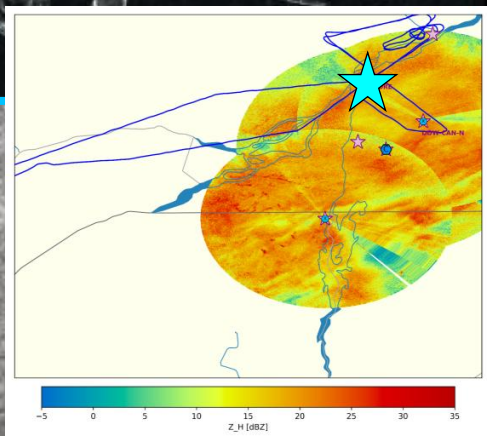
IOP5: *Manual photography*







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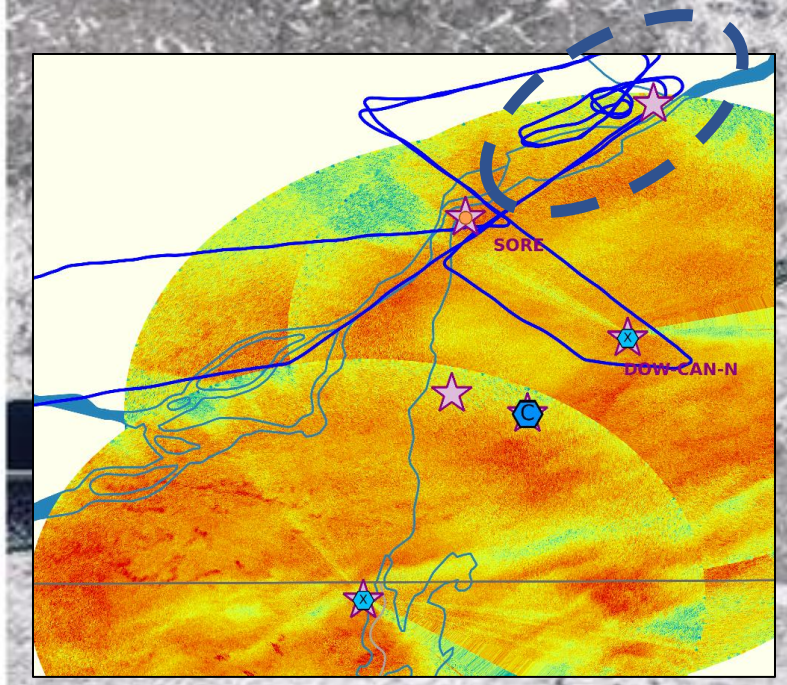
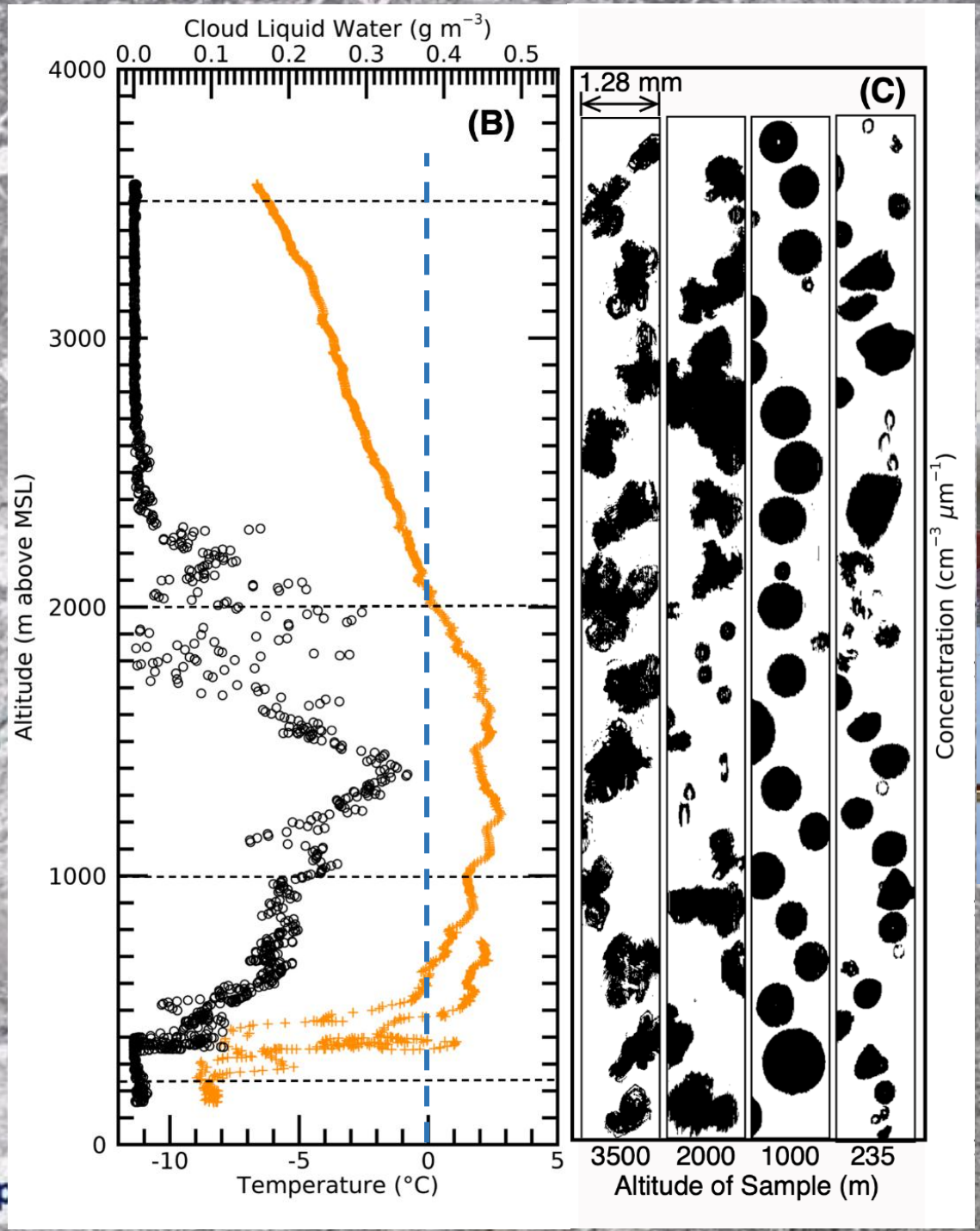
Observations:
Research aircraft

