An overview of the Winter Precipitation Type Research Multi-scale Experiment (WINTRE-MIX)

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

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- Environment and Climate Change Canada – ECCC (Daniel Michelson, Ismail Gultepe)
- National Weather Service – NWS (BTV, Eastern Region)
- Northview Weather (Jason Shafer)
- FAA-TAIWIN demonstration project (Stephanie DeVito)
- NASA-IMPACTS project (Lynn McMurdie)

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Overview

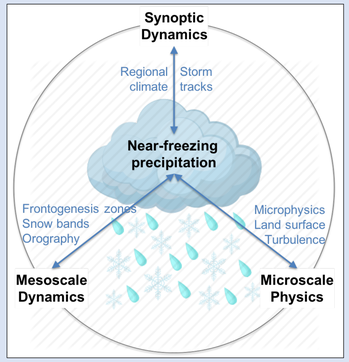
Goal: To better understand how multi-scale processes influence the variability and predictability of precipitation type (p-type) and amount under near-freezing surface conditions.

Basic science questions:
- How do mesoscale dynamics modulate near-freezing precipitation?
- How do microscale processes modulate near-freezing precipitation?
- How do multi-scale processes combine to determine the predictability of near-freezing precipitation?

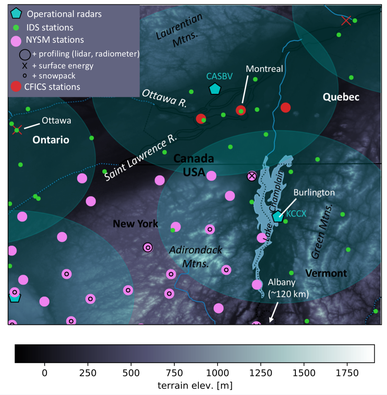
Broader impacts:
- Improved and better-leveraged observations & diagnostics
- Improved and better-leveraged numerical forecasts
- Improved communication between stakeholders, forecasters, researchers
- Educational opportunities through field work, outreach, and citizen science

Approach:
- A focused field campaign to address the above goal and questions
- Time period: 1 Feb – 15 Mar 2022
- Region: Northern New York and southern Quebec
  - Frequent near-freezing precipitation and varied p-types. Events of major societal impact.
  - Important small-scale terrain influences (St. Lawrence R. Valley, L. Champlain Valley)
  - Strong backbone of existing observational networks: New York State Mesonet (NYSM; Brotzge et al. 2020), Canadian Fund for Innovation Climate Sentinel (CFICS) mesonet in Canada, operational weather radars.
- Collaboration with Canadian colleagues, operational agencies (NWS, ECCC), private sector, partner projects (FAA-TAIWIN, NASA-IMPACTS), citizen science (CoCoRaHs, mPING)

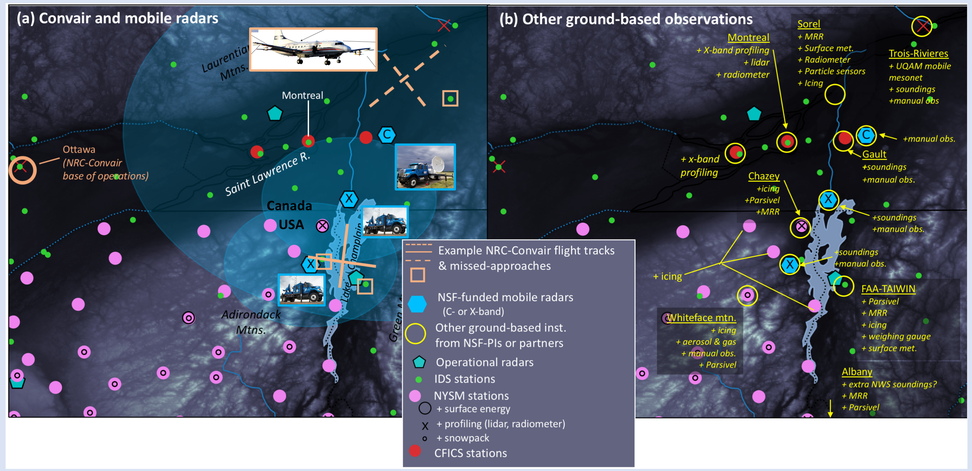
Relevant processes



Region & existing networks



Field observations



Mobile Doppler radars

- From U. Illinois FARM
- 2 X-band "DOW" radars
  - Dual-polarization
  - Deployed at flexible locations near Plattsburgh, NY and Montreal, QC
- 1 C-band "COW" radar
  - Dual-polarization, dual-frequency
  - Deployed at fixed location in Quebec

FARM
Flexible Array of Radars and Mesonets

Research aircraft

National Research Council Canada

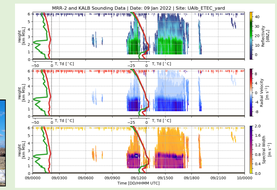
- National Research Council of Canada Convair-580
- Rich array of in situ thermodynamics & microphysics probes
- Aerosol sensors
- Profiling radar and lidar
- Well suited for operations in icing conditions
- Based in Ottawa, Canada
- 60 flight hours (about 10-11 research flights)

Advanced surface stations

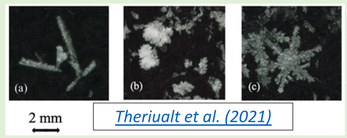
- Built on backbone of advanced NYSM and CFICS networks.
- Advanced sensors include:
  - Profiling radars (Ka-, X-band), lidars, radiometers
  - Shielded weighing & hot-plate precip. gauges, sonic snow depth sensors
  - Icing detectors
  - Optical disdrometers
  - Surface flux measurements

NYS Mesonet
UNIVERSITY AT ALBANY

Example K-band prof. radar data during FZRA



Soundings and manual observations



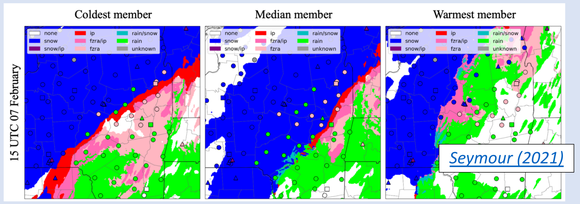
Theriault et al. (2021)

- 4 teams launching soundings in St. Lawrence and Champlain Valleys (~70 sondes each)
- Manual observations of hydrometeor type, snow accumulation, ice accretion
- Hydrometeor macrophotography

Mesoscale modeling

- Observations will be used to evaluate and constrain high-resolution NWP
- Numerical experiments will be used to examine specific physical processes, including roles of terrain features, ice nuclei, small-scale turbulence
- Ensemble experiments (IC/BC perturbations, stochastic physics) will be used to investigate how various uncertainties (e.g., cloud physics, turbulence, large-scale atmospheric circulation) affect p-type predictability

Simulated (shading) vs. observed (points) p-type from 20-member GEFS-forced IC/BC ensemble



Seymour (2021)

Learn more and get involved!

- Check out our webpage (https://www.eol.ucar.edu/field_projects/wintre-mix)
- View observations on our field catalog (http://catalog.eol.ucar.edu/wintre-mix)
- Follow us on social media (https://twitter.com/WINTRE_MIX)
- Collect observations via mPING (https://mping.nssl.noaa.gov/)