

Implementation Of A Data Assimilation System In Conjunction With The New York State Mesonet

Nick Bassill¹ & Ryan Torn²

7th EnKF Workshop

May 27th, 2016

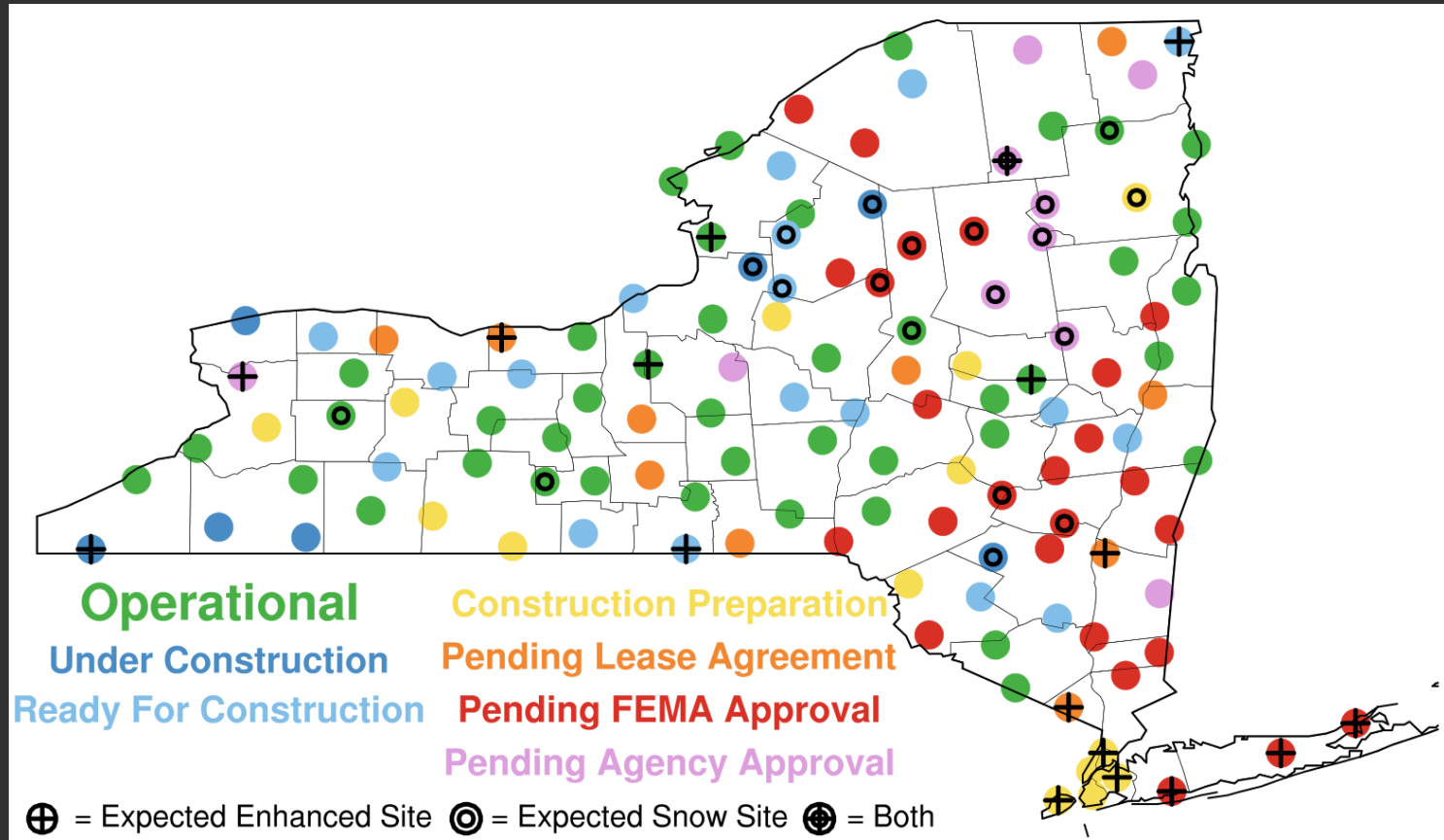
¹New York State Mesonet, University At
Albany, SUNY (nbassill at albany.edu)

²University At Albany, SUNY

Presentation Overview

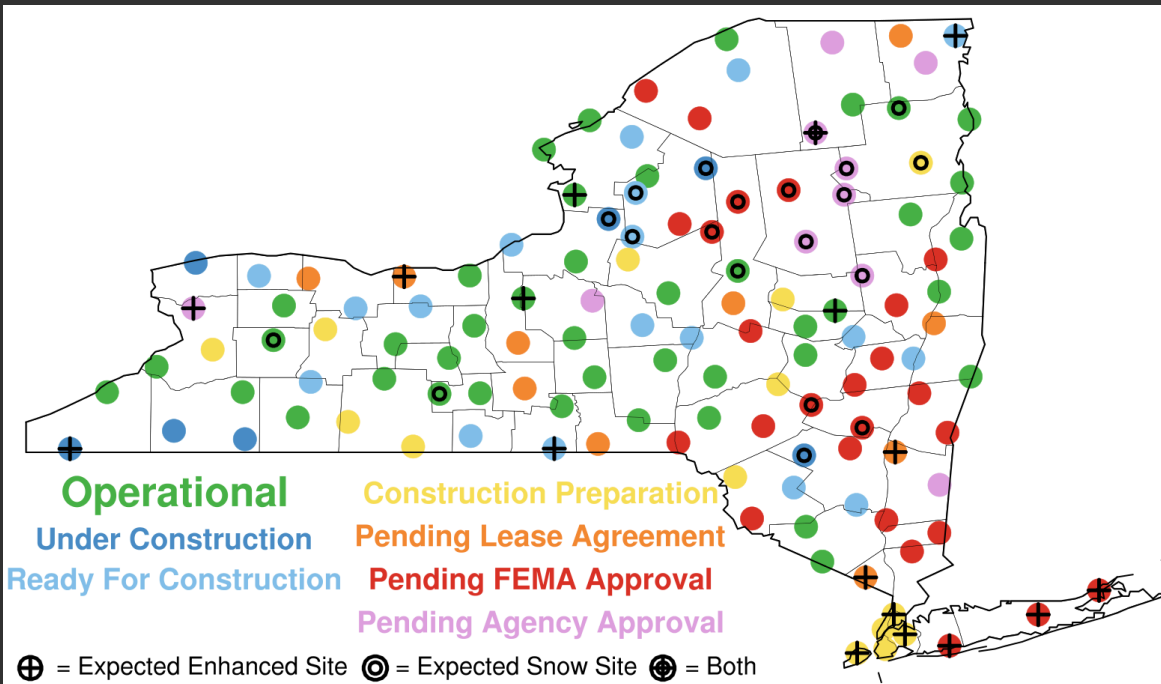
- Introduction of the New York State Mesonet
- Incorporation of Numerical Weather Prediction
- Examination of a test case: 10th-20th February 2016
- Conclusions