Data from missed approach at Trois-Rivieres





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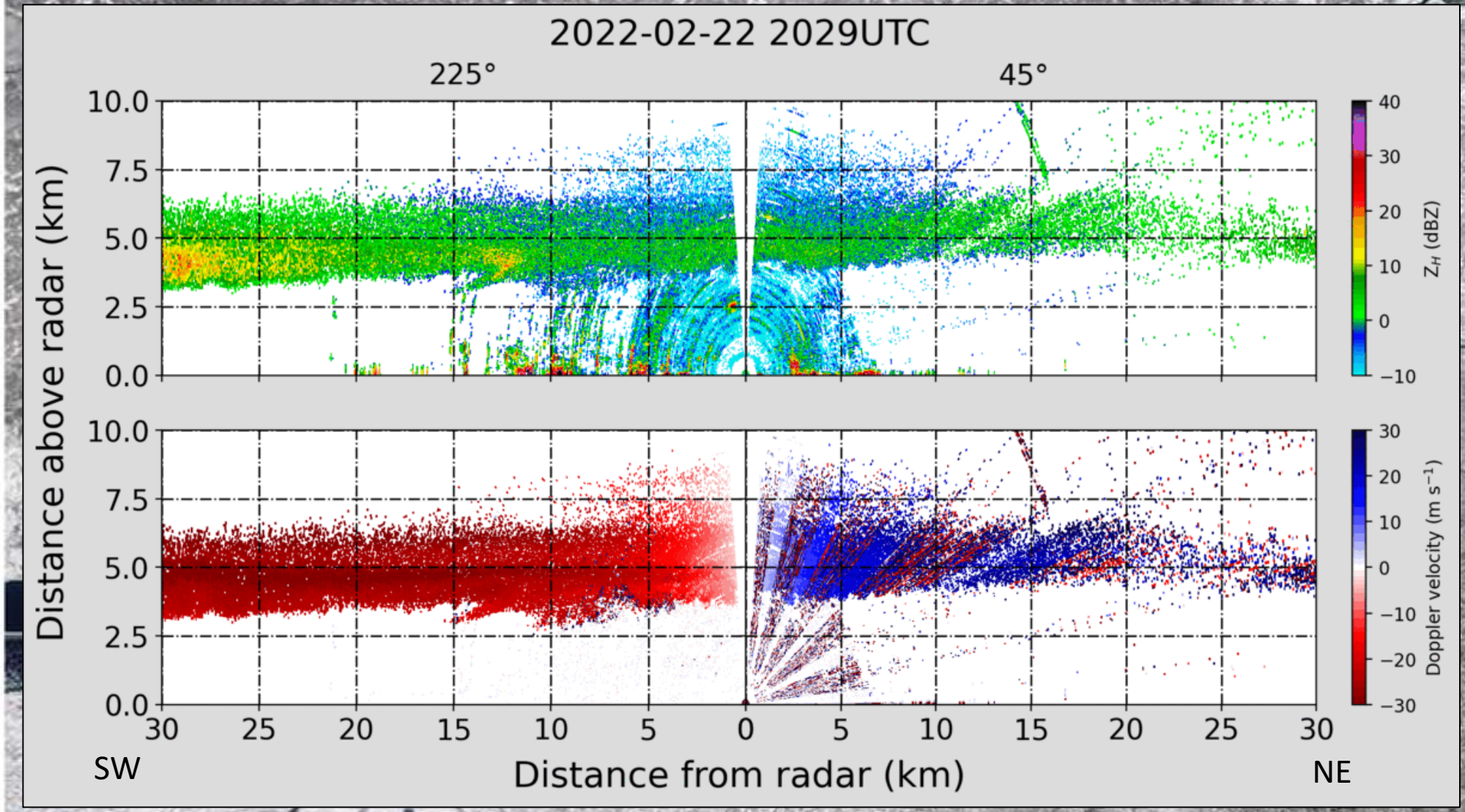
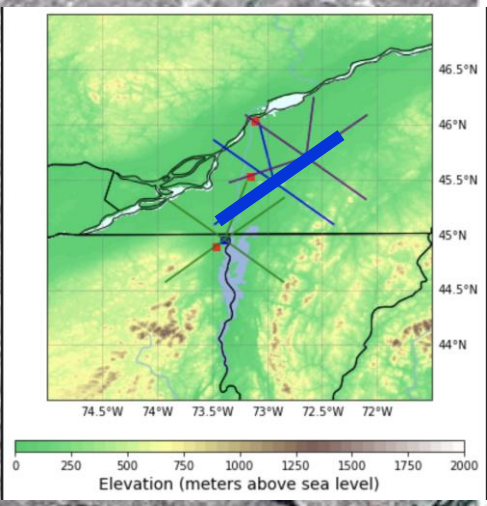
IOP5: *COW radar – along-valley RHIs*





