

December 20, 2022 7:35:37 AM EST
Osceola, NY looking 0°

NYS Mesonet Winter Weather Products

Precipitation Types

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SUNY Albany*

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Collaborators: NWS WFOs & NERFC
Sponsor: NOAA OAR Weather Program Office - Observations Program*



Improvement in NOAA Winter Weather Operations using NYS Mesonet Observations



Goal: Advance NWS winter weather services with the integration of new and innovative mesonet observations and products into real-time operations.

Objectives:

- (1) Develop and evaluate NYSM winter weather data and derived products;
- (2) Refine measurement processes and corrections, based upon evaluations and feedback from WFOs & NERFC;
- (3) Provide products and displays to aid data interrogation and warning operations.

Real-Time Products (RTPs)

1. Snow depth
2. Snowfall rates and accumulation
3. Storm estimates of Snow Water Equivalent and Snow-to-Liquid Ratio (SLR)
4. Frozen soil maps
5. Identification of freezing rain
6. Precipitation type (standard network – 126 locations)
7. Precipitation type (profiler network – 17 locations)
8. Visual confirmation and situation awareness
9. Elevation-dependent maps and analyses
10. Multi-variable maps and analyses

New York State Mesonet:

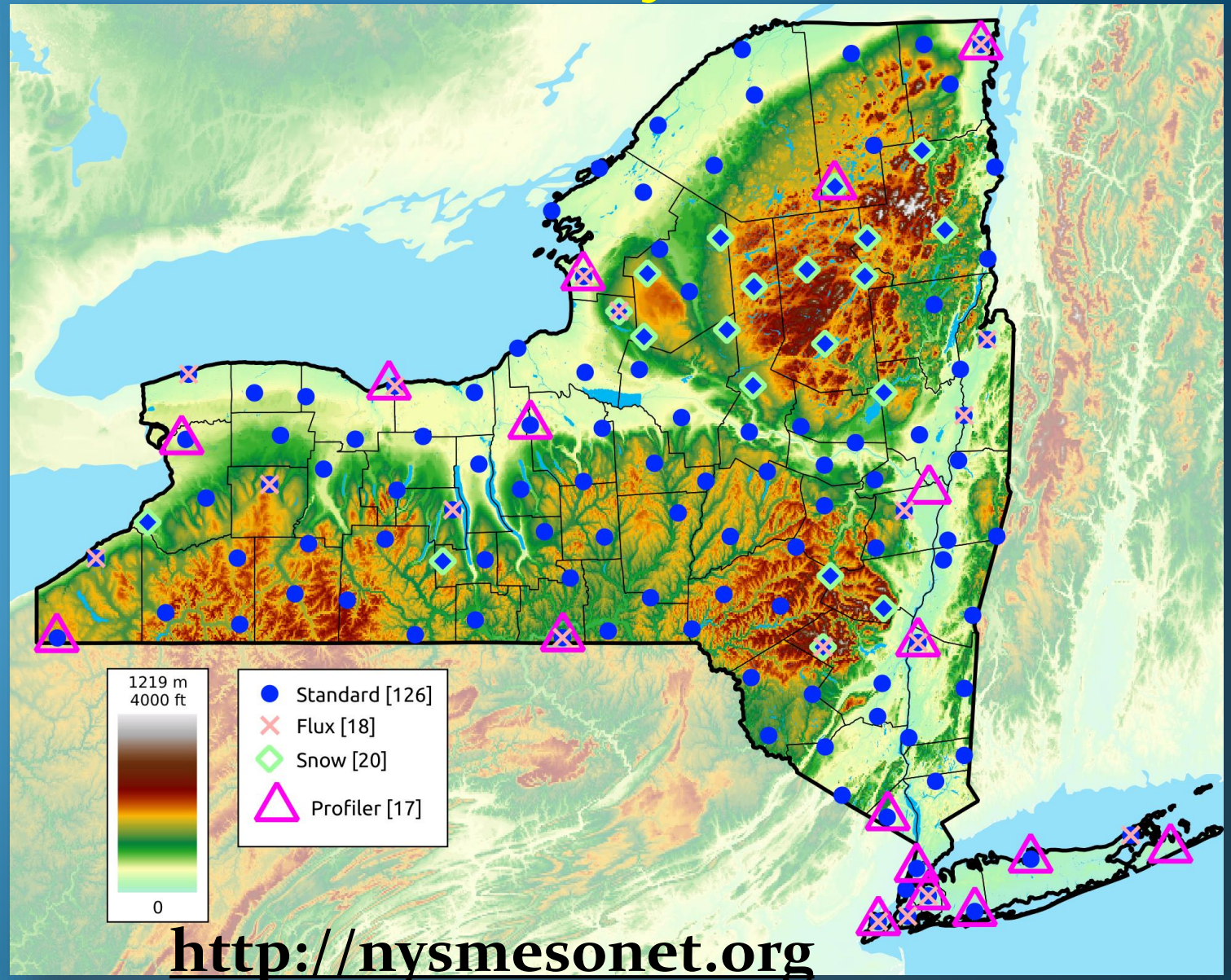
NYS Early Warning Weather Detection System