Overview of the New York State Mesonet



- Originally inspired by flooding events relating to Hurricane Irene and Tropical Storm Lee of 2011
- Funding was eventually allocated as part of the Sandy Supplemental relief bill (after Hurricane Sandy (2012))

Overview of the New York State Mesonet



Standard Observations (125 Sites):

- Precipitation
- Temperature
- Humidity
- Wind Speed and Direction
- Solar Radiation
- Barometric Pressure
- Soil Temperature (5, 25, 50 cm)
- Soil Moisture (5, 25, 50 cm)
- Site Photos

Additional Observing Networks

- Vertical Profiler Network (Microwave Radiometer, LIDAR) – a first!
- Snow Network (Depth, Water Equivalent)
- Flux Network (~17 – TBD)

Numerical Weather Analysis & Prediction

- A 512 core computing cluster will soon be made available to the NYS Mesonet for real-time operations
- One primary goal will be to create high temporal (~ 1 h) and spatial (~ 3 km) resolution analyses for the state of New York
- This will be done within a WRF/DART framework
- Eventually, short-term forecasts may be incorporated, computer-permitting

D O D G E

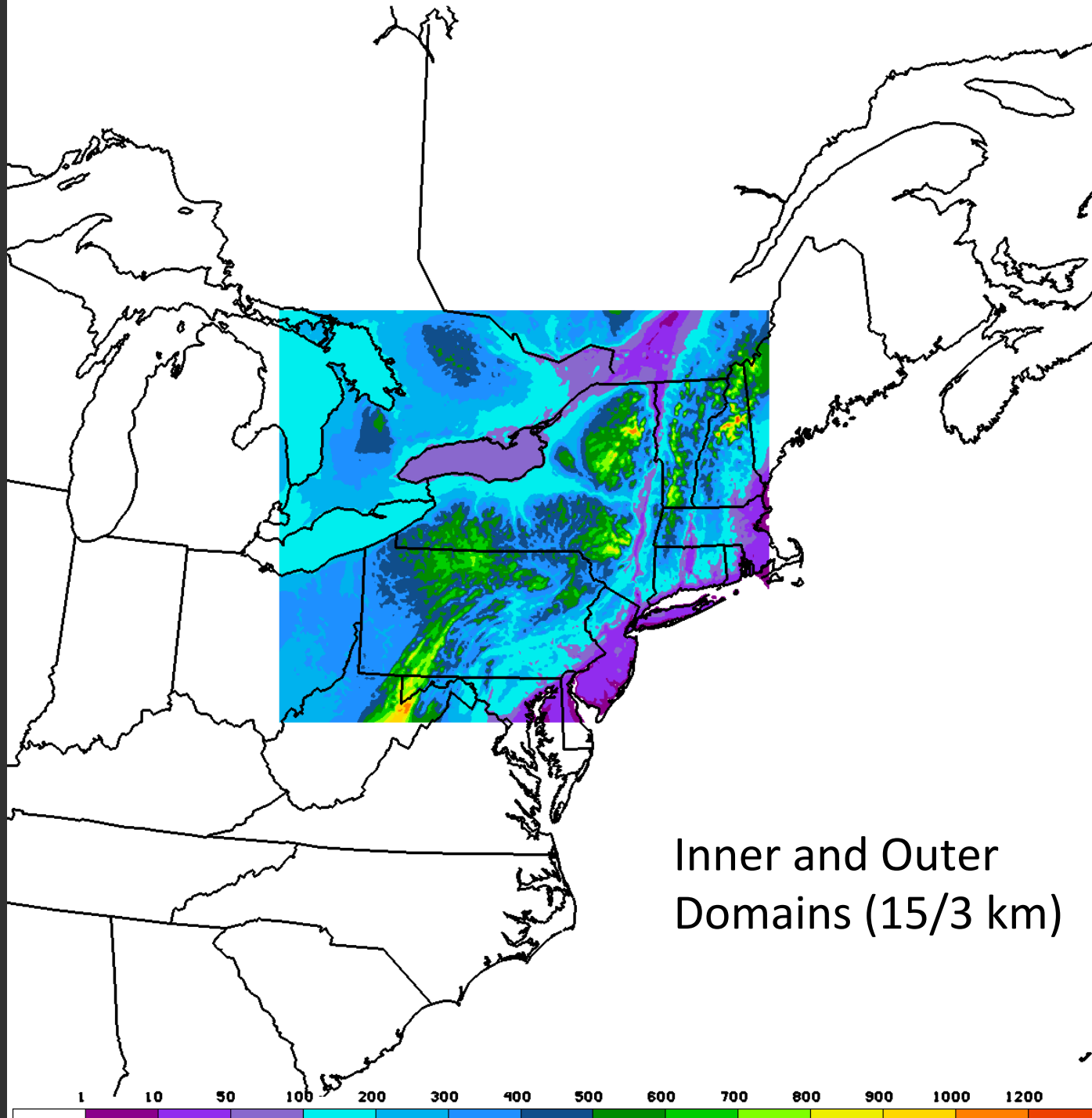
DART

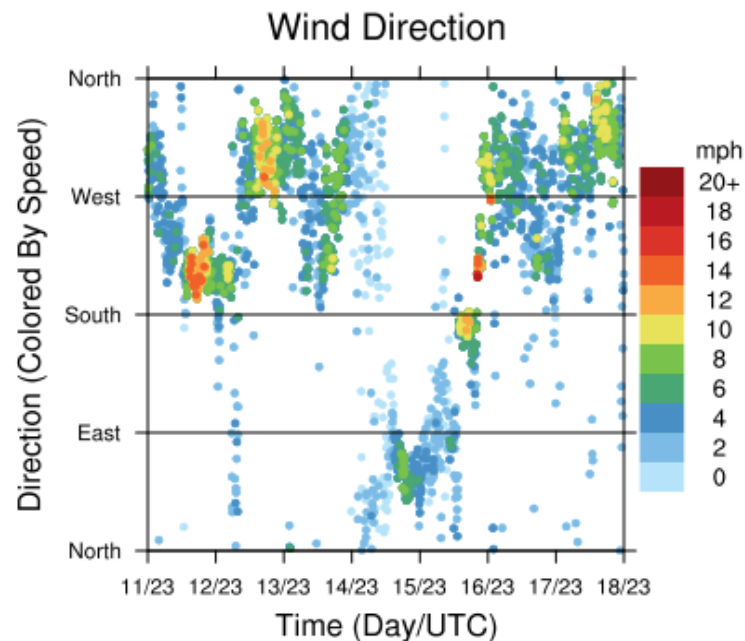
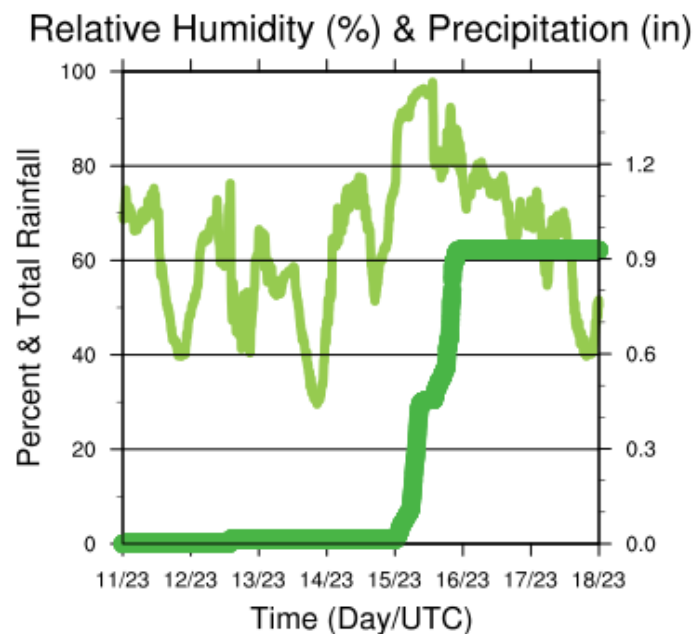
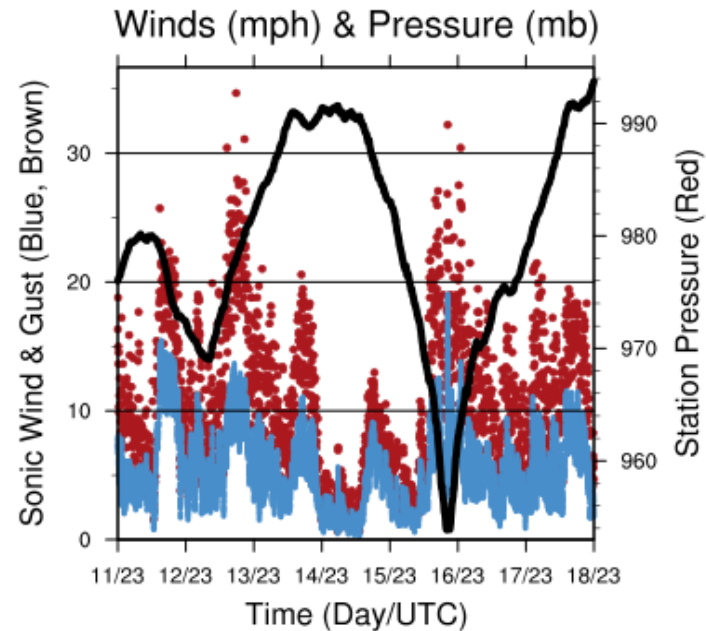
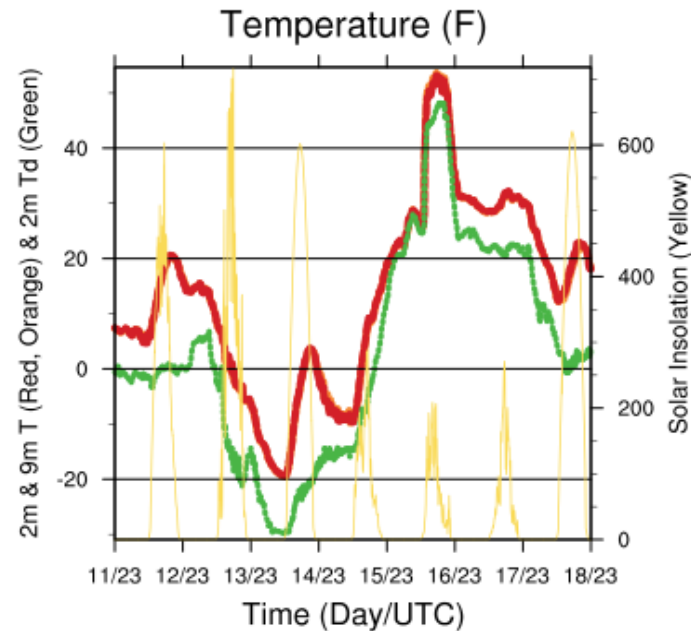
SXT



Current Expected Configuration

- Two domains – 15 km & 3 km, with 56 members
- Perturbed GFS boundary conditions
- Physics:
 - Goddard MP, MYJ PBL, Noah LSM, RRTM & Dudhia radiation (chosen after testing high-impact test cases)
- Inputs:
 - ACARS, METAR, Radiosonde, SSEC Satellite Wind, Marine, (NYS) Mesonet, possibly Radiometer/Lidar as available (future?)

