https://worldview.earthdata.nasa.gov/

UAlbany update and plans

@WINTRE_MIX

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

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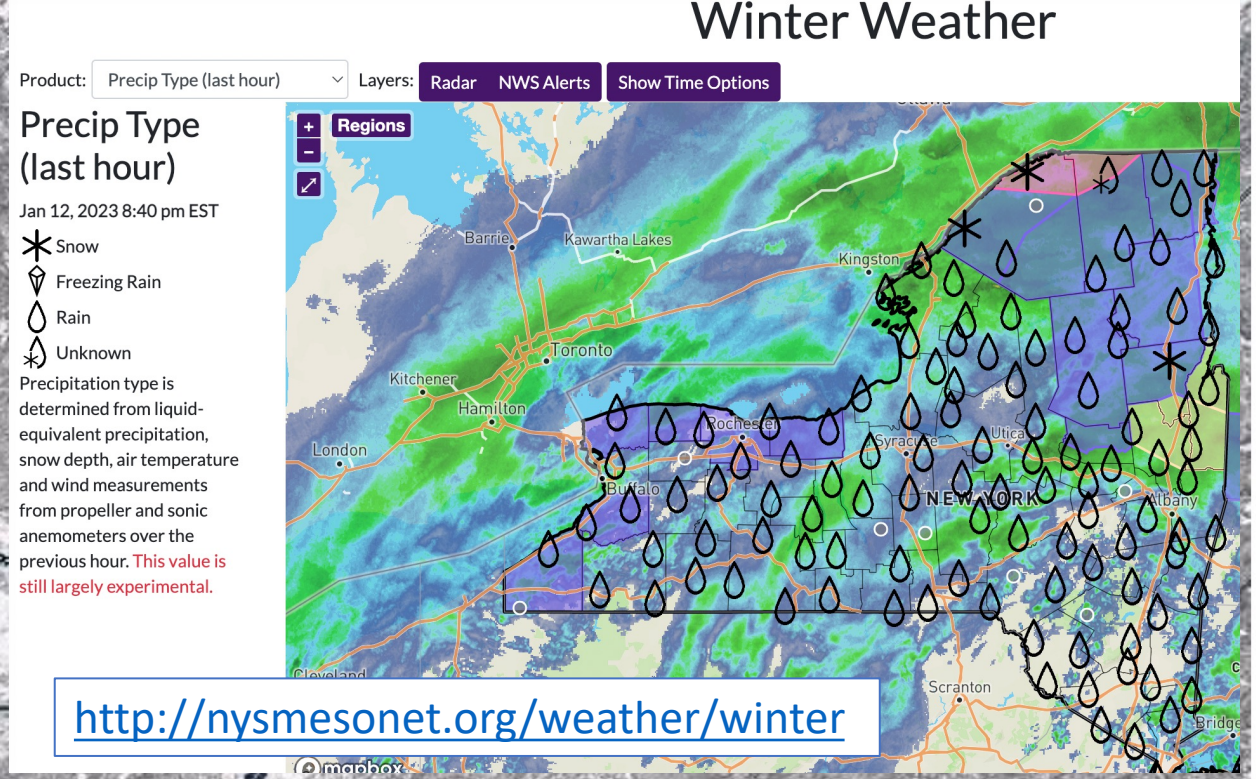
https://worldview.earthdata.nasa.gov/

Ongoing work:
P-type & ice product evaluation/development



http://nysmesonet.org/weather/winter

<u>So far (w/ John England, NYSM)</u>

- Initial attempt at automated p-type diagnosis from Climate Sentinels
- Icing detectors currently deployed:
  - NYSM stations: CHAZ, WFMB, REDH
  - UAlbany

<u>Future plans</u>

- Deploy icing detector near Whiteface Mountain summit
- Evaluate/refine automated p-type diagnostics from NYSM and CFICS
- NYSM FRAM-based icing estimates

<u>Potential collaborations</u>

- Work with UQAM / McGill on CFICS p-type?
- NOAA-NSSL for SBC p-type?