NYS Mesonet
UNIVERSITY AT ALBANY

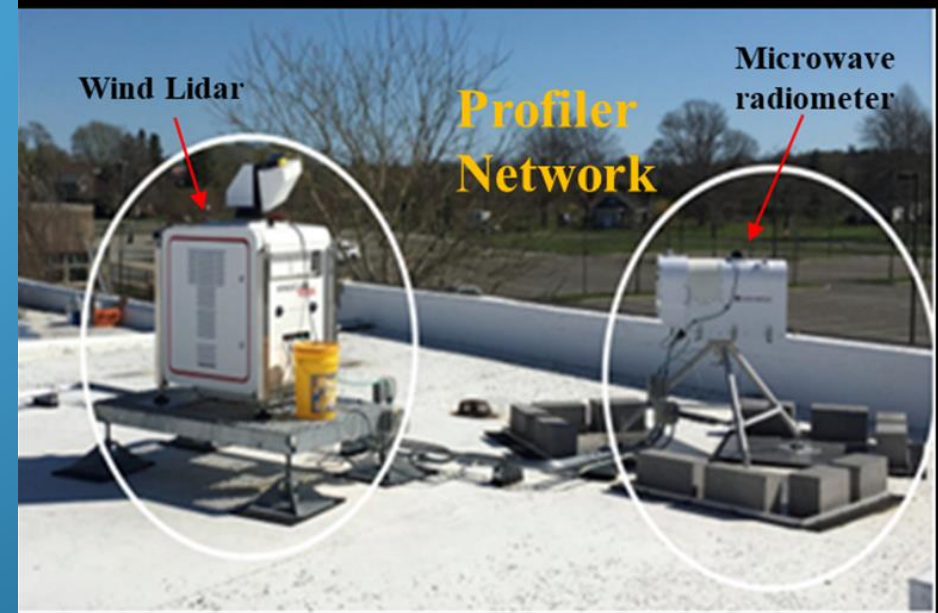
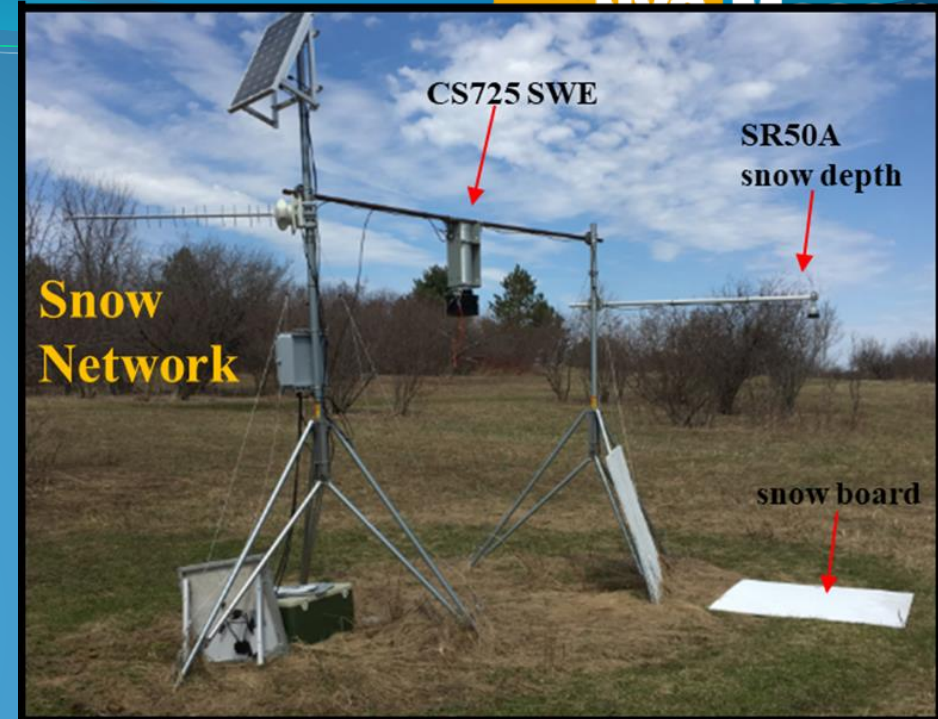
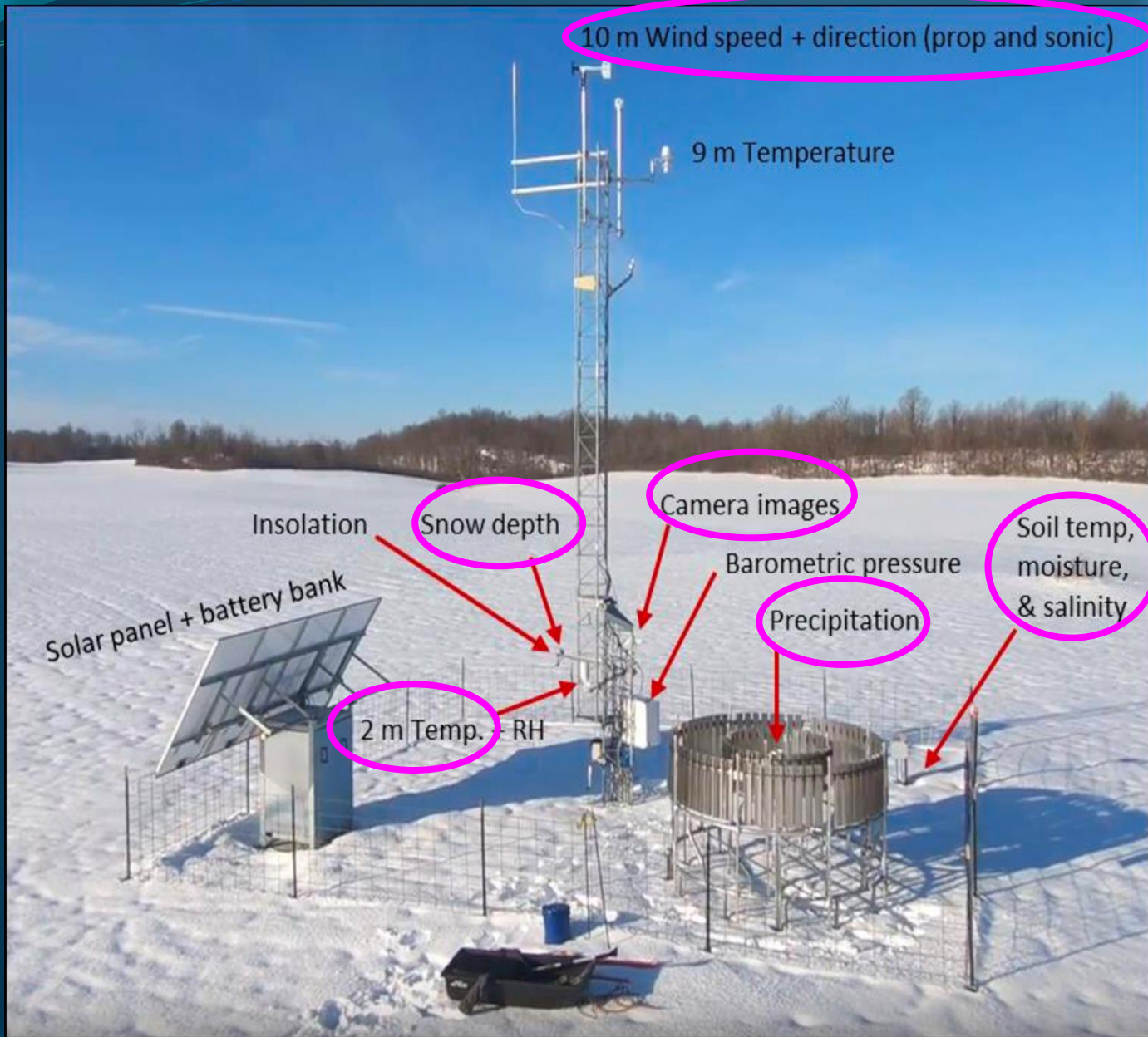
✓ **Mission:** Provide the best meteorological data, the best products, and the best services possible with the goal of saving lives and property while building a smart weather economy

- ✓ **6 networks:** standard, profile, flux, snow, urban, roadside
- ✓ **211 stations**
- ✓ **Spaced ~17 miles apart**
- ✓ **Reports every 5 minutes**

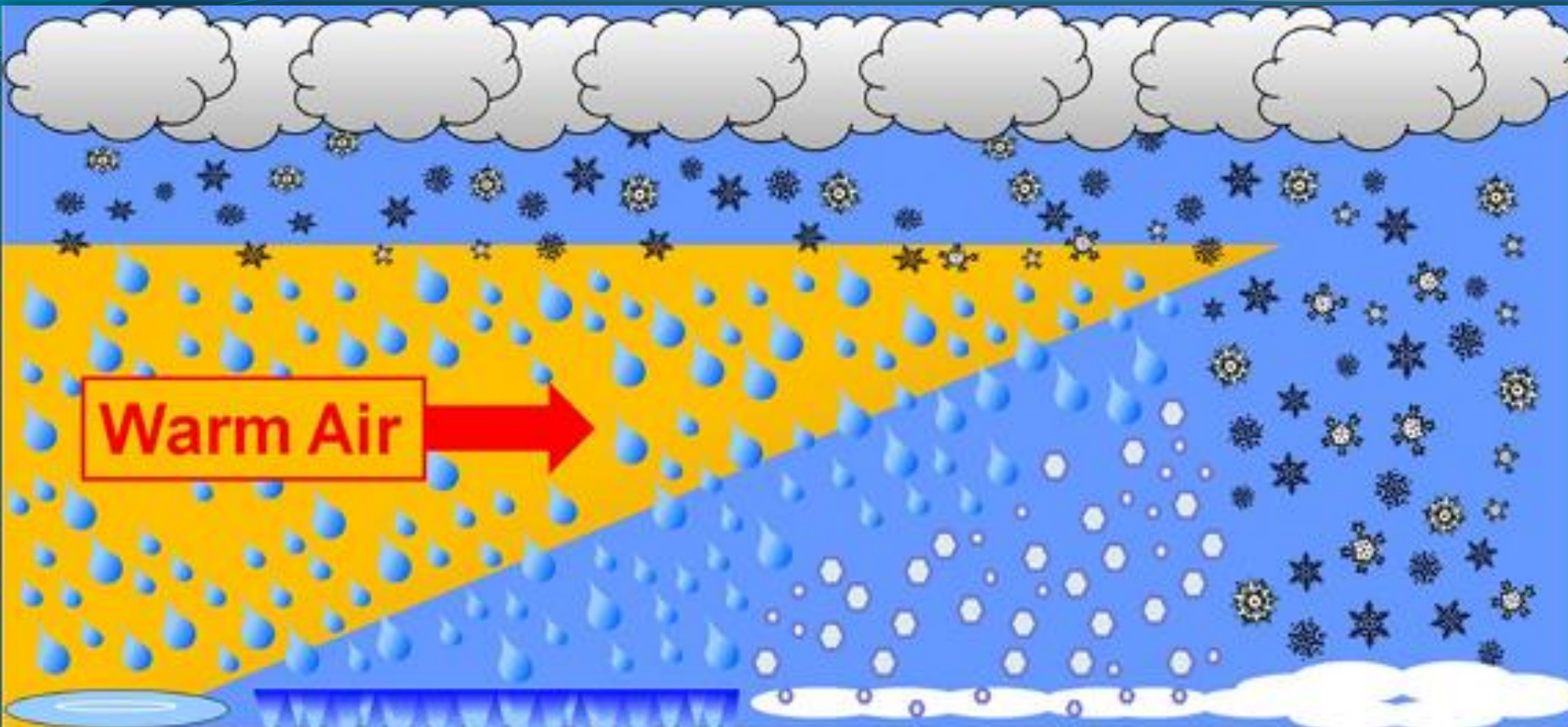
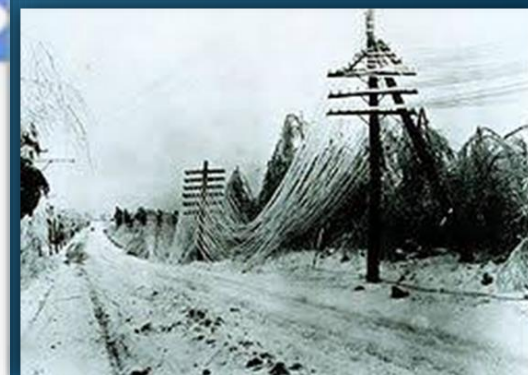
✓ **All data collected, quality controlled, archived, and disseminated to customers in real-time!**



NYS Mesonet for Winter Weather



Winter Precipitation Types



Rain

Frozen precipitation
Melts and reaches
the ground as rain.

https://www.weather.gov/rnk/Measure_Icing

Freezing Rain

Frozen precipitation
melts in warm air. Rain falls
and freezes on cold surfaces.