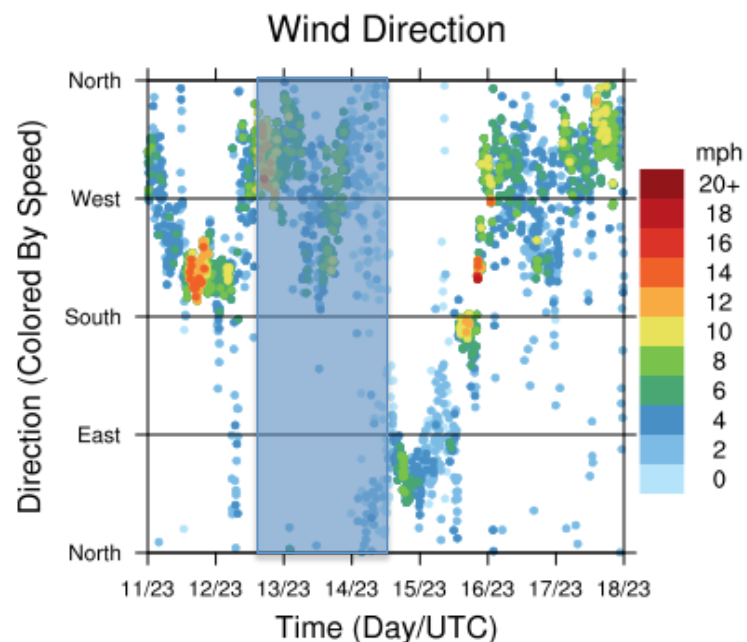
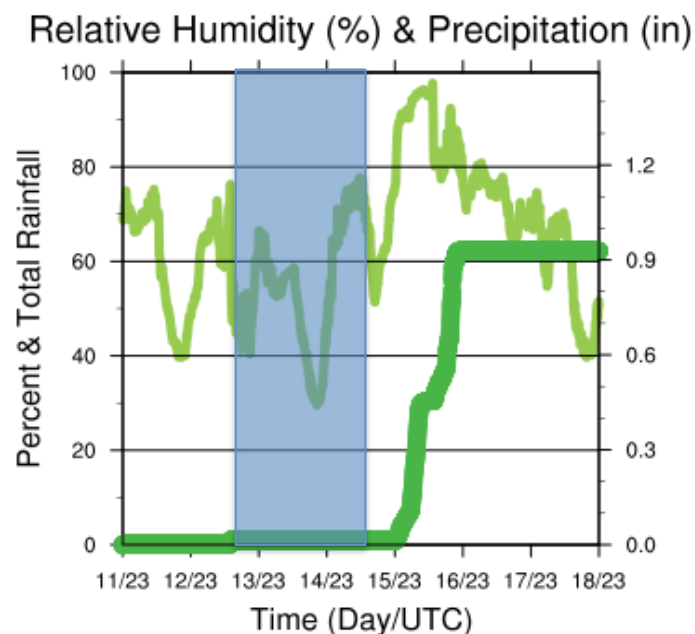
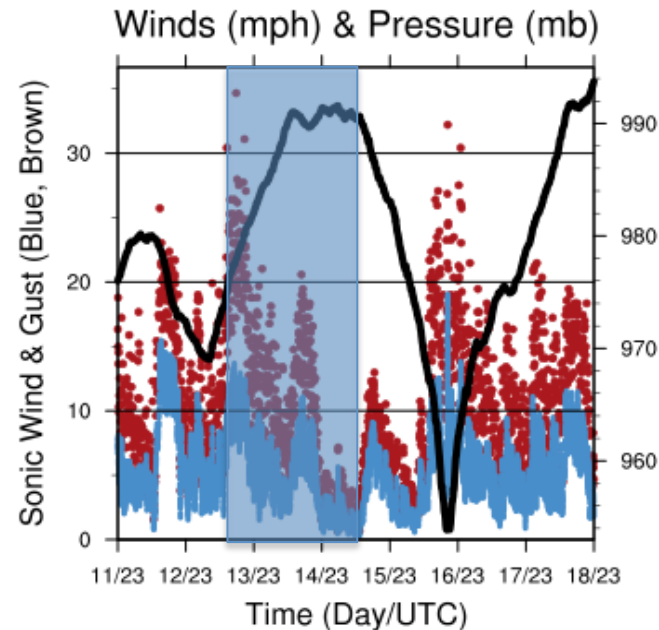
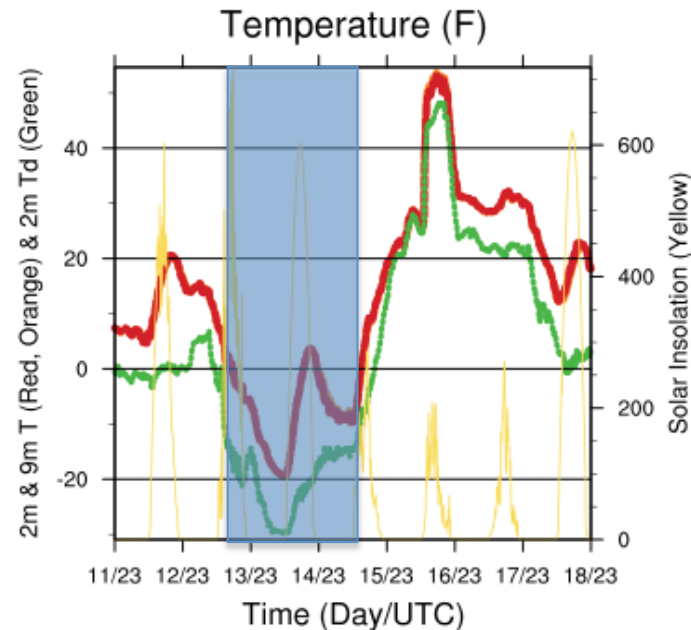




Location: Cobleskill
 Station elevation: 327.96 m
 Station lat/lon: 42.6763; -74.508
 Figure created on Thu, 2016-02-18, at 23:56 UTC
 Most recent data timestamp: "2016-02-18 23:50:00"

Extremes For Past 7 Days
 (High/Low/Max Wind/Total Precipitation)