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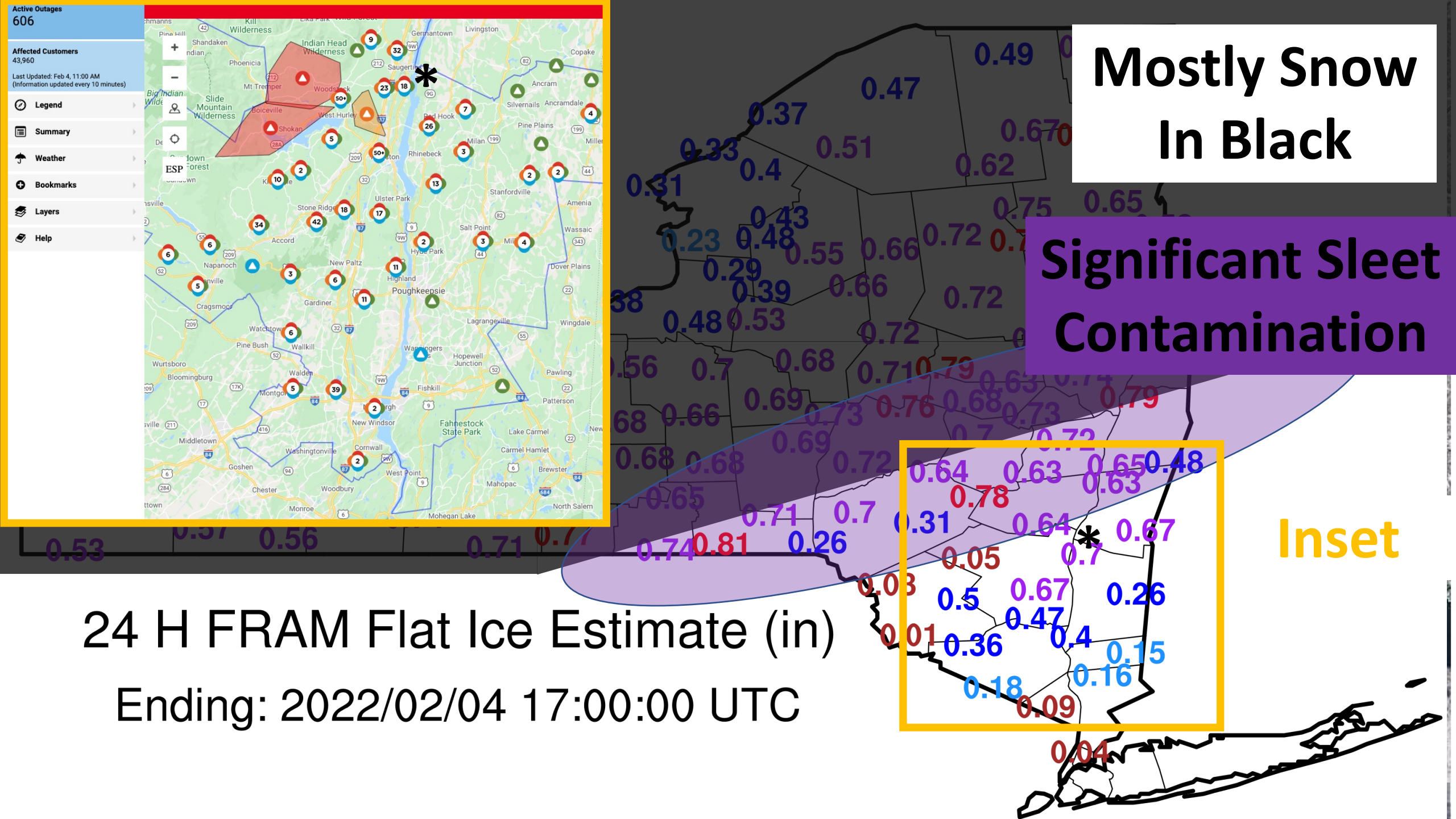
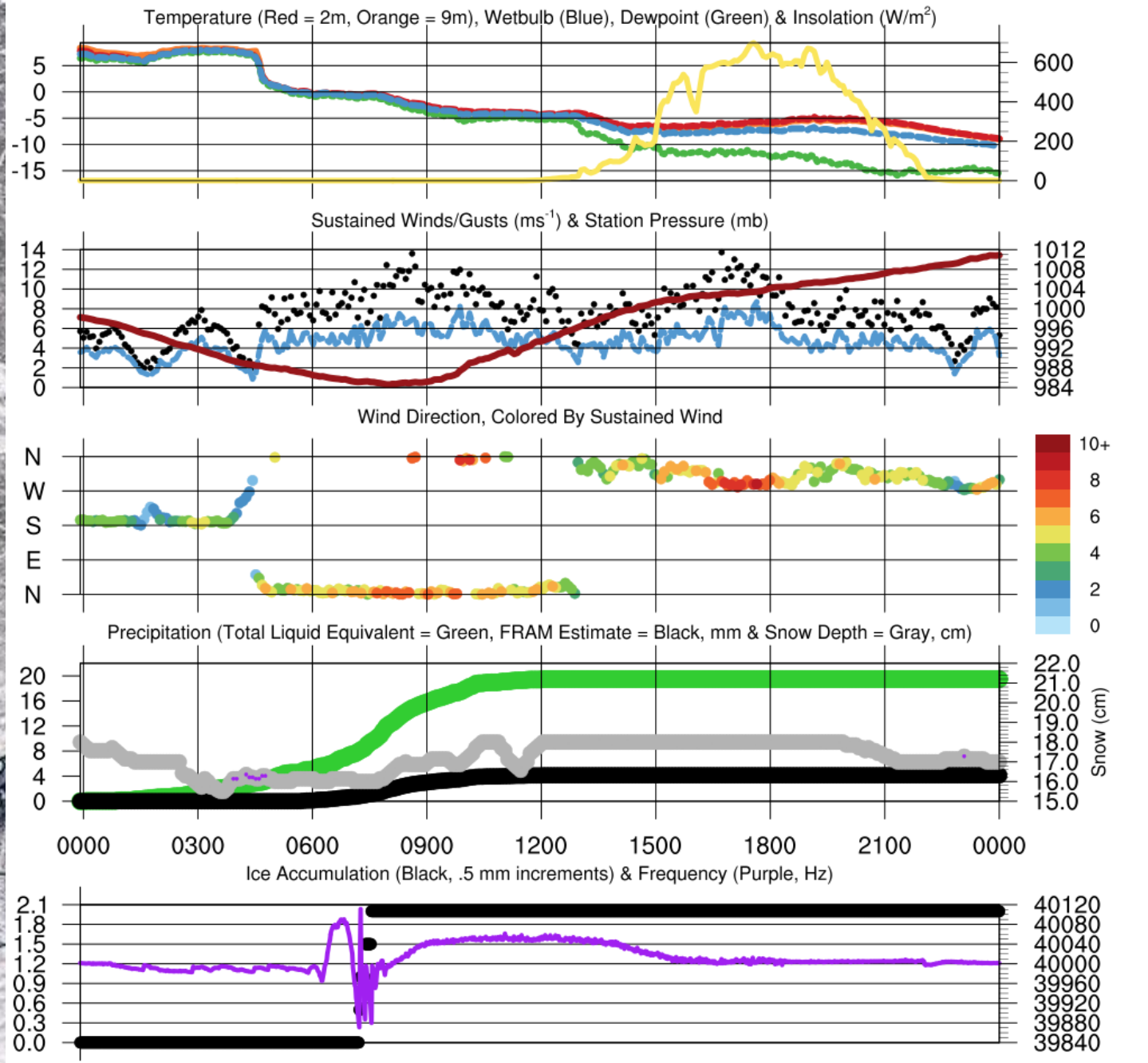

Active Outages
606
Affected Customers
43,960
Last Updated: Feb 4, 11:00 AM
(Information updated every 10 minutes)
Legend
Summary
Weather
Bookmarks
Layers
Help
ESP
Mostly Snow
In Black
Significant Sleet
Contamination
Inset
24 H FRAM Flat Ice Estimate (in)
Ending: 2022/02/04 17:00:00 UTC

https://worldview.earthdata.nasa.gov/

IOP4



Location: Essex
Station Elevation: 55.5 m
Station lat/lon: 44.3144; -73.3675

Data Valid On 2022/02/18, All Times UTC

Total Precipitation: 19.48 mm
Total FRAM Freezing Rain: 4.13 mm
(note: FRAM considers all precipitation to be rain)

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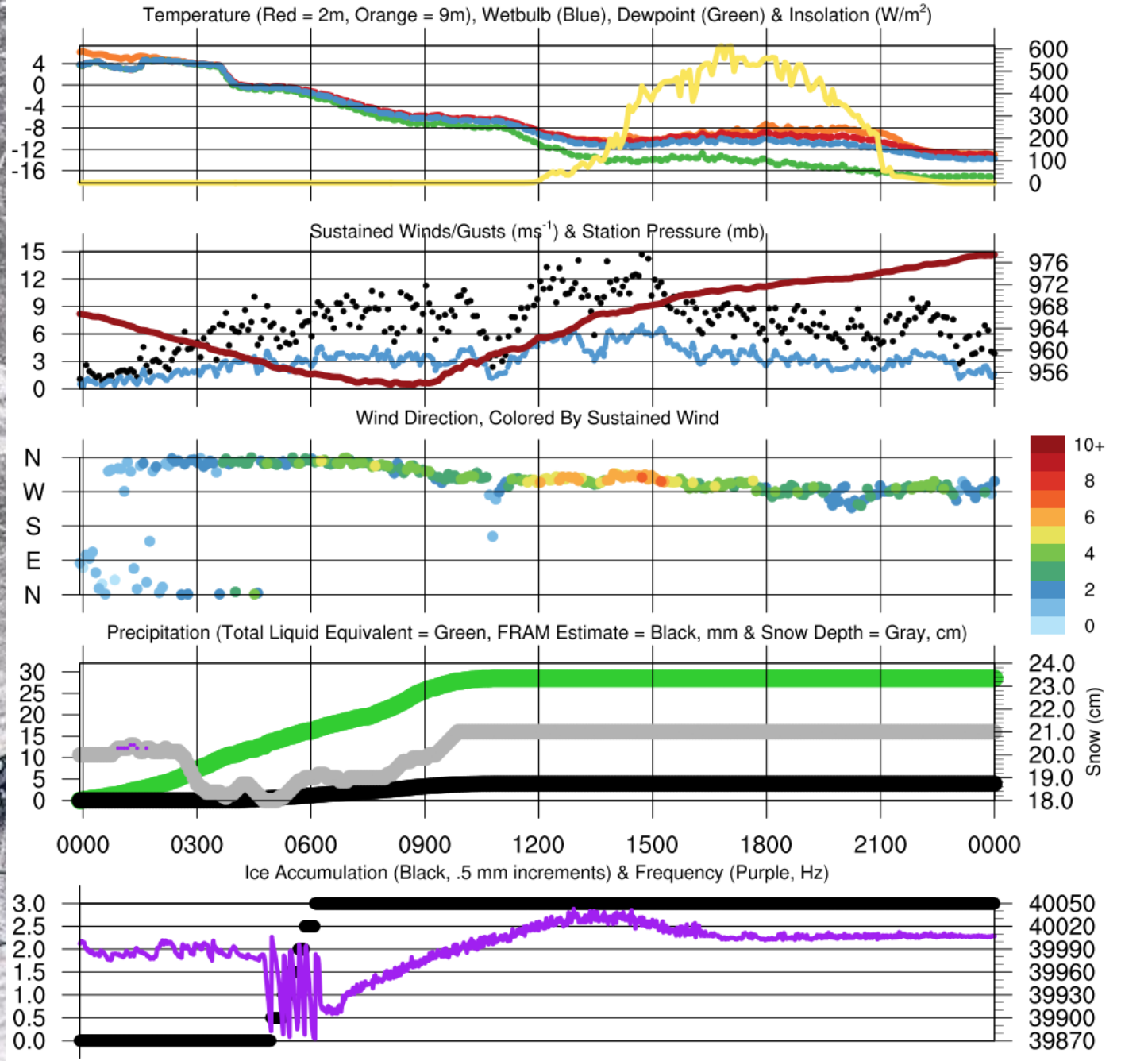
https://worldview.earthdata.nasa.gov/