Sleet

Frozen precipitation melts in
shallow warm air. Then
refreezes into sleet before
reaching the surface.

Snow

Snow falls
through cold air
and reaches
the surface

Freezing Rain Detection

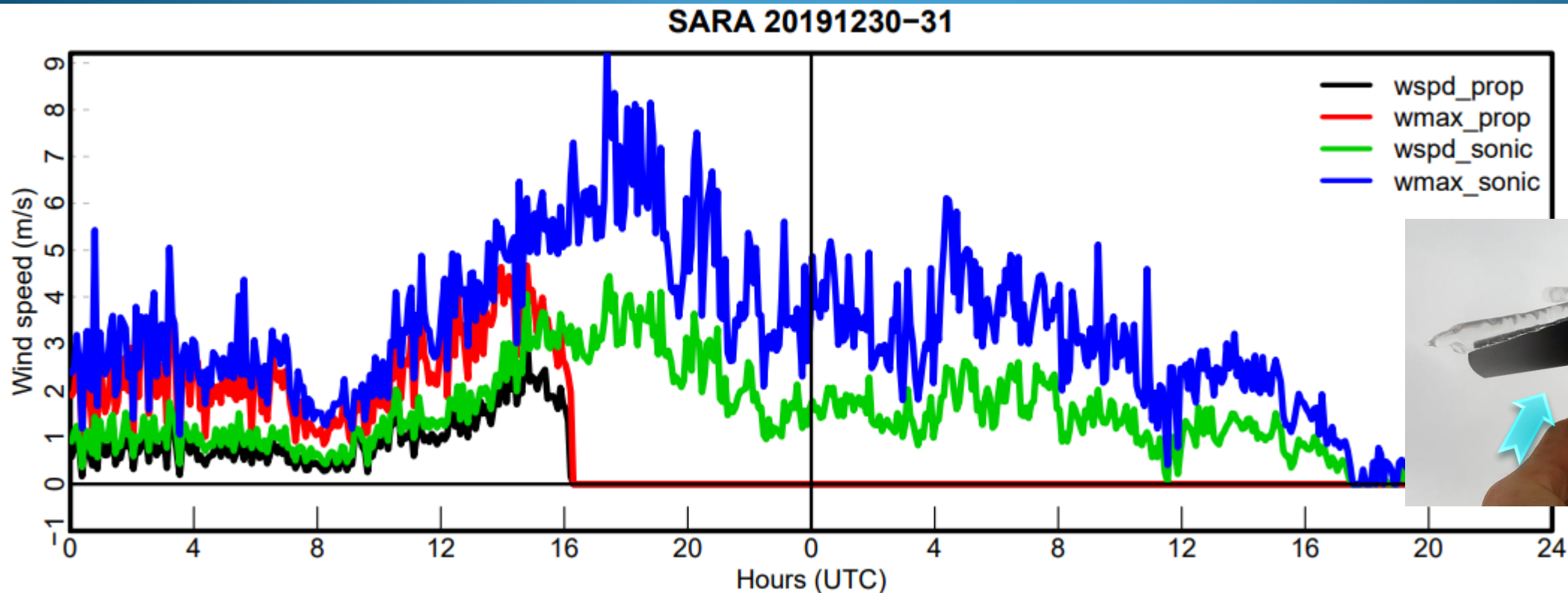
Freezing Rain

Frozen precipitation melts in warm air. Rain falls and freezes on cold surfaces.