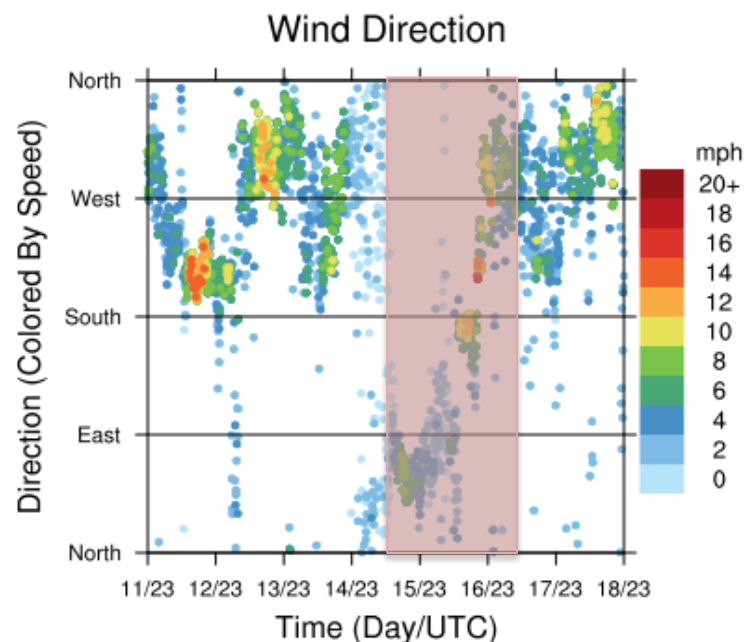
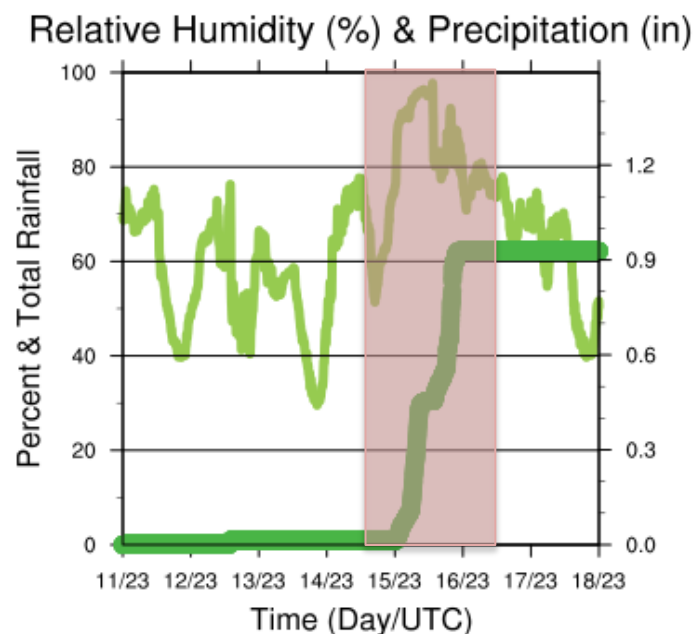
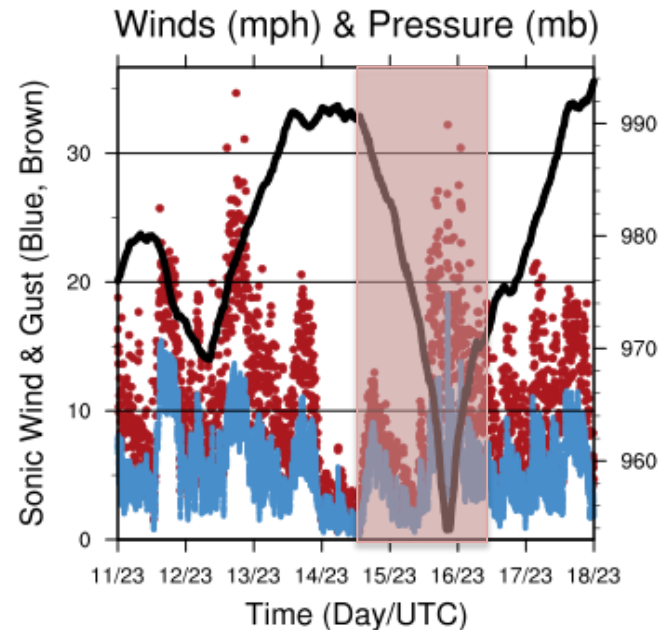
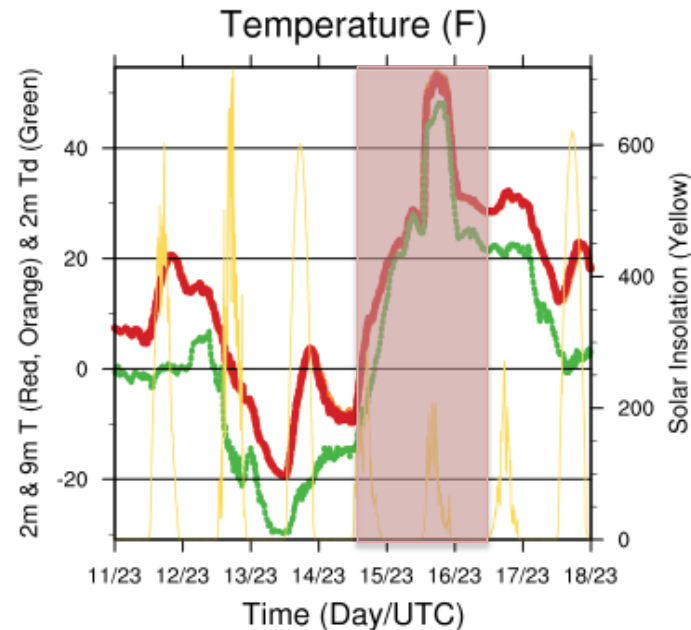
53.2/-19.4/19.2/0.93



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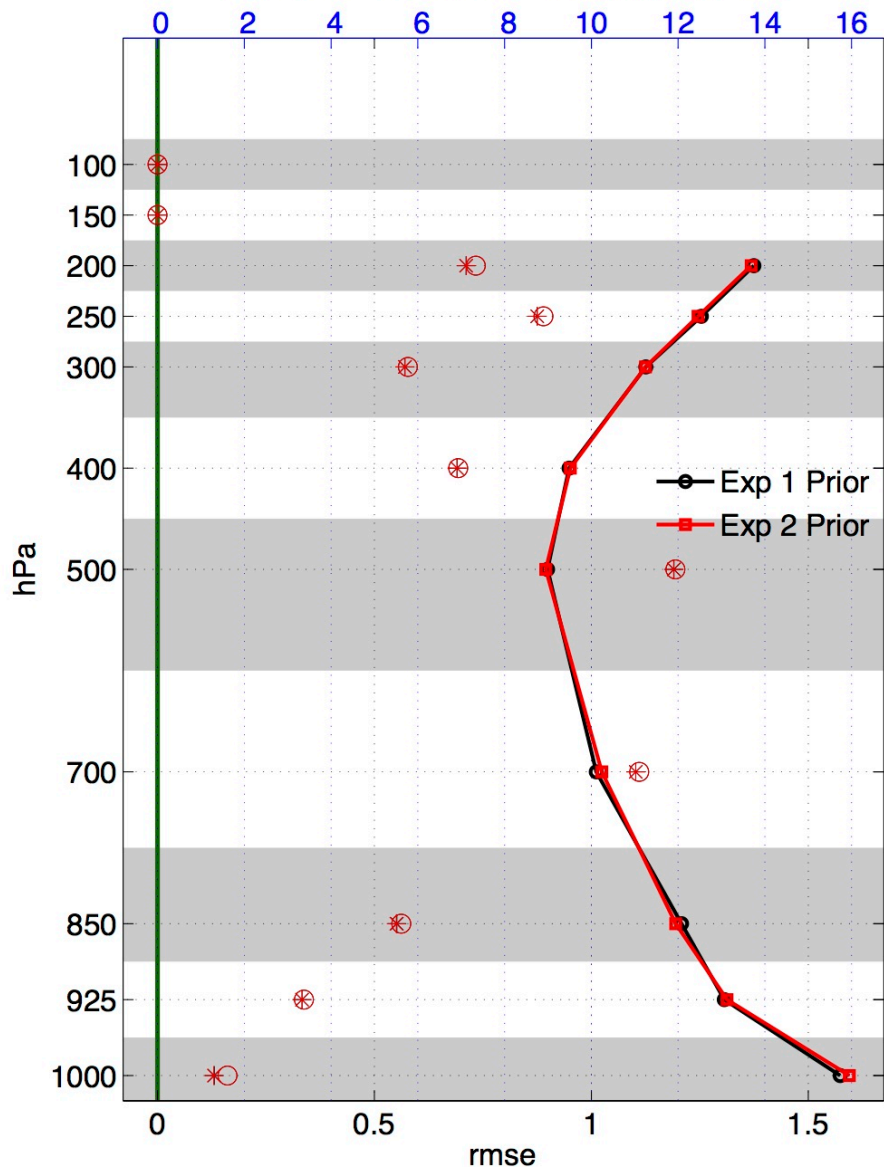
53.2/-19.4/19.2/0.93

