NYS Mesonet Winter Weather Products

Precipitation Types

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

10 m Wind speed + direction (prop and sonic)

9 m Temperature

Insolation

Snow depth

Camera images

Barometric pressure

Precipitation

Soil temp, moisture, & salinity

2 m Temp. - RH

Solar panel + battery bank

Snow Network

CS725 SWE

SR50A snow depth

Snow board

Profiler Network

Wind Lidar

Microwave radiometer
Winter Precipitation Types

Rain
- Frozen precipitation melts and reaches the ground as rain.

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.

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

Icing Causes Propeller to Slow/Stop

Wind Speed Differences are Reported

Precipitation Seen in Camera

Investigate Wind Speed Differences

Temperature is Within Threshold

NO

Investigate Wind Speed Differences

YES

Flag Data as a Freezing Rain Event
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)

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February 3-4th 2022 Winter Storm with Significant Ice Accretion in Ulster County
Comparisons with ASOS (2017-2021)

Legend
- ASOS_matched
- ASOS_not_matched
- NYSM Profiler
- NYSM_standard
- Sites used in other plots

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

Frequency (%)

- ASOS (526)
- NYSM (498)
- ASOS_EXP
- NYSM_EXP

Duration (hours)
Comparisons with ASOS

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

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<tr>
<th>Starting Time</th>
<th>Ending Time</th>
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<td>Duration</td>
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(a) 11/01-04/30 (2017-2021)

Starting relative hours (NYSM)

Starting relative hours (ASOS)

N=91
R=0.93
Mean=2.25
SD=3.22

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

Ending relative hours (NYSM)

Ending relative hours (ASOS)

N=91
R=0.92
Mean=1.22
SD=3.51

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

Duration (hrs NYSM)

Duration (hrs ASOS)

N=91
R=0.58
Mean=0.52
SD=4.28
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 Ice Storm

Iced fence at DELE

Iced camera at HAMM

Iced & “sleeping” bushes at NEWC

“Woken” bushes at NEWC
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
Thank You!

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

Winter Weather Products:
http://nysmesonet.org/weather/winter

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