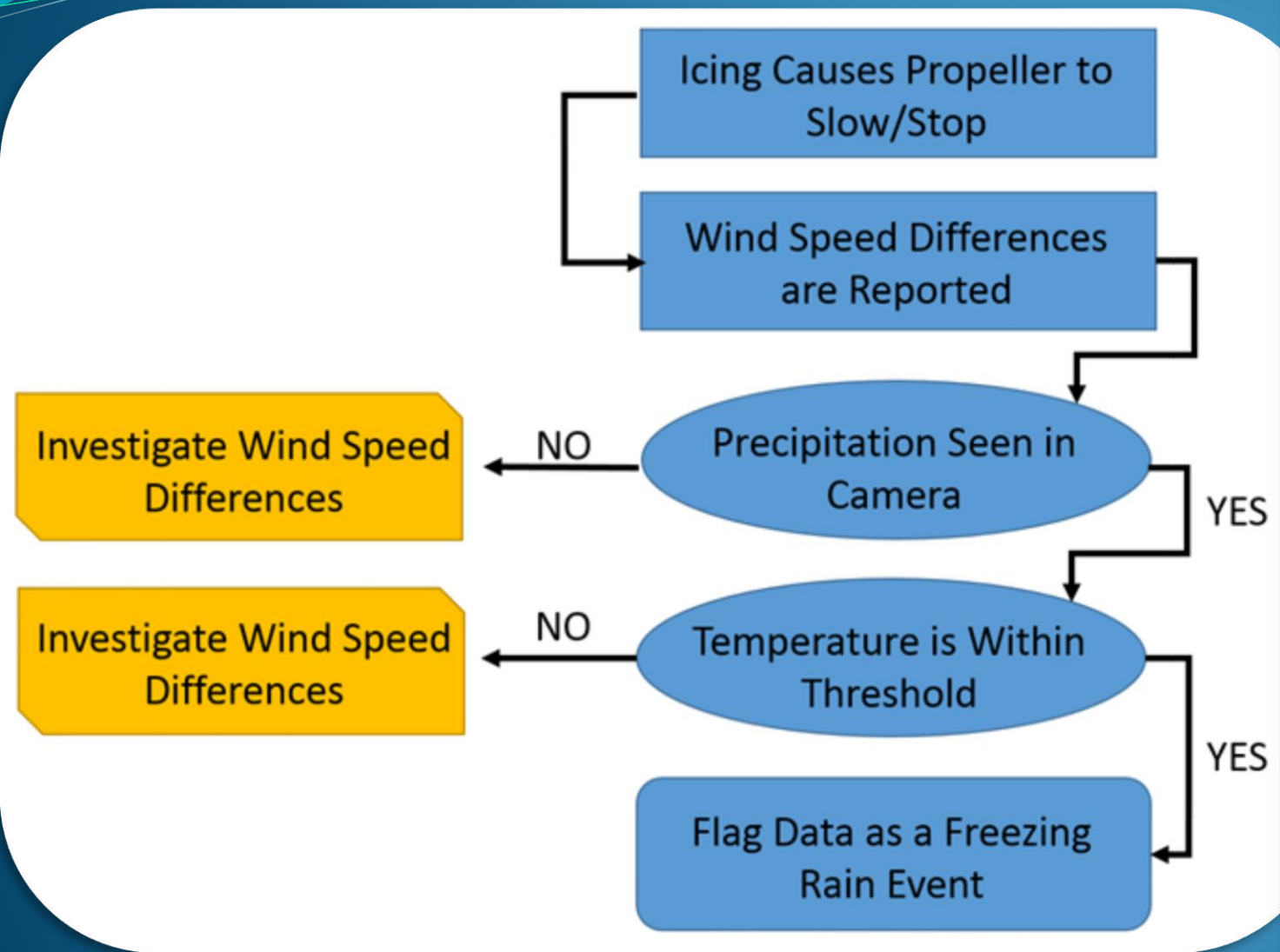


Wind comparisons

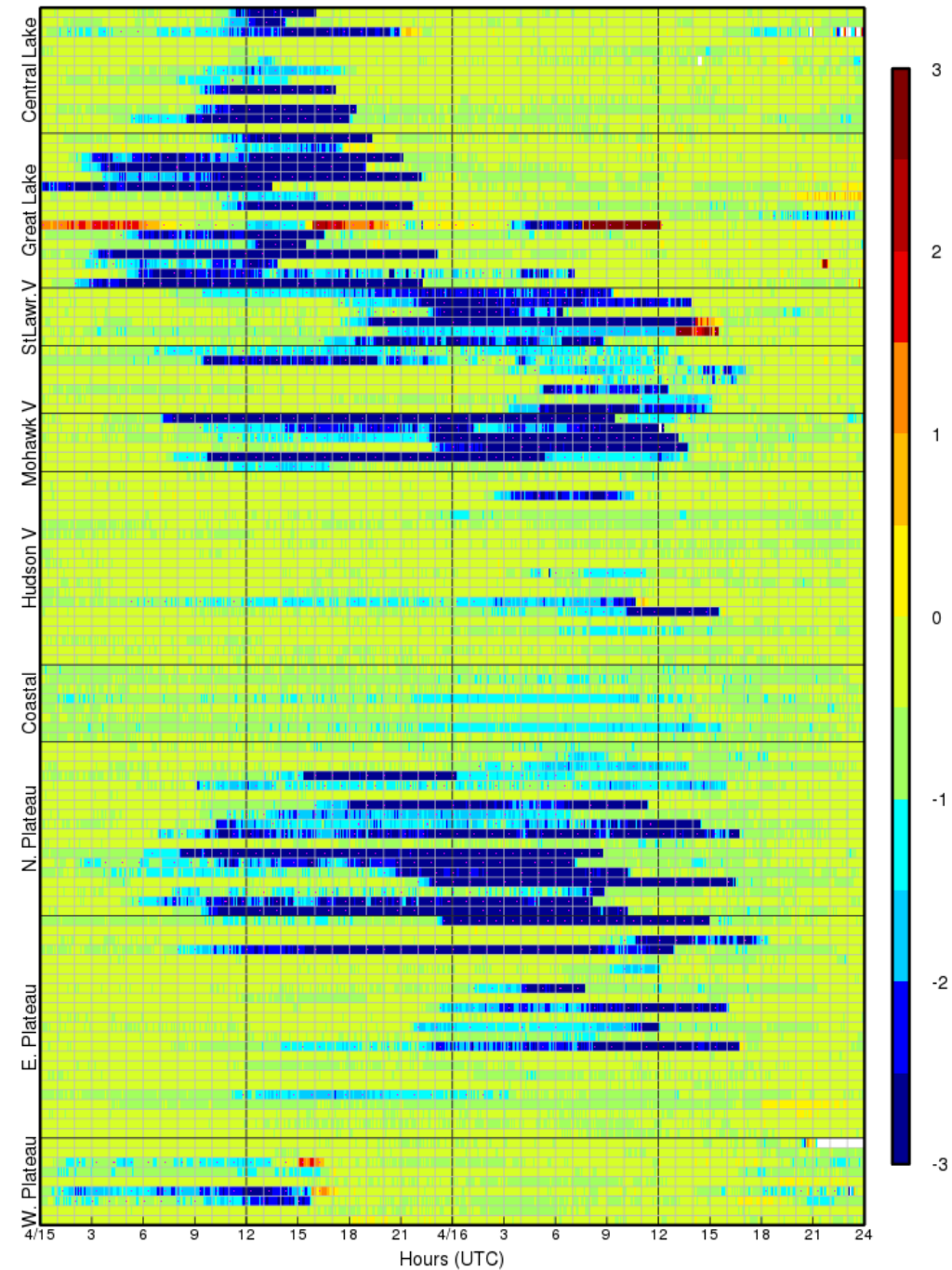
1. Evaluate the performance of both sensors
2. Quality-control the data
3. Fill the gaps
4. Provide some other useful information???



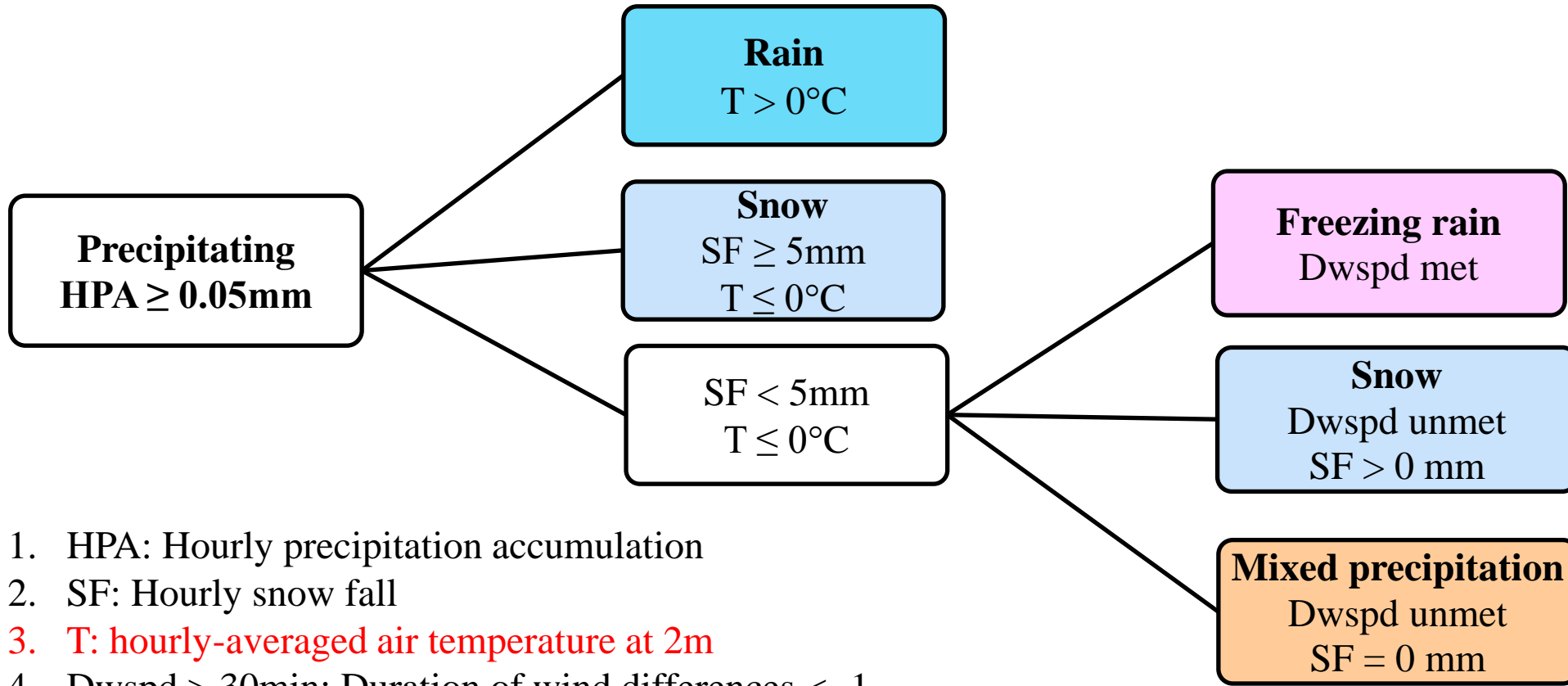
Freezing Rain Detection



wspd_prop-wspd_sonic (04/15~16/2018) (-14.59 ~ 5.4m/s)



Precipitation Type Determination



1. HPA: Hourly precipitation accumulation
2. SF: Hourly snow fall
3. **T: hourly-averaged air temperature at 2m**
4. Dwspd > 30min: Duration of wind differences < -1 m/s or (wspd_prop = 0 m/s & Wspd_sonic > 0 m/s)