Current Experiment Configuration

- Outer domain only (15 km)
- Perturbed GFS initial conditions and boundary conditions unique to each member and each cycle
- Perform 3 hourly assimilation cycles
 - Adaptive Anderson Inflation
 - Gaspari Cohn localization, .05 (~600 km) horizontal localization
- Inputs for **Experiment 1**:
 - ACARS, METAR Altimeter, Radiosonde, SSEC Sat Winds, Marine
 - Evaluate Only: NYS Mesonet, Metar wind/temp
- Inputs for **Experiment 2**:
 - Experiment 1 + NYS Mesonet winds/temp
- Using METAR obs as “truth” will allow us to assess the impact of adding NYS Mesonet data
- Only the final 9 days will be used for comparison purposes

NY ACARS_TEMPERATURE

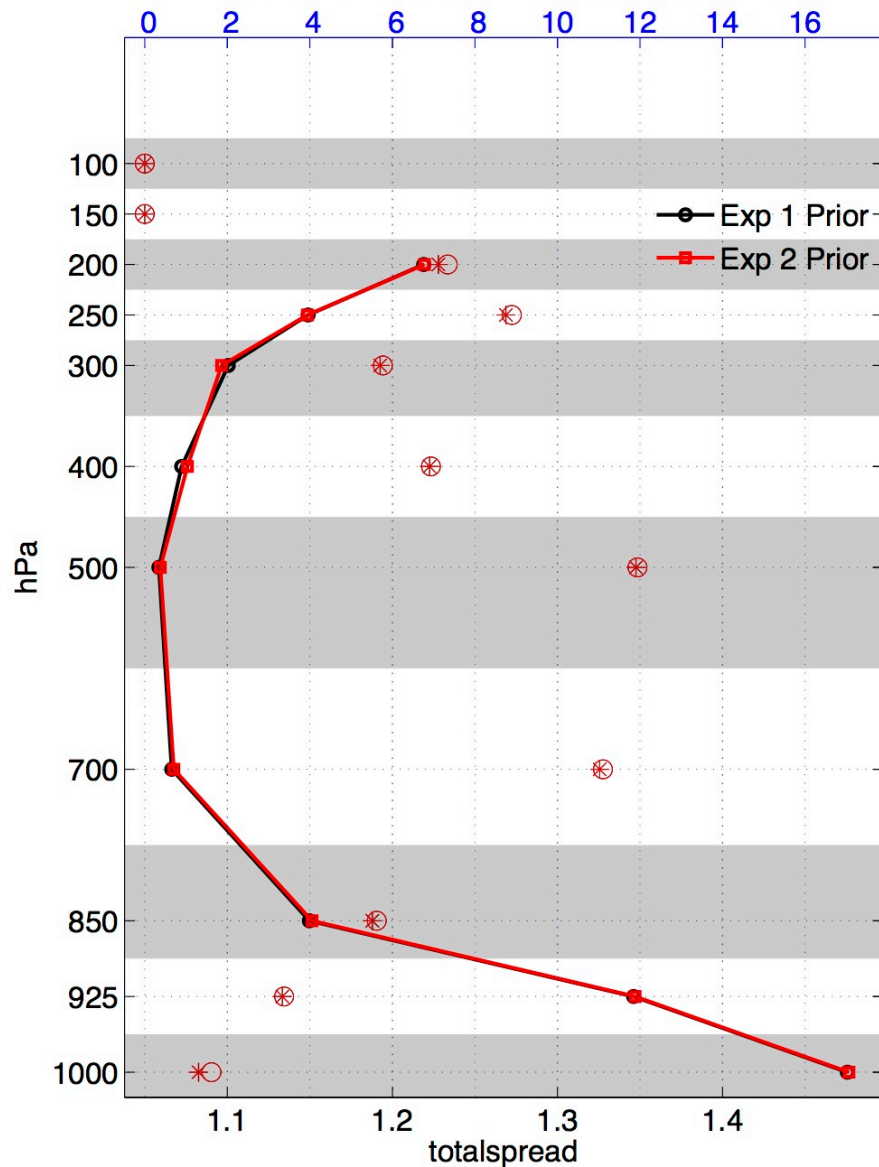
of obs (o=possible, *=assimilated) x1000