IOP4



Location: Saranac
Station Elevation: 313.731 m
Station lat/lon: 44.7076; -73.6712

Data Valid On 2022/02/18, All Times UTC

Total Precipitation: 28.48 mm
Total FRAM Freezing Rain: 3.92 mm
(note: FRAM considers all precipitation to be rain)

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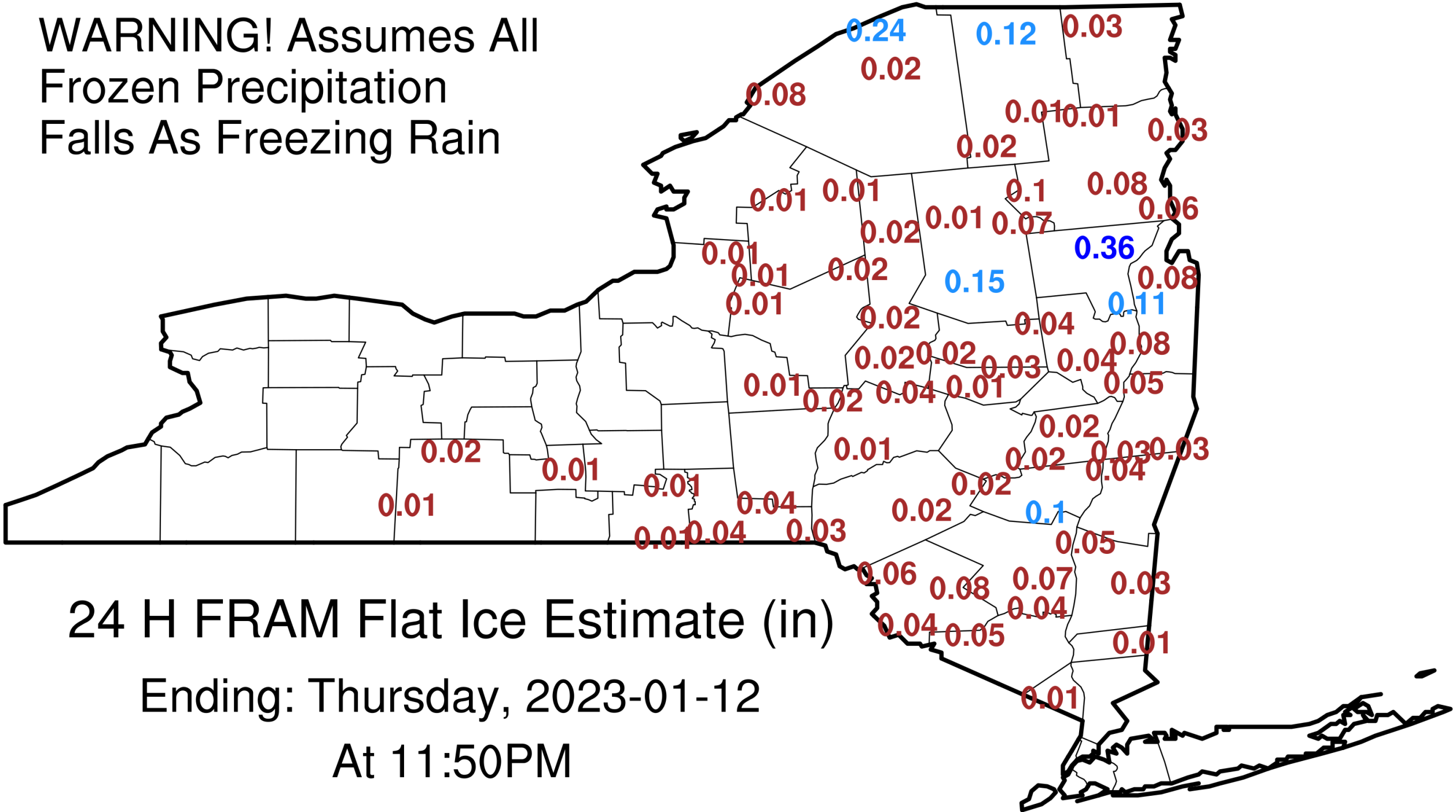
WARNING! Assumes All
Frozen Precipitation
Falls As Freezing Rain



24 H FRAM Flat Ice Estimate (in)

Ending: Thursday, 2023-01-12

At 11:50PM

https://worldview.earthdata.nasa.gov/

Ongoing work:
Operational Mesoscale NWP eval.

<u>So far (w/ John England, Michael Barletta, Massey Bartolini)</u>

- Evaluation of HREF members for IOPs 4, 5 underway
- Using FRAM model diagnostics and ice detector data for ice accretion

<u>Future plans</u>

- Expand to other IOPs
- Conduct multi-season evaluation of HREF (and exp. RRFS?) members against NYSM, CFICS, mPING, ASOS

<u>Potential collaborations</u>

- Also consider Canadian model?
- CU for synoptic context

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UNIVERSITY AT ALBANY
State University of New York

Contact: jengland@albany.edu

Precipitation Type in the High-Resolution Ensemble Forecast System during the February 17th & February 23rd, 2022, Winter Storms

John R. England, Justin R. Minder
Department of Atmospheric and Environmental Sciences, University at Albany

WINTRE-MIX 2022

NSF

NSF Grant Number: AGS-2113995

Introduction & Research Goals

- Winter weather events with near-freezing surface temperatures are often associated with mixed surface precipitation types (p-types). Such events can have large impacts on society affecting road transportation, aviation and utilities.
- The WINTRE-MIX campaign conducted intensive observational periods (IOP's) on these events to investigate how multiscale processes influence the predictability of p-type.
- A commonly used probabilistic forecasting tool to simulate p-type for these events is the High-Resolution Ensemble Forecast (HREF) which produces ensemble products from 5 models with 3km grid spacing where time-lagging is utilized.

HREFv3 Member Configuration

Member	IC's	LBC's	PBL	Microphysics	Included in HREF Hours
HRW ARW	RAP	GFS -6h	YSU	WSM6	0-48
HRW FV3	GFS -6h	GFS -6h	GFS EDMF	GFDL	0-60
HRW NSSL	NAM	NAM -6h	MYJ	WSM6	0-48
HRRR	RAP -1h	RAP -1h	MYNN	Thompson	0-36
NAM Nest	NAM	NAM	MYJ	Ferrier-Aligo	0-48

Table 1: HREF Member Table adapted from SPC HREF Ensemble Viewer. Only non-time lagged members are shown. IC & LBC refer to the parent model's initial and lateral boundary conditions, respectively.

Research Goal

Investigate two near-freezing winter storms to evaluate and compare skill of HREF members in forecasting p-type, and to explore what meteorological features contribute to member discrepancies.