Winter Weather Webpage

Winter Weather

Product: Precip Type (last hour) Layers: Radar NWS Alerts Hide Time Options

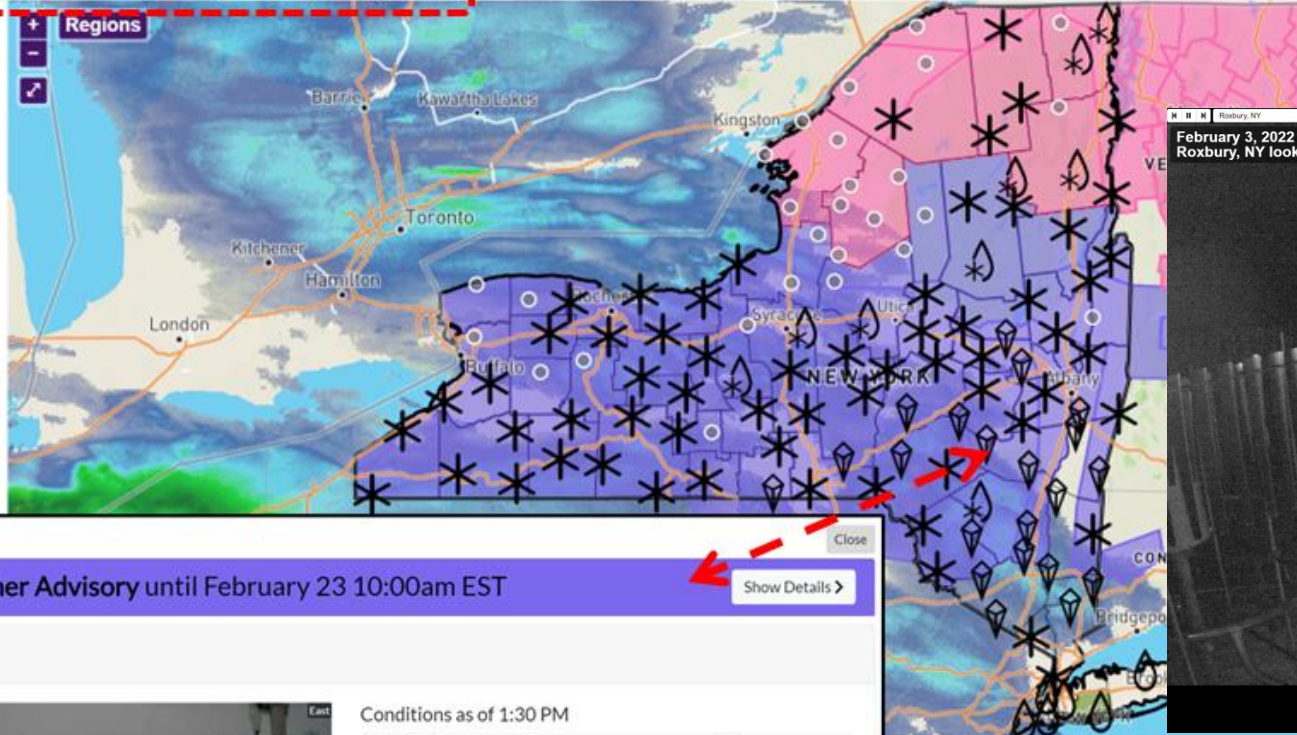
Mode: Real-time Archive 2022-02-04 13:30 Eastern UTC Submit

Precip Type (last hour)

Feb 4, 2022 1:30 pm EST

- ❄ Snow
- ❄ Freezing Rain
- 💧 Rain
- ❄ Unknown

Precipitation type is determined from liquid-equivalent precipitation, snow depth, air temperature and wind measurements from propeller and sonic anemometers over the previous hour. This value is still largely



February 3-4th 2022 Winter Storm with Significant Ice Accretion in Ulster County



Winter Weather Advisory until February 23 10:00am EST

Roxbury

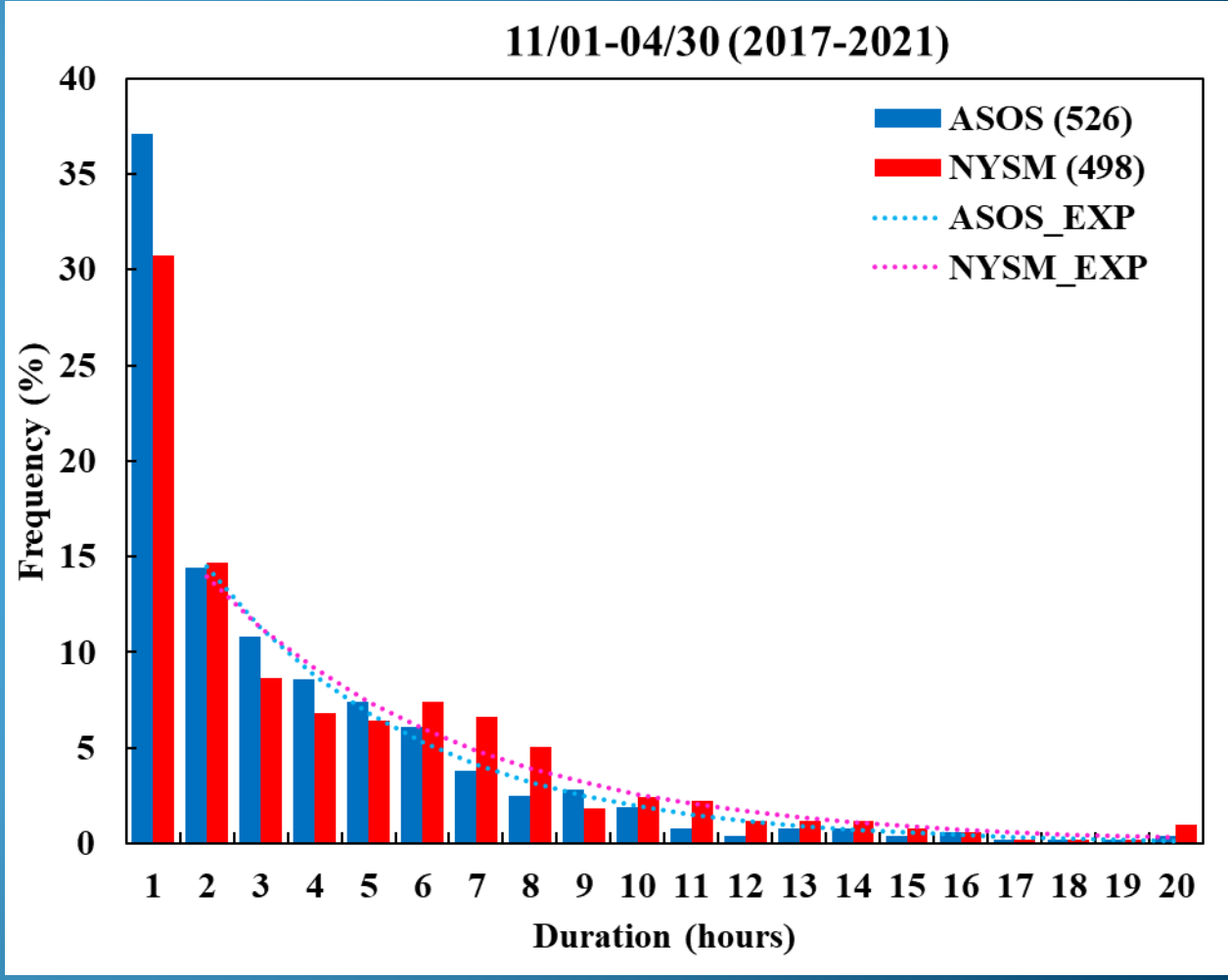
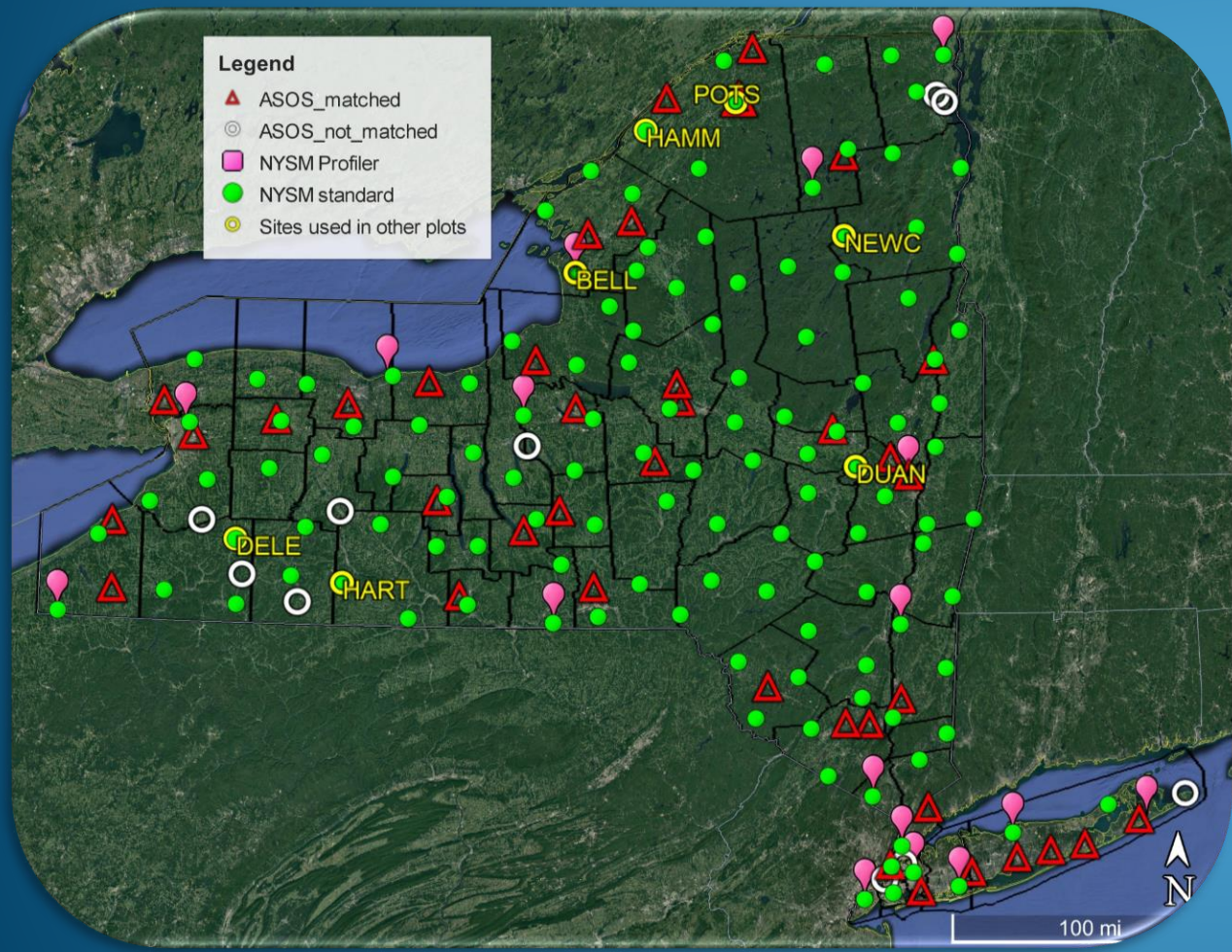