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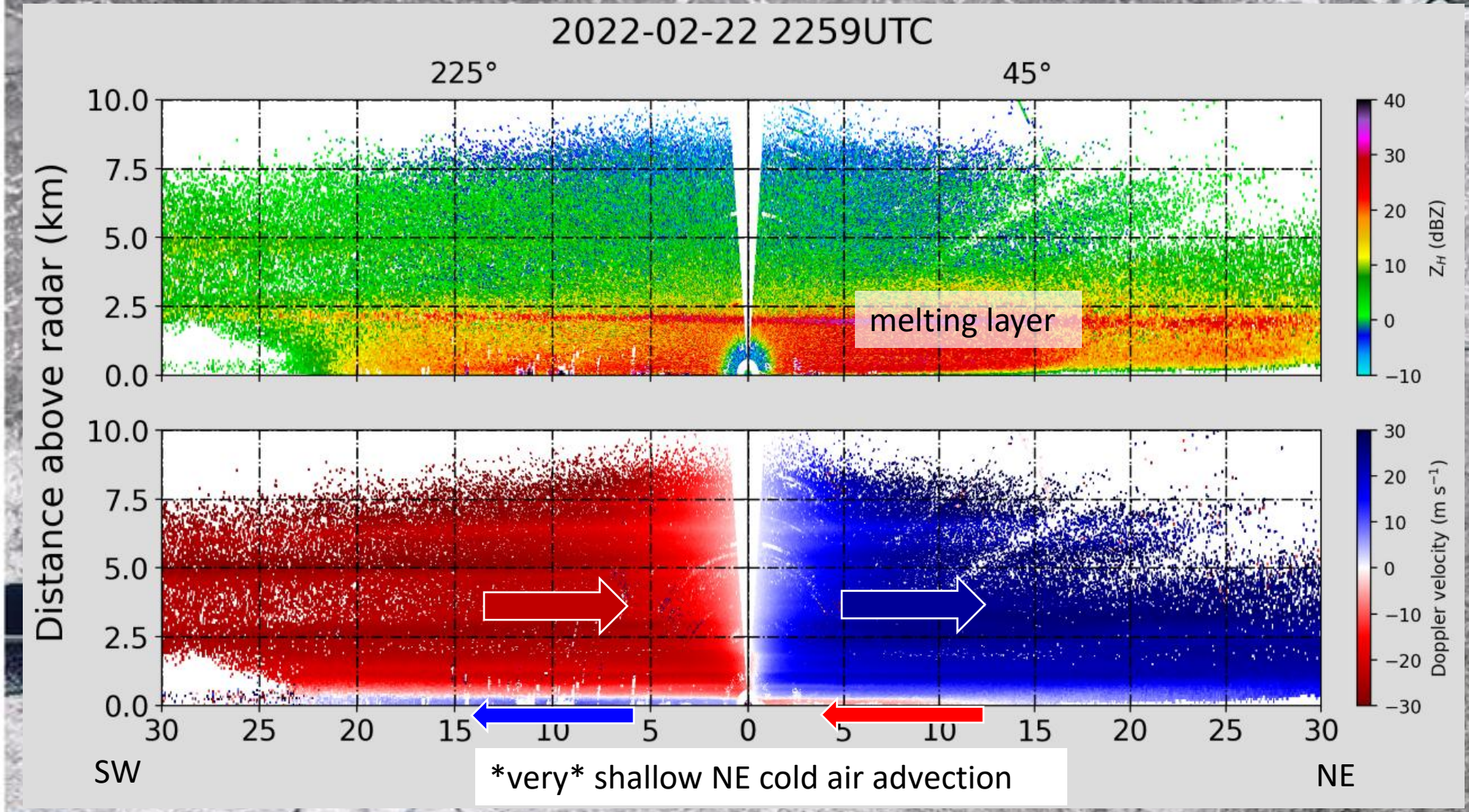

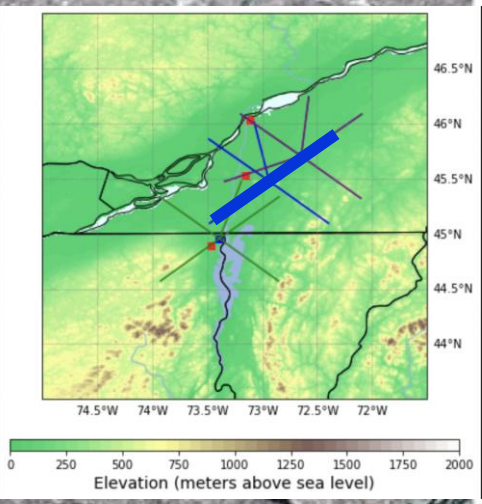

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Applications of WINTRE-MIX observations/results

- Use WINTRE-MIX observations to evaluate, improve, and develop observational diagnostics
  - …from stations, satellite, radar, …
  - Including data fusion with AI/ML
- Use WINTRE-MIX observations to evaluate and improve numerical forecasts
  - …from operational and experimental NWP models
  - Including probabilistic forecasting techniques

Motivating questions for this workshop:

- *What are key needs of stakeholders affected by winter p-type?*
- *How can WINTRE-MIX (and other novel research) help?*

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Summary

- WINTRE-MIX is studying the variability and predictability of precipitation type and amount under near-freezing surface conditions
  - Field campaign:1 February – 15 March 2022
  - Initial analysis underway
- Multi-faceted observations in northern NY and southern QC
  - Advanced mesonets
  - NRC Convair-580 research aircraft
  - FARM mobile radars
  - Research soundings, manual observations
- **Data published to EOL archive, publicly available**

Justin Minder
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Extra slides

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When & Where?