Methodology & Data Parameters

Observational Data (WINTRE-MIX, NYSM, ASOS, mPING, CFI)

- WINTRE-MIX deployed field teams to locations across the Lake Champlain Valley & the St. Lawrence Valley. Field teams launched radiosondes and recorded manual hydrometeor observations.
- Additional observational data included: the New York State Mesonet (NYSM), CFI Climate Sentinels (CFI), Automated Surface Observing System (ASOS), and meteorological Phenomena Identification Near the Ground (mPING) reports.

Observational Sites & Areas of Interest

Figure 1: NYSM Standard Sites (Yellow Circles), NYSM Standard Stations with Ice Sensors (Yellow Circles with Pink Outlines), ASOS (Red Squares), WINTRE-MIX Sites (Black X's), Climate Sentinel Sites (Light Blue Diamonds).

CFI & NYSM P-Type Determination

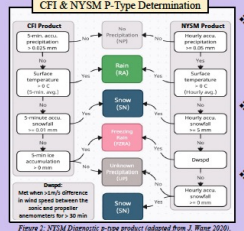

Figure 2: NYSM Diagnostic p-type product (adapted from J. Wang 2020). Custom CFI p-type product.

- The NYSM created an algorithm that used precipitation, snow depth, air temperature, and wind measurements to derive p-types. (Wang et al. 2021) (Figure 2)
- 5 NYSM stations were equipped with ice detectors from WINTRE-MIX which overrode p-type if FZRA was observed.
- We constructed a similar diagnostic product for the CFI stations that used a similar algorithm to derive p-type. (Figure 2)

High Resolution Ensemble Forecast Version 3 (HREFv3) Data

- Short term forecasts were analyzed through both IOPs to investigate how model physics contributed to member differences in p-type simulations.
- The forecast hours selected in figures 3 & 5 are representative of the HREF member biases that exist through all forecast hours for a given IOP.

Results

IOP4: HREFv3 members at 0500 UTC 18 February 2022. Forecast Hour 17:

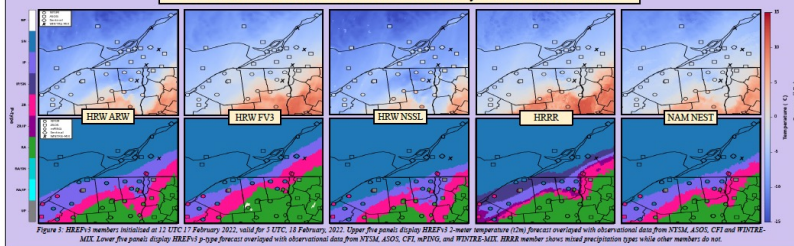

Figure 5: HREFv3 members initialized at 12 UTC 17 February 2022, valid for 5 UTC, 18 February, 2022. Upper five panels display HREFv3 2-meter temperature (12m) forecast overlayed with observational data from NYSM, ASOS, CFI and WINTRE-MIX. Lower five panels display HREFv3 p-type forecast overlayed with observational data from NYSM, ASOS, CFI, mPING, and WINTRE-MIX. HRRR member shows mixed precipitation types while other members do not.

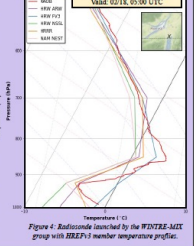

Figure 4: Radiosonde launched by the WINTRE-MIX group with HREFv3 member temperature profiles.

IOP4 was associated with low-level cold air below an 850-hPa warm air layer in the Champlain Valley. Observational data showed near-freezing low-level temperatures throughout Champlain Valley simulated accurately by the FV3 and HRRR and 4-5°C lower by the ARW and NSSL. The FV3 and HRRR kept the RA/FZRA, and IP/SN boundaries farthest north, and best simulated the FZRA observed by WINTRE-MIX. At 850-hPa, the FV3 best simulated the warm nose feature with other members ~ 4°C cooler.

IOP5: HREFv3 members at 0000 UTC 23 February 2022. Forecast Hour 12:

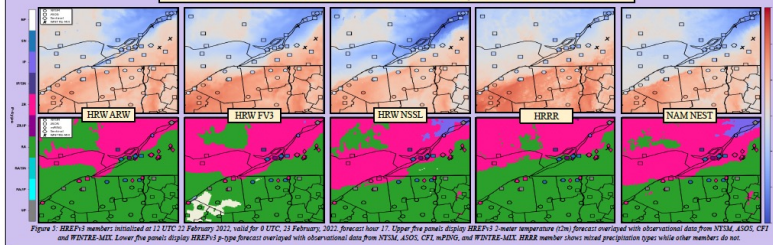

Figure 5: HREFv3 members initialized at 12 UTC 22 February 2022, valid for 0 UTC, 23 February, 2022, forecast hour 17. Upper five panels display HREFv3 2-meter temperature (12m) forecast overlayed with observational data from NYSM, ASOS, CFI and WINTRE-MIX. Lower five panels display HREFv3 p-type forecast overlayed with observational data from NYSM, ASOS, CFI, mPING, and WINTRE-MIX. HRRR member shows mixed precipitation types while other members do not.

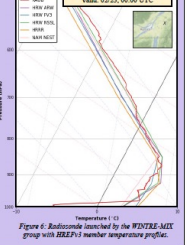

Figure 6: Radiosonde launched by the WINTRE-MIX group with HREFv3 member temperature profiles.

IOP5 was associated with a 100–500m deep, below-freezing, surface cold layer within the St. Lawrence Valley. All members simulated near-surface temperatures 7-10°C warmer than observed across the Champlain Valley and northern New York. Members simulated the RA/FZRA boundary into Quebec, missing the FZRA observed in northern NY by the NYSM and the WINTRE-MIX field teams. In the northern St. Lawrence Valley, IP was observed by the WINTRE-MIX field teams and simulated by only the FV3 and NAM members. HREF member spread is minimal above 950-hPa and agree with observations from the WINTRE-MIX radiosonde launched in the Champlain Valley.

Conclusions

The following biases are representative of HREF member performance throughout all initialization times and forecast hours associated with the two near freezing storms investigated in this study:

- IOP 4: The FV3 and HRRR accurately simulated the shallow surface cold air and p-types across the Lake Champlain Valley. The NSSL and ARW allowed more cold air into the Champlain valley resulting in simulated FZRA through much of the valley where only rain was observed by NYSM and ASOS.
- IOP 5: Members failed to simulate a wide swath of FZRA across northern NY and southern Quebec due to a missed shallow surface cold layer. The NAM and FV3 simulated the occurrence of PL in the St. Lawrence Valley that other members failed to simulate.

Acknowledgements & References

This research is made possible by the New York State (NYS) Mesonet. Original funding for the NYS Mesonet was provided by Federal Emergency Management Agency grant FEMA 4085-DR-NY, with the continued support of the NYS Division of Homeland Security & Emergency Services; the state of New York; the Research Foundation for the State University of New York (SUNY); the University at Albany, SUNY; the Atmospheric Sciences Research Center (ASRC) at SUNY Albany; and the Department of Atmospheric & Environmental Sciences (DAES) at SUNY Albany. The Automated Surface Observing System (ASOS) data from the Iowa Environmental Mesonet. The CFI Climate Sentinel Data and WINTRE-MIX data from the NCAR/UCAR Earth Observing Laboratory Data Archive. (https://data.eol.ucar.edu/master_lists/generated/wintre-mix/). HRRF member data from National Sever Storms Laboratory (NSSL) High-Resolution Ensemble Forecast Archive. Israel Jirak (SPC), Adam Clark and Chris Karstens (NSSL), Matt Pyle (EMC)
(https://data.nssl.noaa.gov/thredds/catalog/FRDD/HREF/catalog.html)