Conditions as of 1:30 PM

Snow Depth	6"				
P-type	Freezing Rain				
	1-hr	3-hr	6-hr	12-hr	24-hr
Snow Accumulation	0.0"	0.0"	0.0"	1.2"	2.0"
Depth Change	0.0"	0.0"	0.4"	1.2"	1.2"
Liquid-Equivalent	0.02"	0.02"	0.10"	0.60"	1.67"
SLR	--	--	--	4	2

<http://nysmesonet.org/weather/winter>

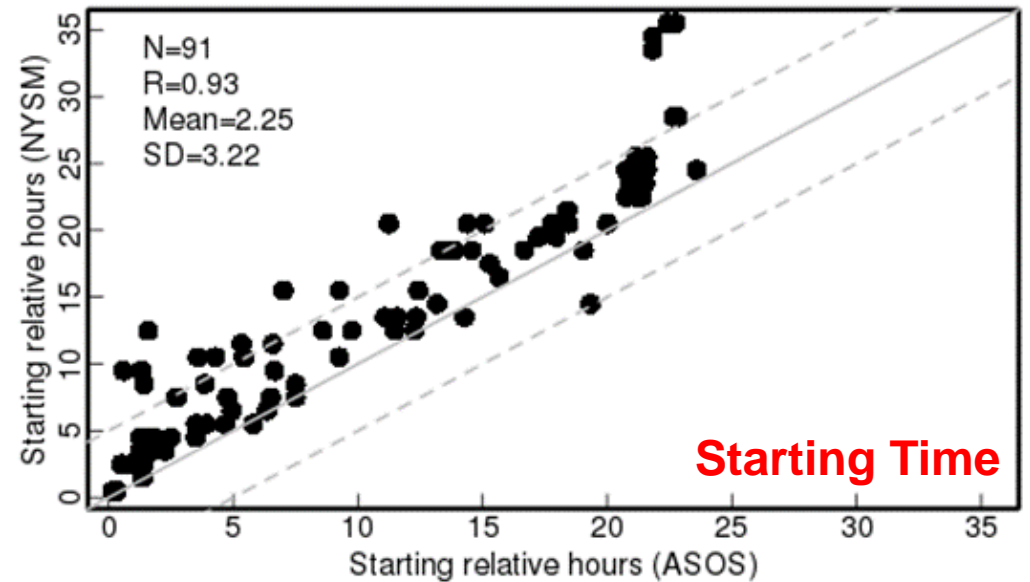
Comparisons with ASOS (2017-2021)



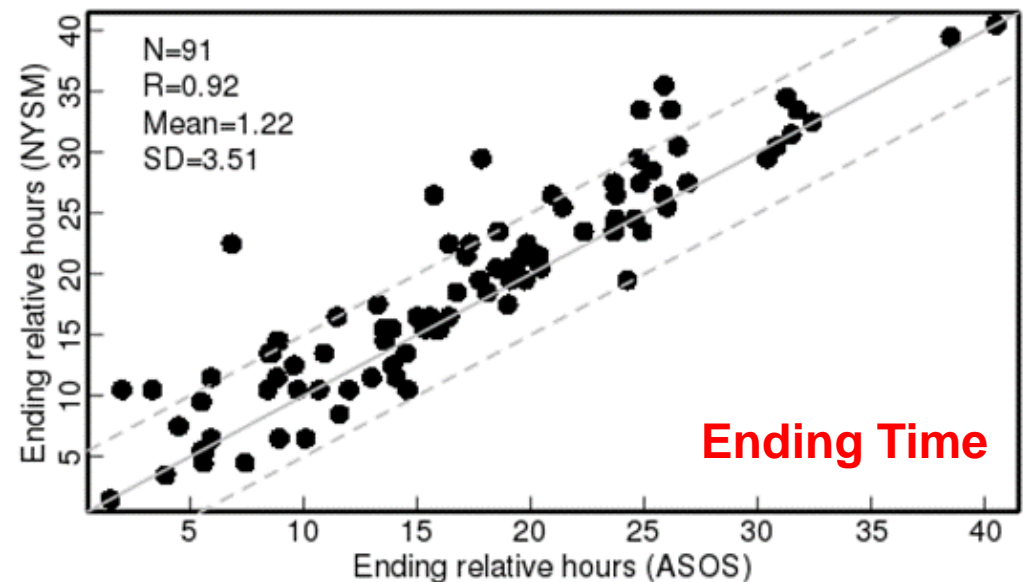
Comparisons with ASOS

- Good agreements in starting and ending times;
- NYSM starts and ends later;
- Significant correlation in duration too.

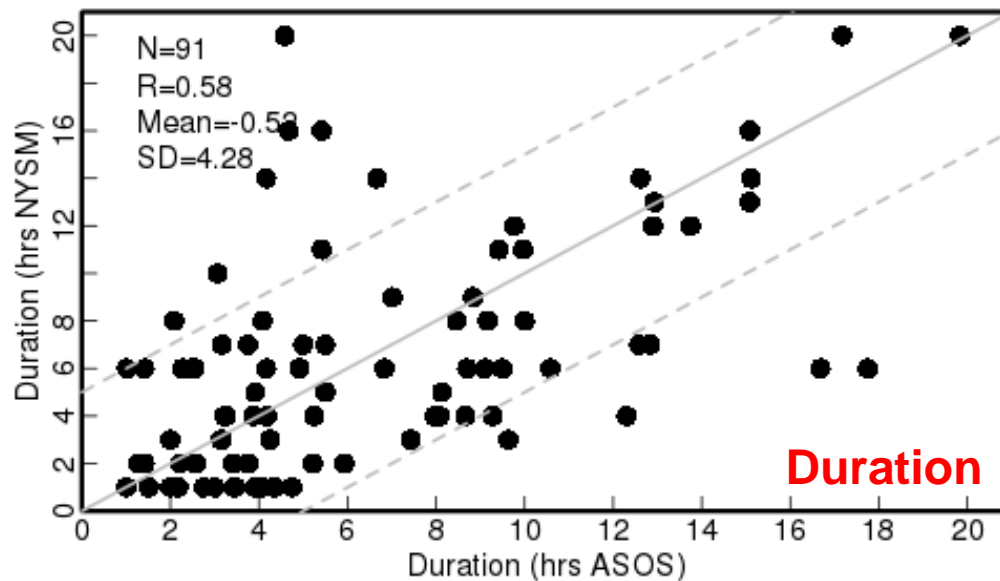
(a) 11/01-04/30 (2017-2021)



(b) 11/01-04/30 (2017-2021)