10-Feb-2016 22:30:01 through 20-Feb-2016 01:30:00

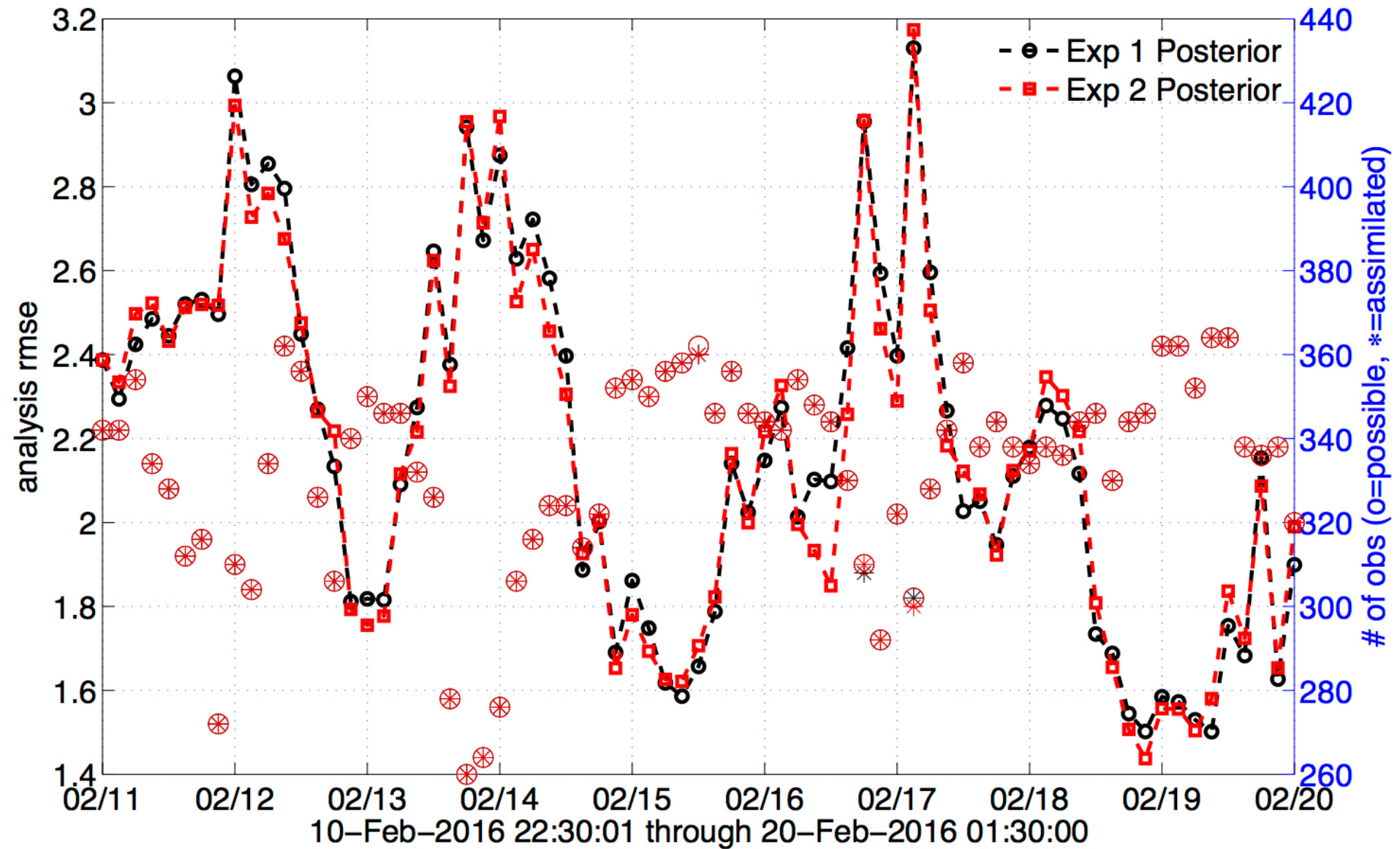
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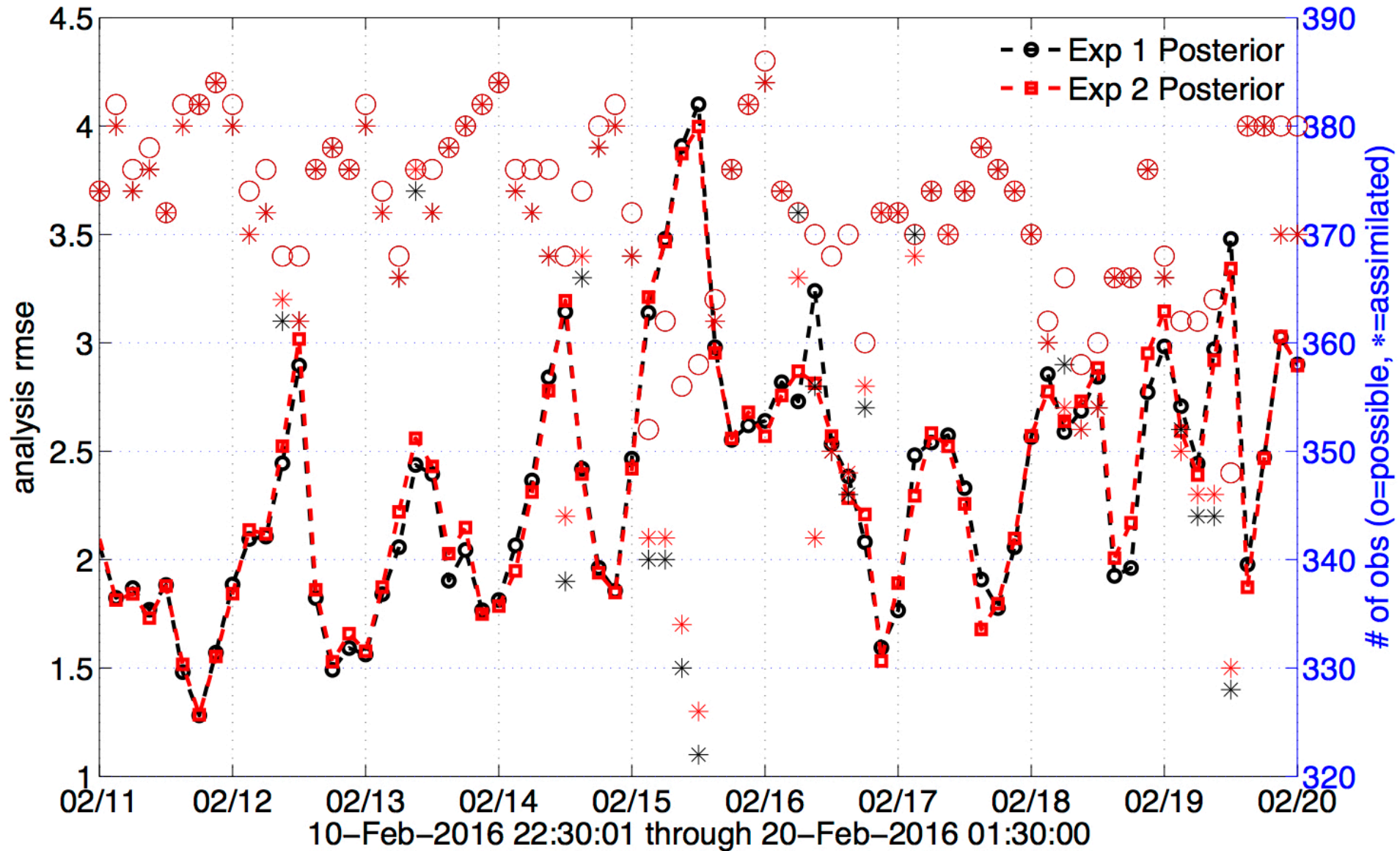