Wang, J. J. Brotzge, J. Shultz, and N. Bain (2021)
Enhancing Icing Detection and Characterization using the New York State Mesonet. Journal of Atmospheric and Oceanic Technology.
10.1175/JTECH-D-20-0215.1

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Ongoing work:
Dynamics and microphysics of FZDZ

Future plans (with Megan Schiede)

- Focus on IOP9
- Overview of surface & airborne observations
- Evaluate HRRR forecasts of surface p-type and supercooled water aloft
- WRF simulations and sensitivity experiments

Potential collaborations

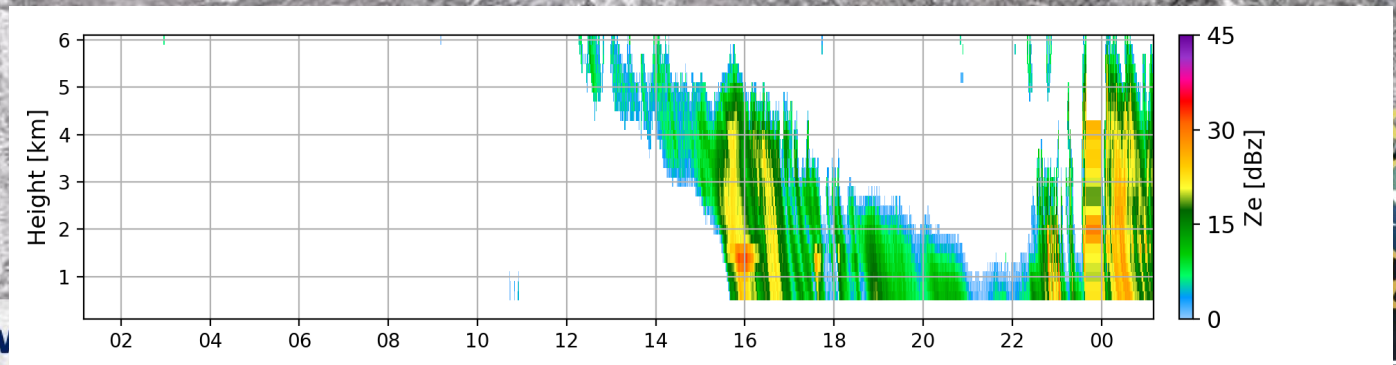
- NRC, UWyoming for airborne observations
- UQAM, UWyoming for cloud physics
- CU for dual-pol diagnostics, synoptic context
- UWashington (evaluate new warm cloud/rain parameterization)

4:00 PM

4.2 Improving Warm Rain Prediction Using a Lognormal Cloud Water Distribution

Robert Conrick, *Univ. of Washington, Seattle, WA; and C. F. Mass and L. A. McMurdie*

Colorado Convention Center - 704/706 (Meeting Room Level)



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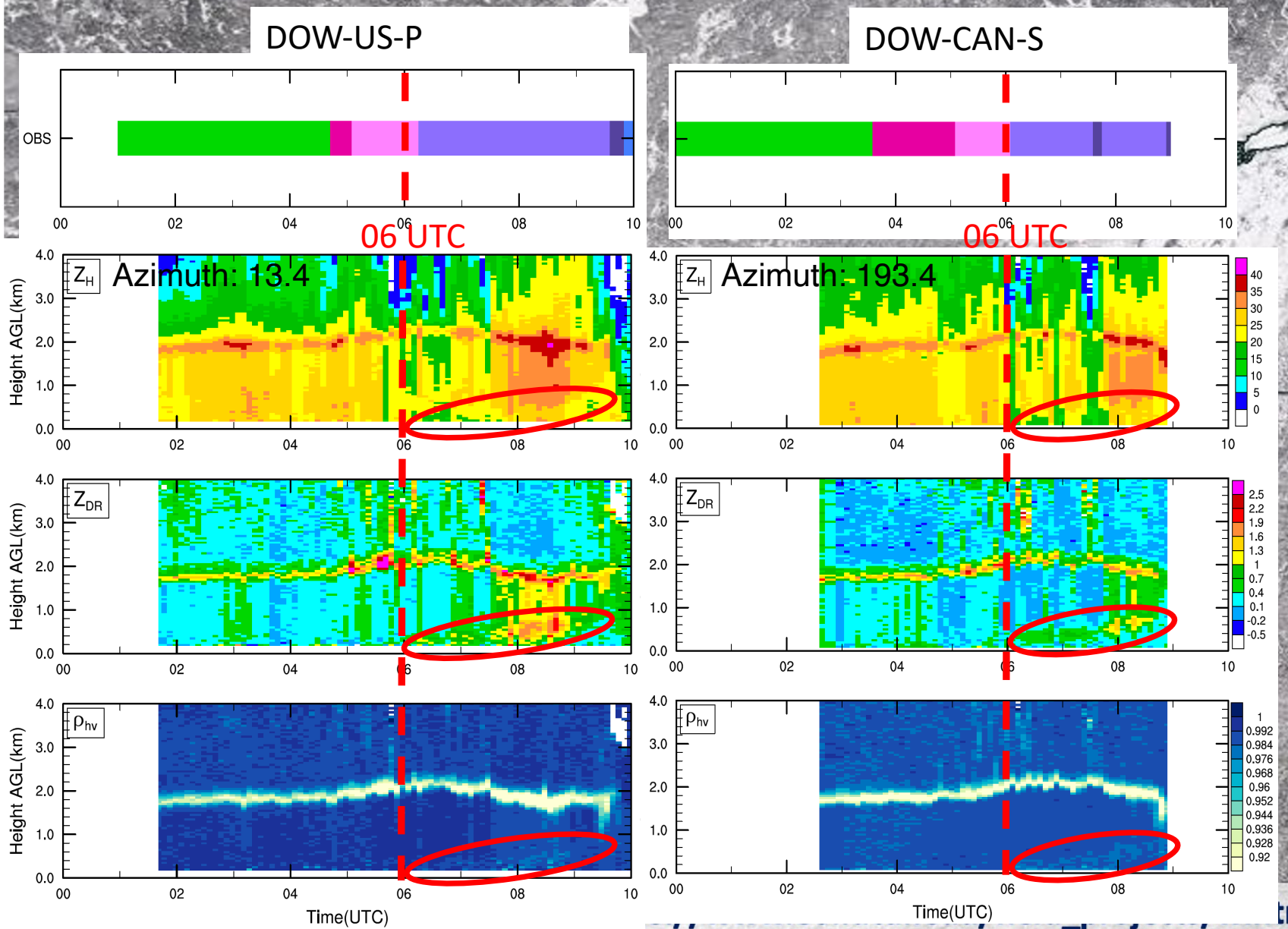
https://worldview.earthdata.nasa.gov/

Progress 1: using RHI-based QVPs of DOW radars to support manual p-type reports (IOP4)



RA: rain; FZ: freezing rain

IP: ice pellets; SN: snow

FZ/IP: mixed FZ and IP

IP/SN: mixed IP and SN

RHI-based QVPs (range for averaging: 2-10 km) show the refreezing signatures at lower levels, supporting the formation of ice pellets starting from 06 UTC.

QVPs from other azimuths show similar results.