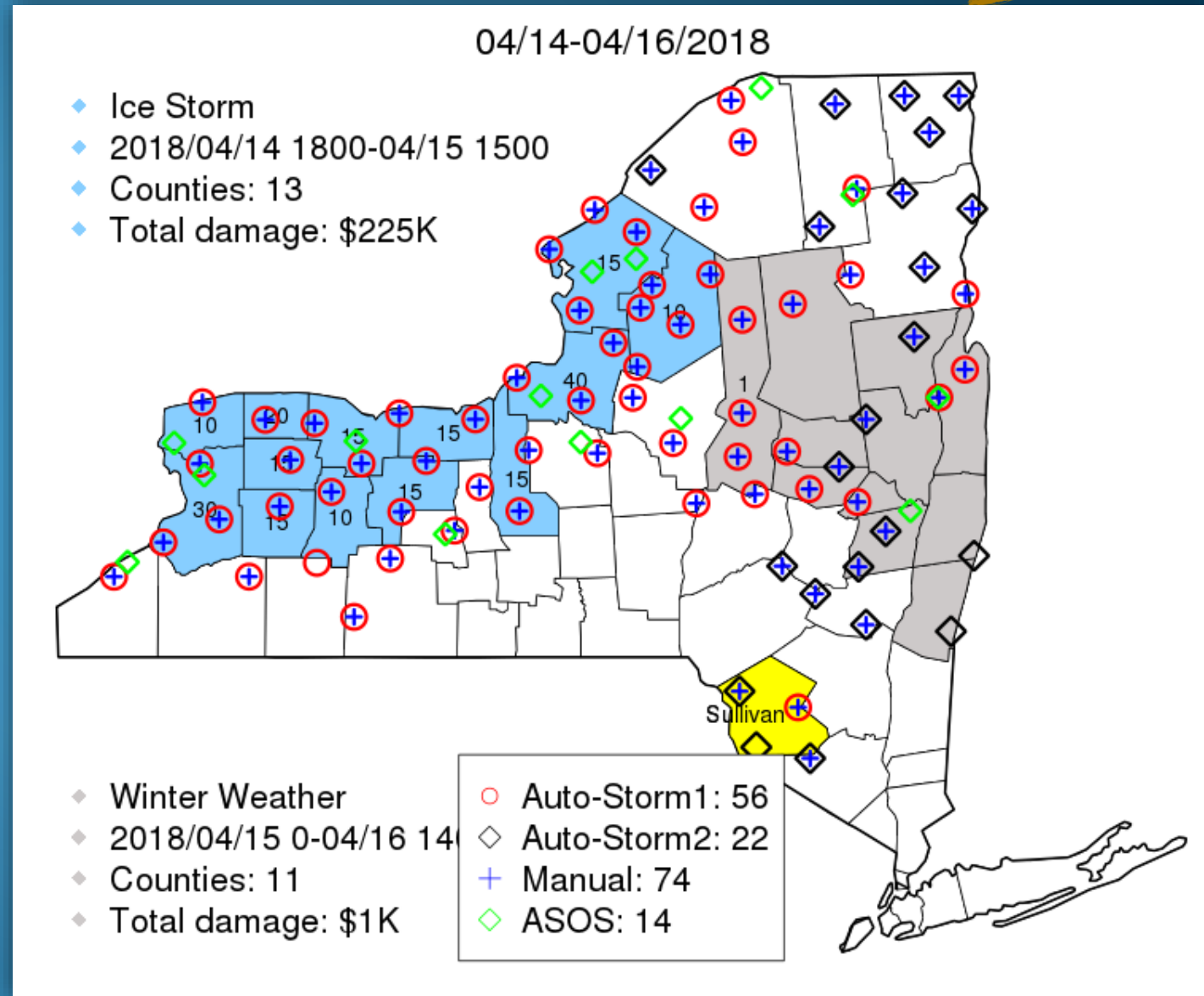


(c) 11/01-04/30 (2017-2021)



April 14–16 2018 Ice Storm

- Synoptically driven storm with large scale impacts across the US: Tornadoes, Severe thunderstorms, Flooding, and Blizzards!
- Freezing rain combined with wind caused multiple trees to fall and power lines to fall in NYS. Total \$225K damage
- NCEI reports mainly focus on great lake area, but NYSM shows much wider area.
- Good agreements with ASOS