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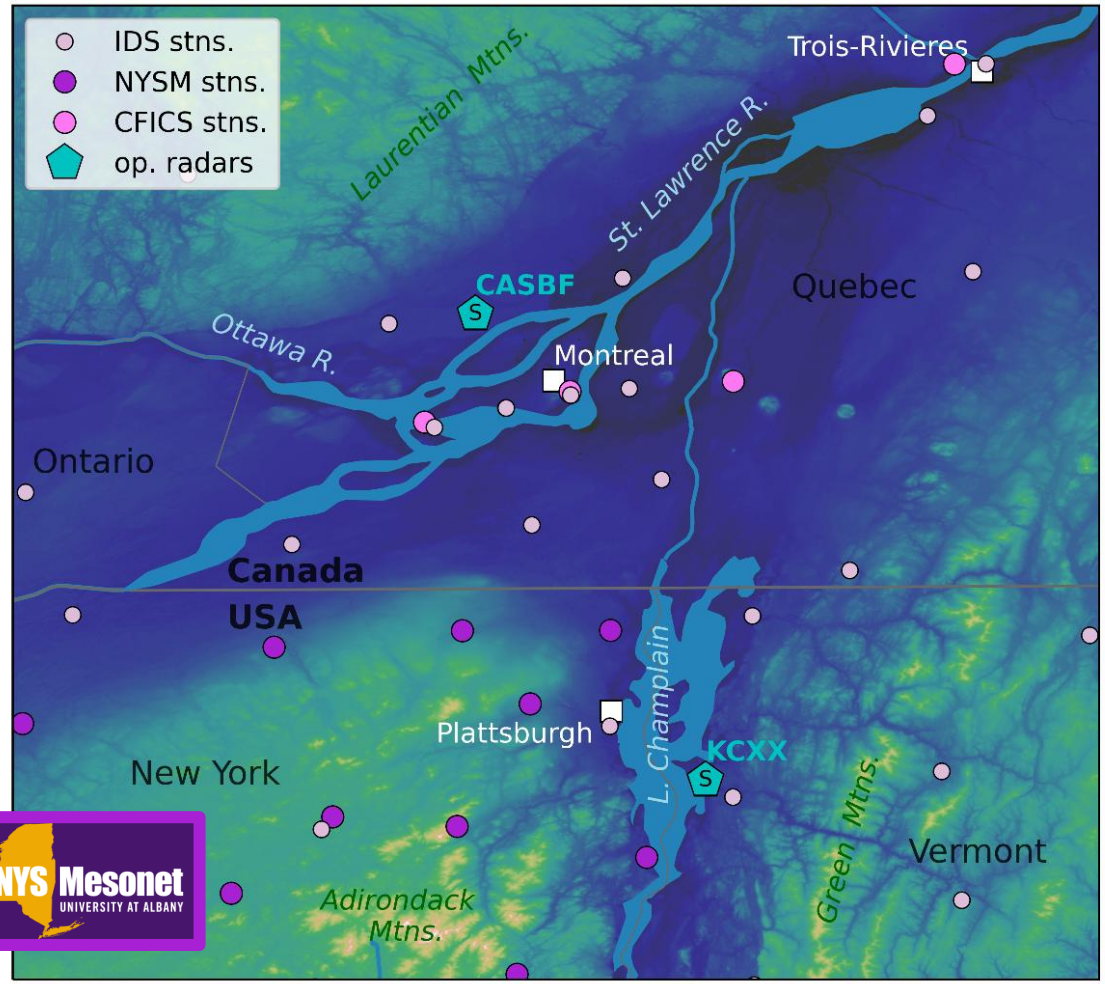