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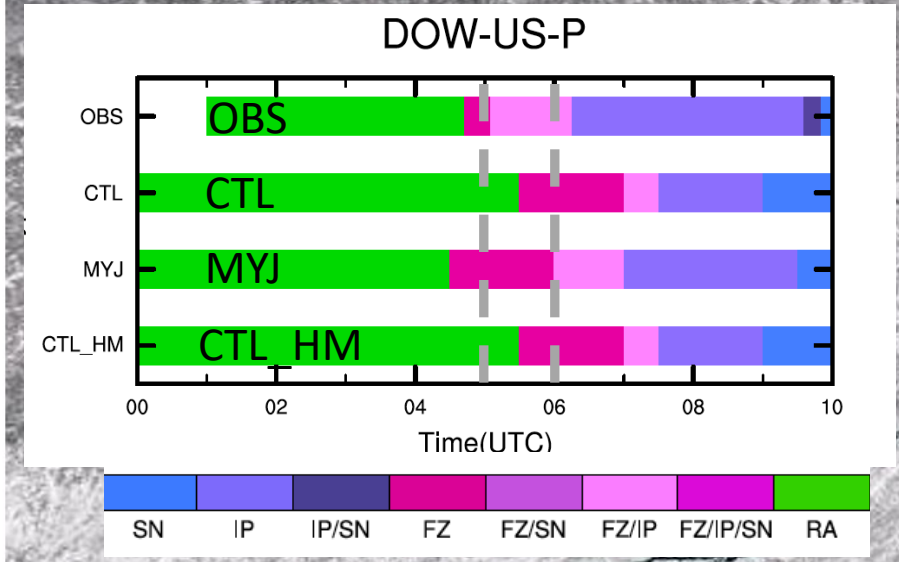
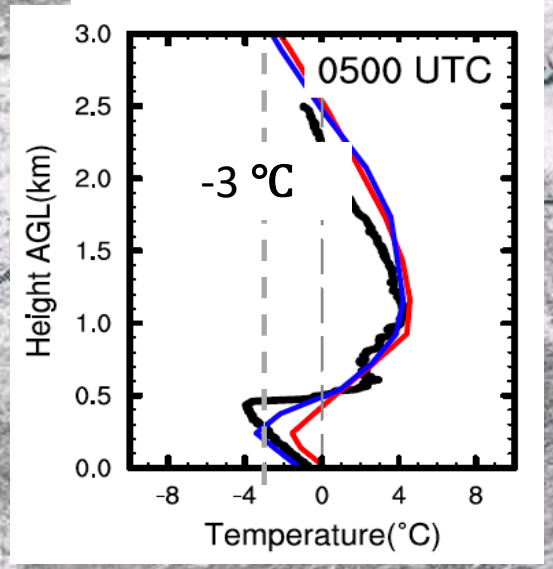
Progress 2: understanding possible reasons for the improvements in simulated p-types

At DOW-US-P, the MYJ test has a colder subfreezing layer and reaches the temperature range of the Hallett–Mossop process (SIP; active within -3 to -8 ℃) at an earlier time (i.e., closer to the obs.).

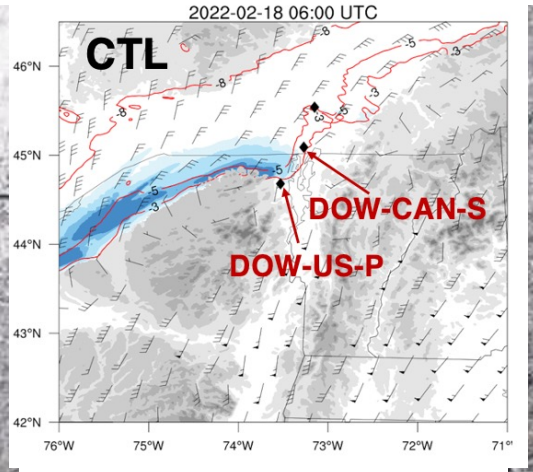


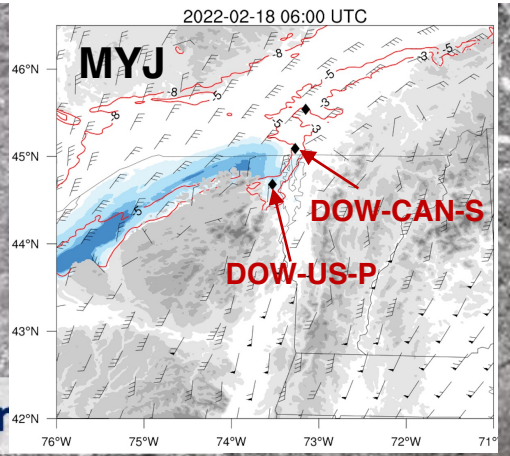
Sim.	Description
CTL	Control experiment
MYJ	Same as CTL, except using MYJ as the PBL scheme
CTL_HM	Same as CTL, except adding another source term for the H-M process

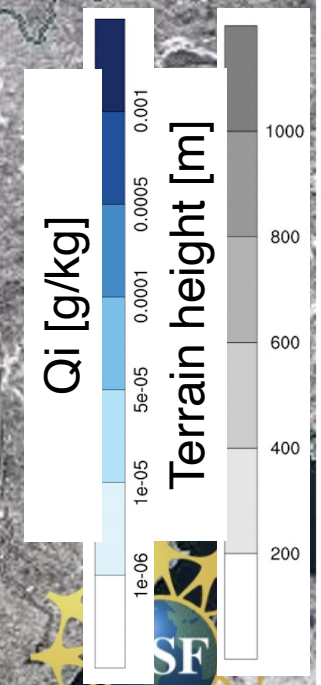
Temp. profiles at 0500 UTC



Spatial distribution of cloud ice amount at 0.5-km height (MSL); Red contours: -3, -5, -8 °C







https://www.eol.ucar.edu/field_projects/wir

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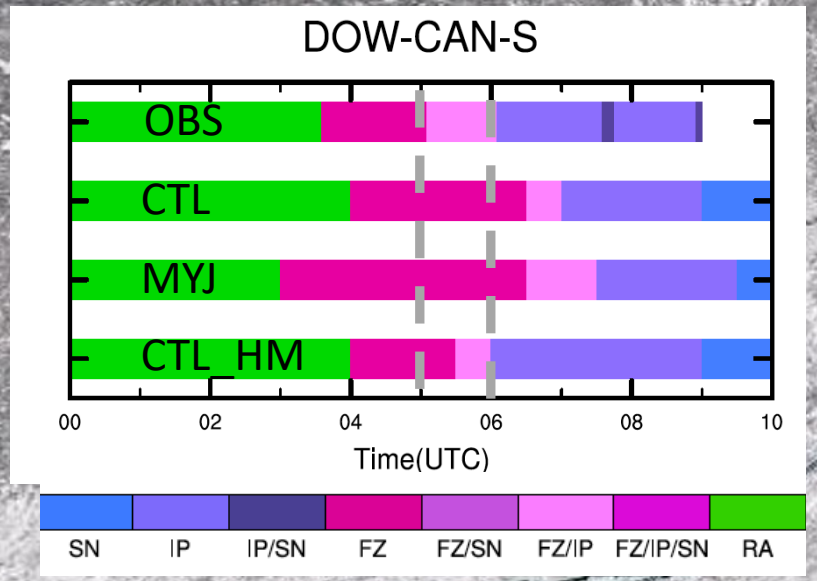
https://worldview.earthdata.nasa.gov/

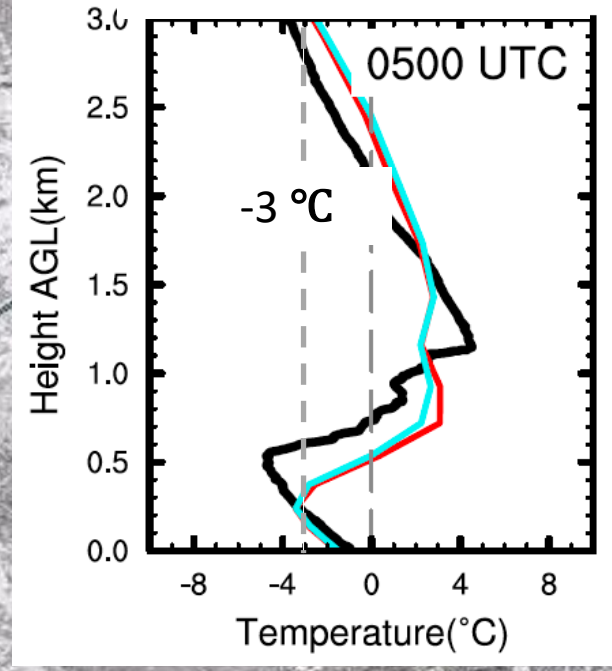
Progress 2: understanding possible reasons for the improvements in simulated p-types

At DOW-CAN-S, the CTL test reaches -3 ℃ in the subfreezing layer but might lack enough cloud ice to consume rain aloft. The CTL_HM test can mitigate that by increasing cloud ice number (w/o influencing temperature).