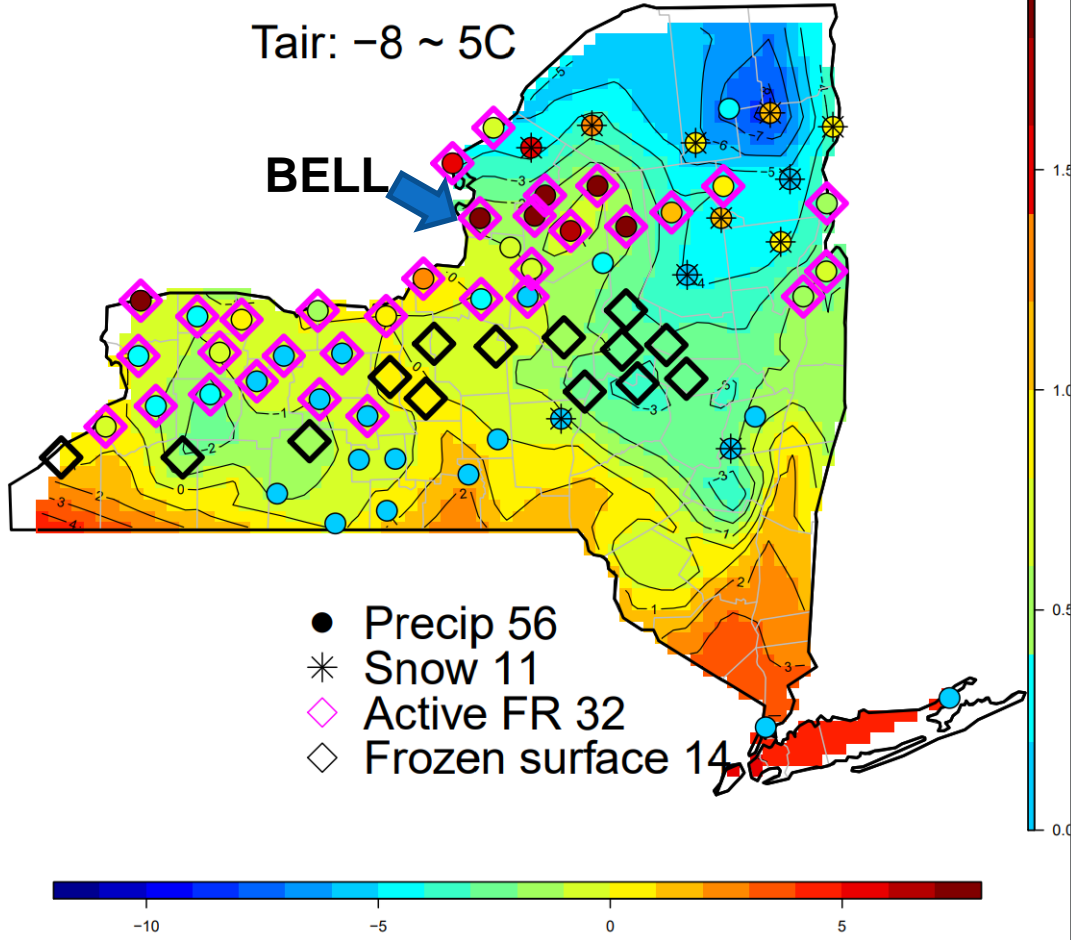


April 14–16 2018

2018-04-15 14 UTC

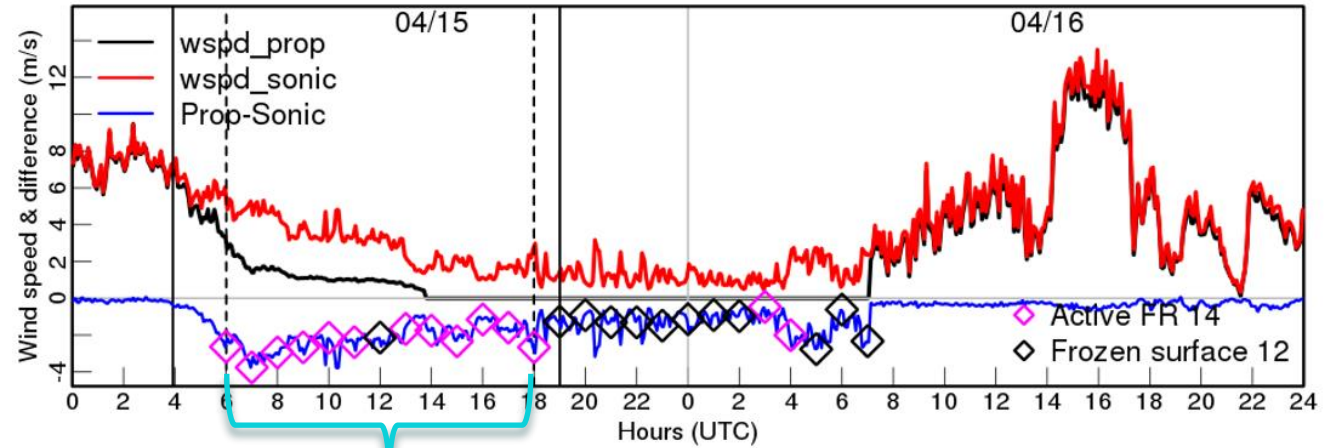
Tair: -8 ~ 5C

BELL



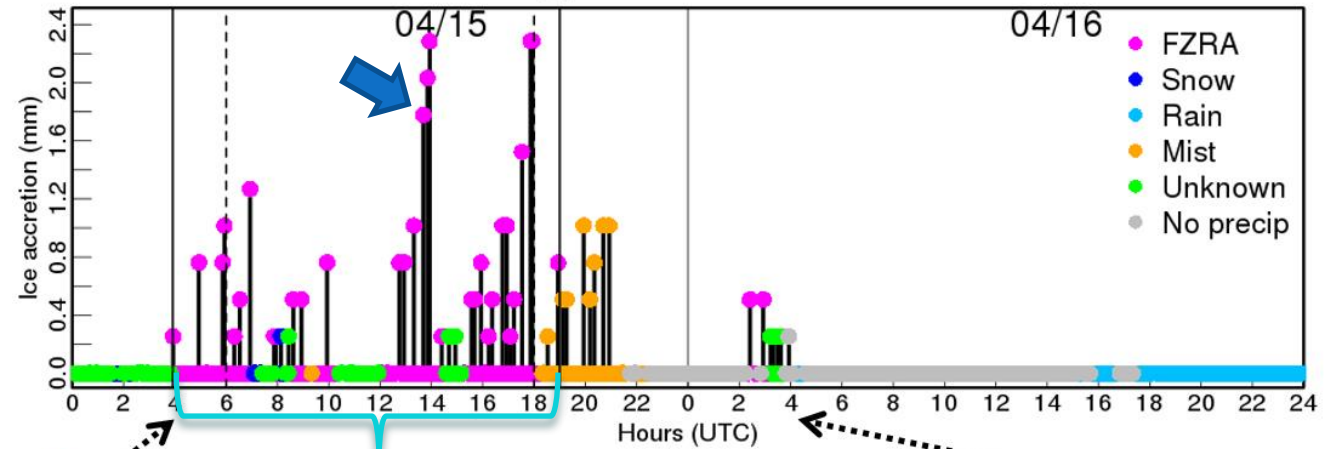
(b) BELL 20180415-16

NYSM



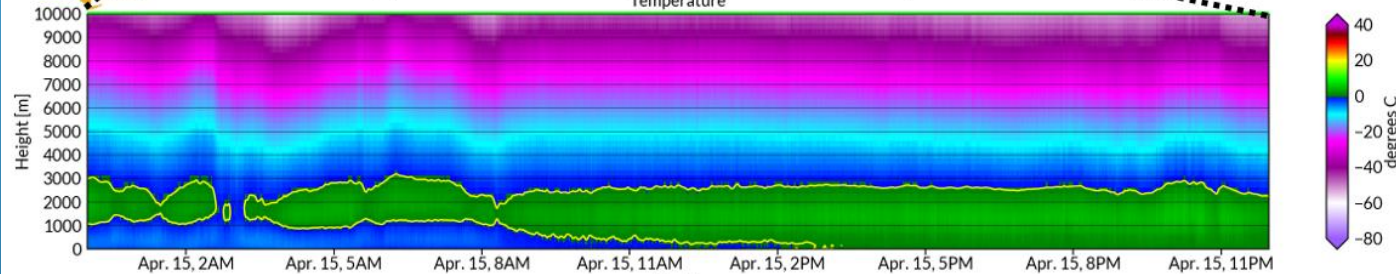
(c) BELL 20180415-16

ASOS



(d) Panel Microwave Radiometer Plot for Belleville, NY

MWR



April 14–16 2018 Ice Storm

April 15, 2018 8:00:27 AM EDT
Delevan, NY looking 0°

Iced fence at DELE

(a)

April 15, 2018 8:00:27 AM EDT
Hammond, NY

Iced camera at HAMM

(b)

April 16, 2018 8:00:28 AM EDT
Newcomb, NY

Iced & “sleeping” bushes at NEWC

(c)

April 16, 2018 3:45:29 PM EDT
Newcomb, NY looking 0°

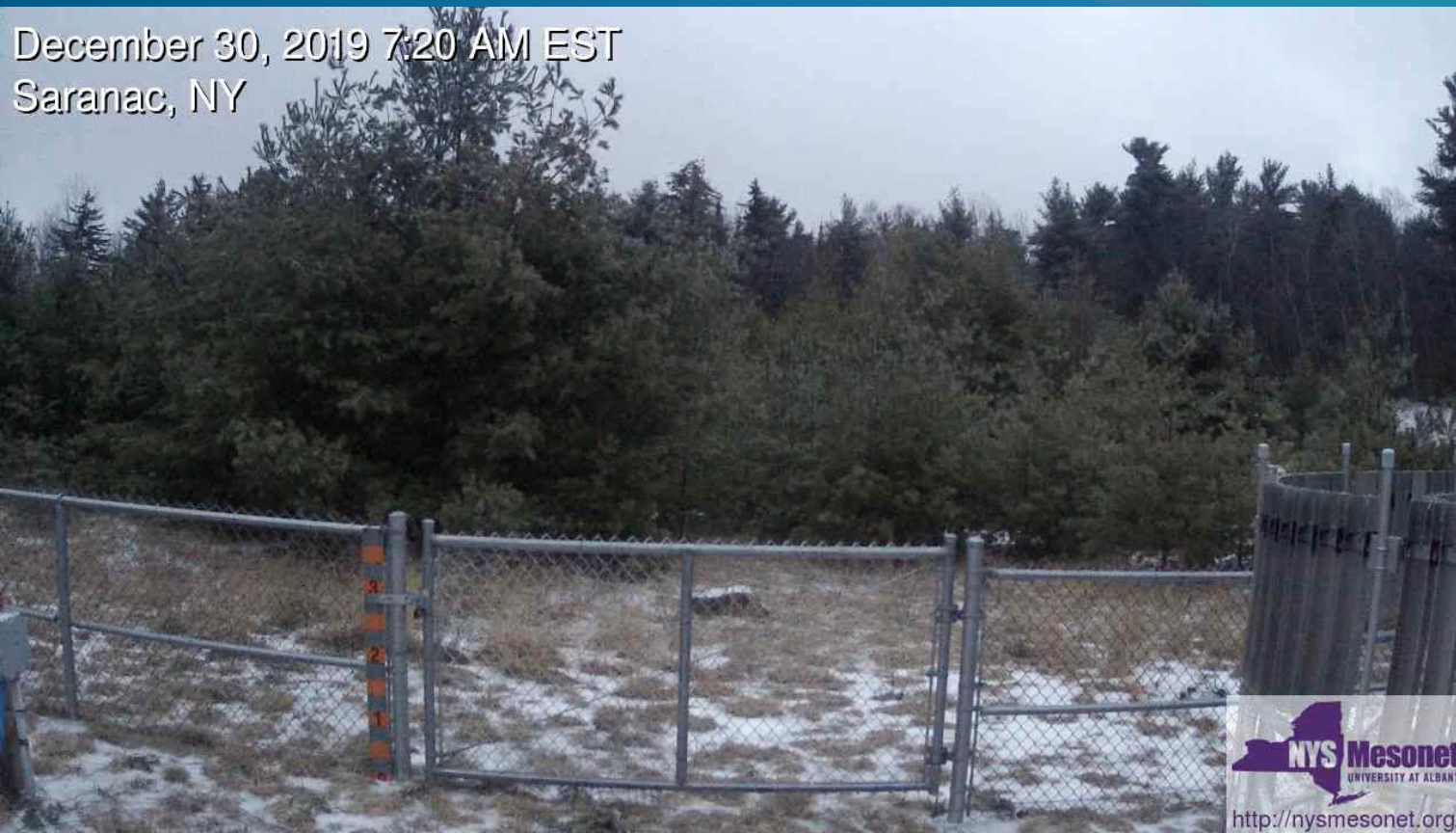
“Woken” bushes at NEWC

(d)

Conclusions & Future Work

- ❖ An algorithm is developed to determine precipitation type in real-time and high spatial resolution using NYSM data.
- ❖ The algorithm is implemented in NYSM Winter Weather Product Website (<http://www.nysmesonet.org/weather/winter>) to assist WFOs for situation awareness and better warning and forecasting.
- ❖ The unique freezing rain detection algorithm takes advantage of co-incident wind measurements from propeller and sonic anemometers and is validated by comparing with ASOS data in its capability in detection, timing and spatial coverage.
- ❖ The algorithm needs to be further improved: sensitivity to different thresholds, false alarm, temporal/spatial coherence, snowfall calculation.
- ❖ Validation: comparisons with freezing rain sensor, mPING, ASOS and profiler data.
- ❖ Applications of 6-year NYSM winter wx products

December 30, 2019 7:20 AM EST
Saranac, NY



Winter Weather Products:

<http://nysmesonet.org/weather/winter>

Contact: June Wang (jwang20@albany.edu)

Thank You!

Profiler Network Products:

http://nysmesonet.org/networks/profiler#stid=prof_alba