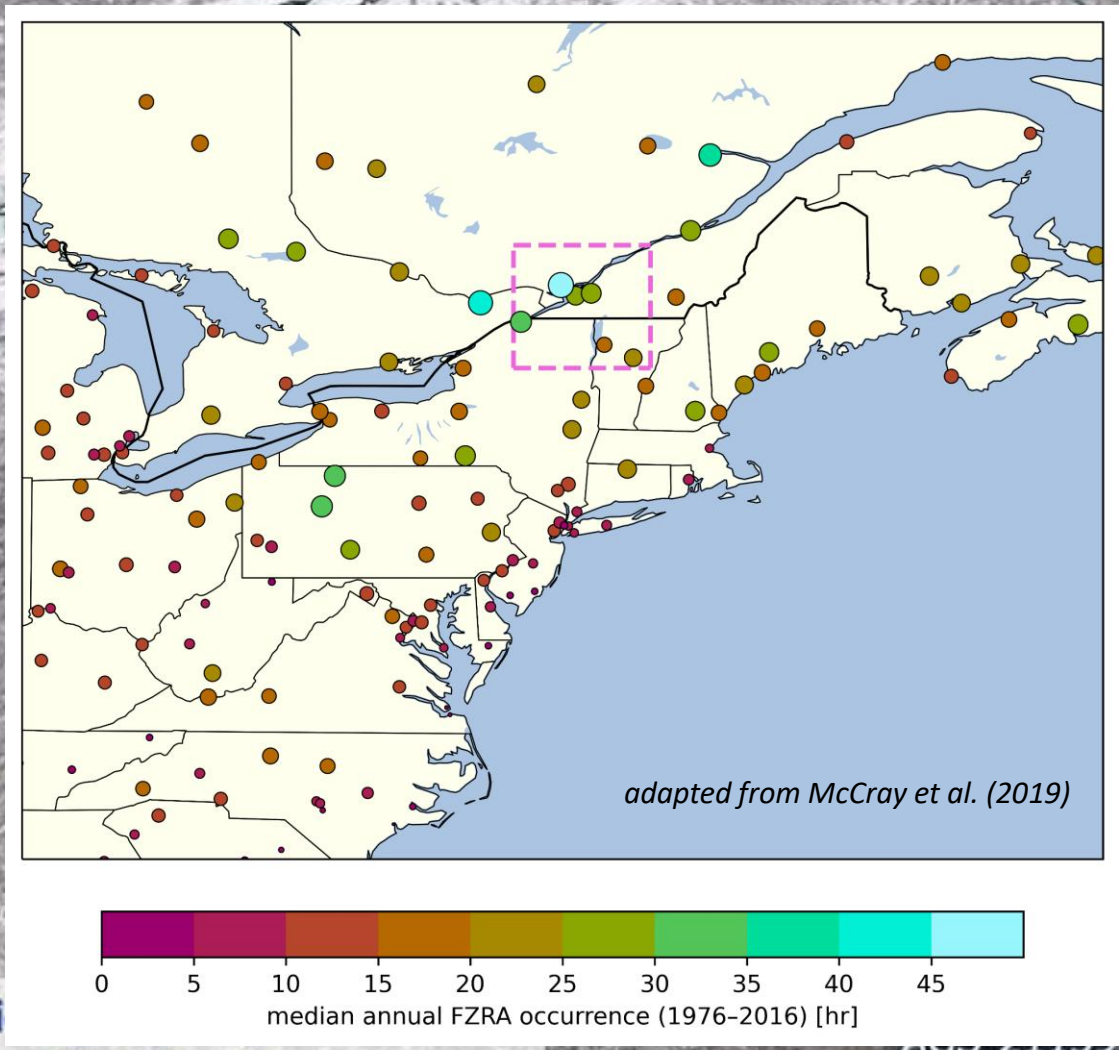


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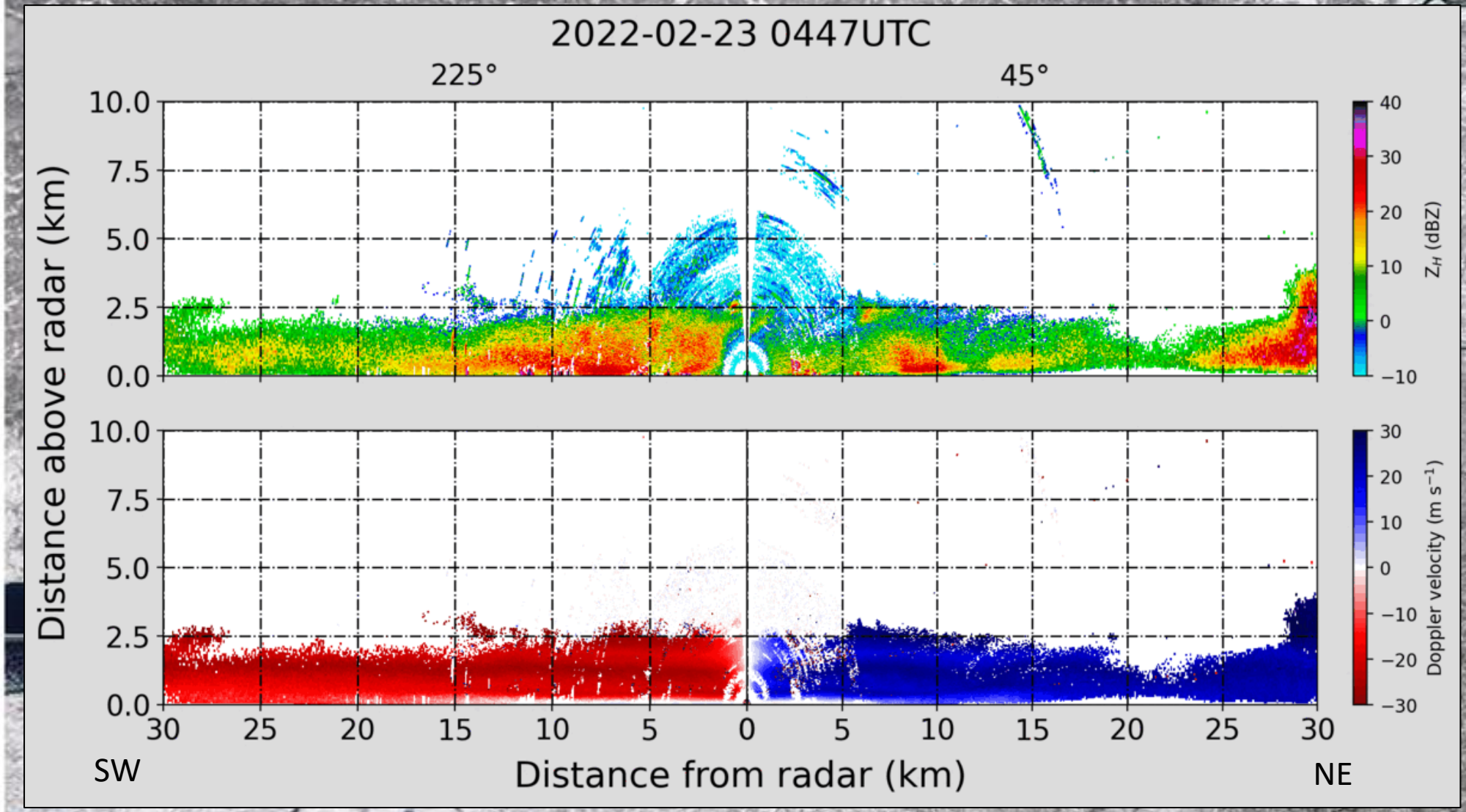
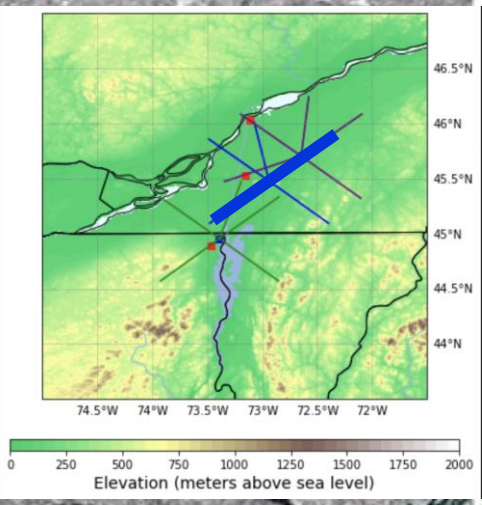
IOP5: *COW radar – along-valley RHIs*



Posters on WINTRE-MIX radar obs.:

- 294 (Friedrich)
- 301 (Fagerson)



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