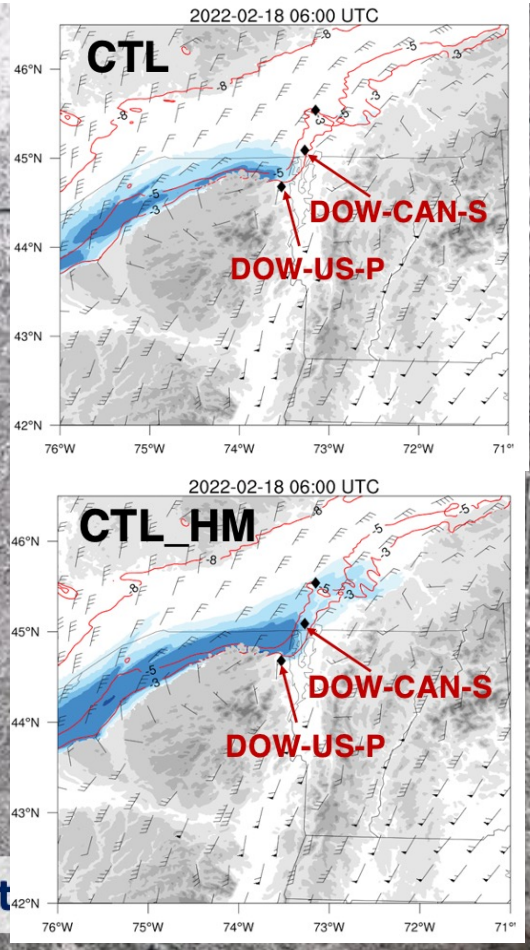


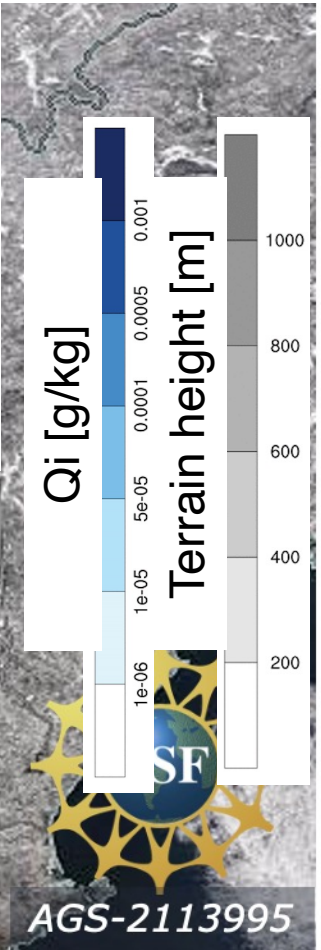
Sim.	Description
CTL	Control experiment
MYJ	Same as CTL, except using MYJ as the PBL scheme
CTL_HM	Same as CTL, except adding another source term for the H-M process

Temp. profiles at 0500 UTC



Spatial distribution of cloud ice amount at 0.5-km height (MSL); Red contours: -3, -5, -8 ℃





https://www.eol.ucar.edu/field_projects/wint

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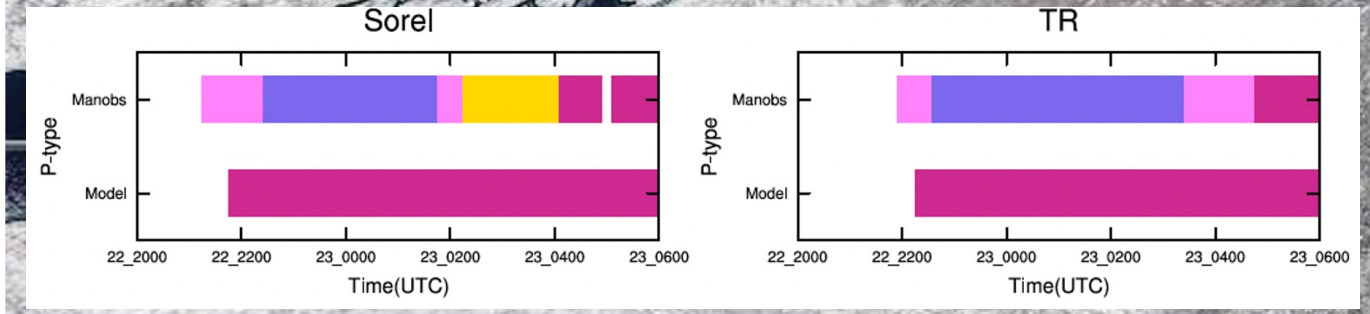
https://worldview.earthdata.nasa.gov/

Future work: mainly focus on the IOP5 case

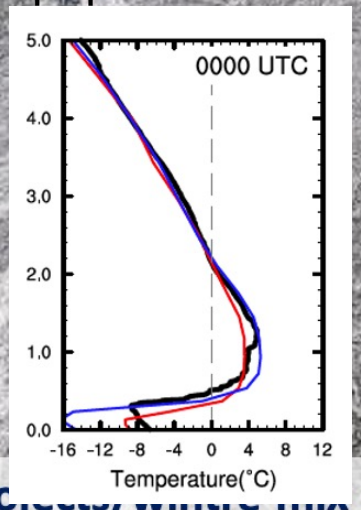
- The simulations have difficulties reproducing the temperature profile within the subfreezing layer (smaller depth of subfreezing layer or too cold) at the Sorel and TR sites.

- Compared to the observed long-duration of ice pellets, the simulated precipitation type is freezing rain. This might be partially related to the p-type diagnosis method. Artificially increasing cloud ice based on the CTL test can increase ice pellet amount but not enough to be diagnosed as ice pellets at the surface.

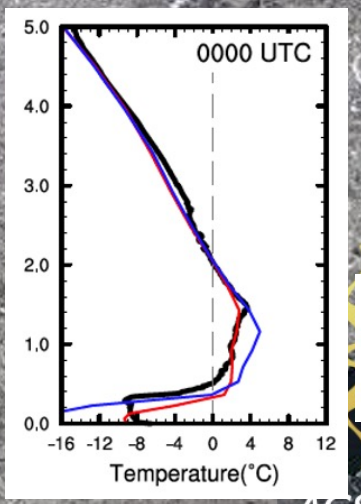
- The depth of the subfreezing layer is significantly smaller than that of the melting layer during IOP5, which is unfavorable for ice pellets production in the simulations. Further tests on the fall speed of graupel might give us more information.

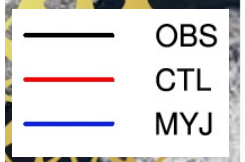


Temp. profiles at Sorel



Temp. profiles at TR





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Resources our group can offer to others

- Facilitate access to, and interpretation of, NYSM data & products
- Analysis of archive mesoscale NWP output
- WRF control and sensitivity experiments
- Facilitate interaction with NWS forecasters and stakeholders in northeastern US

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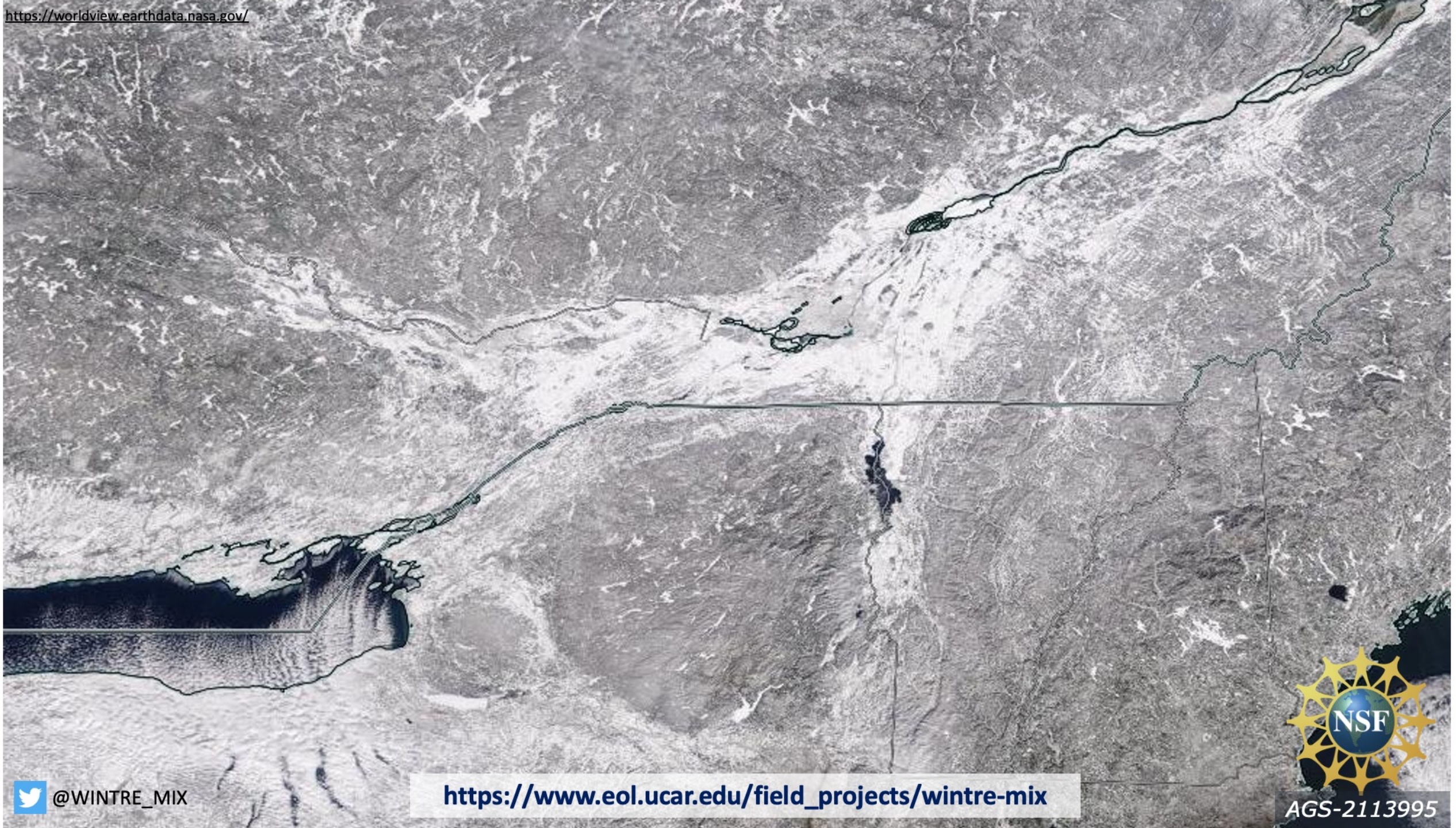
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https://www.eol.ucar.edu/field_projects/wintre-mix
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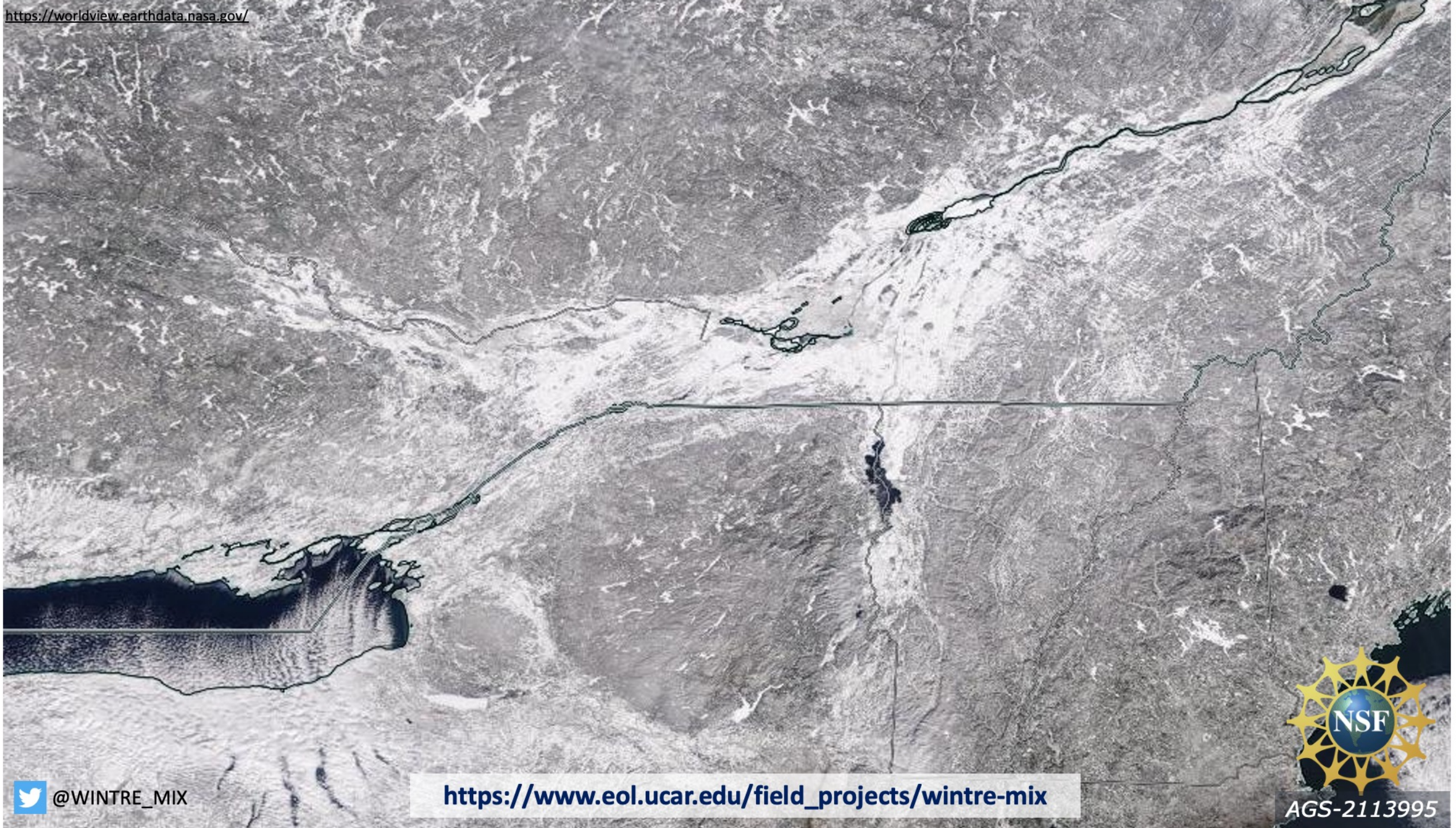
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