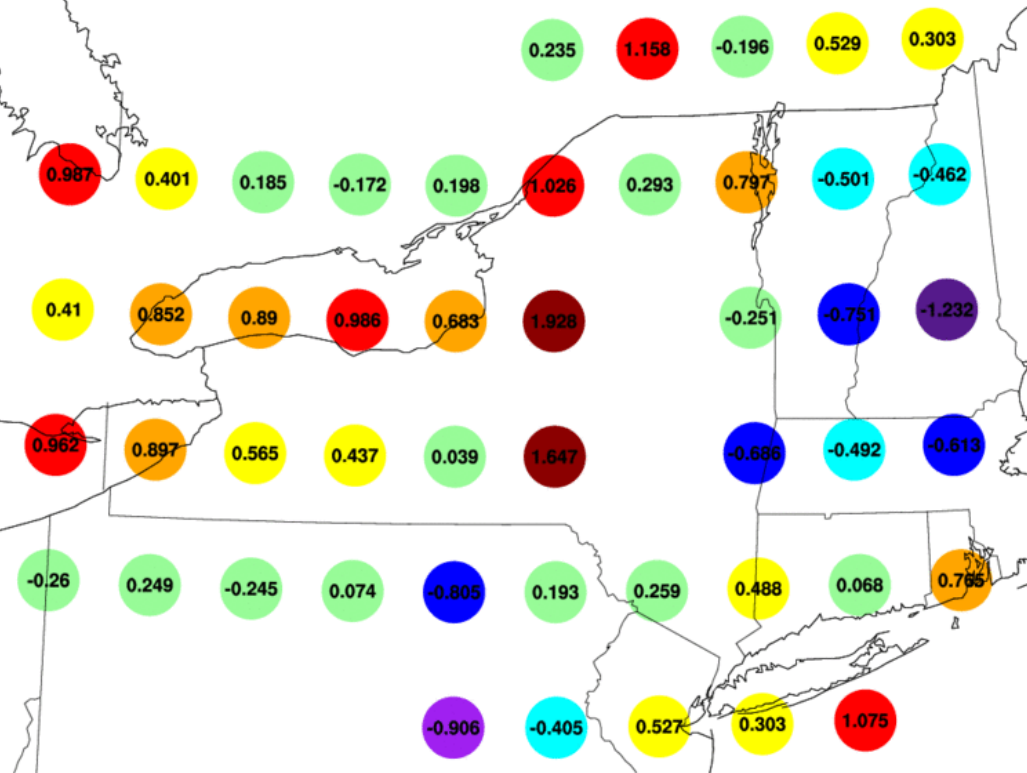
10-Feb-2016 22:30:01 through 20-Feb-2016 01:30:00

NY METAR_U_10_METER_WIND @ 1 surface



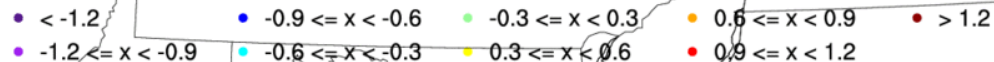
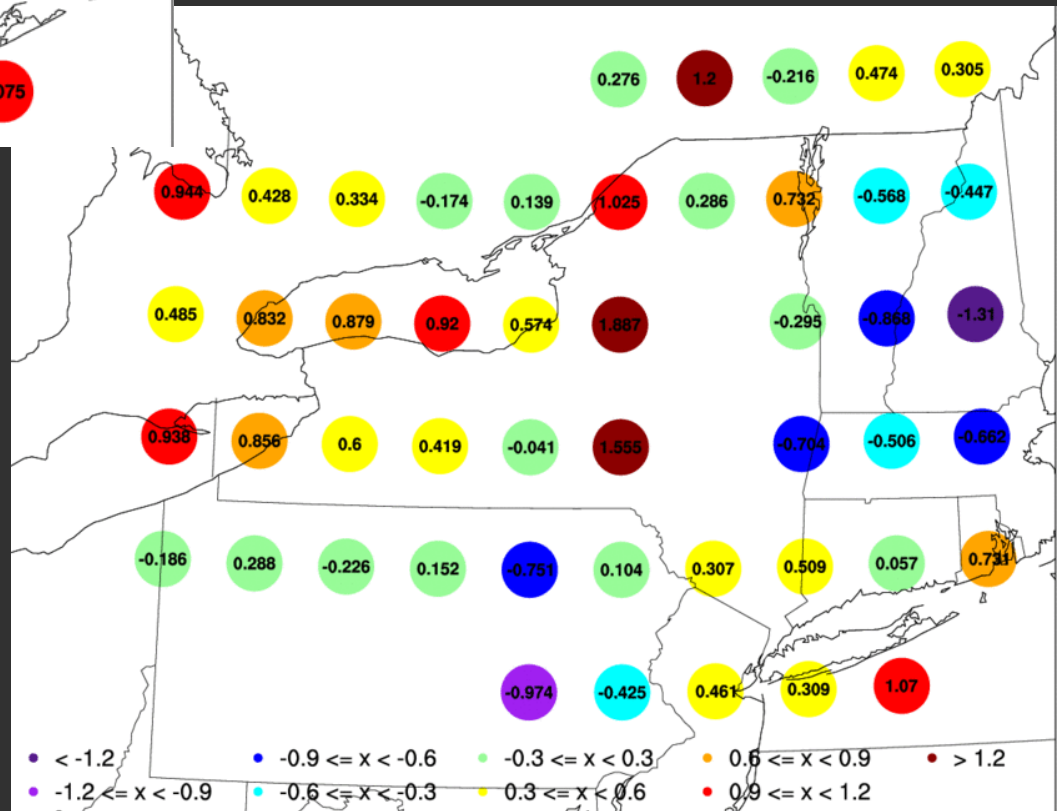
NY
METAR_TEMPERATURE_2_METER @ 1 surface

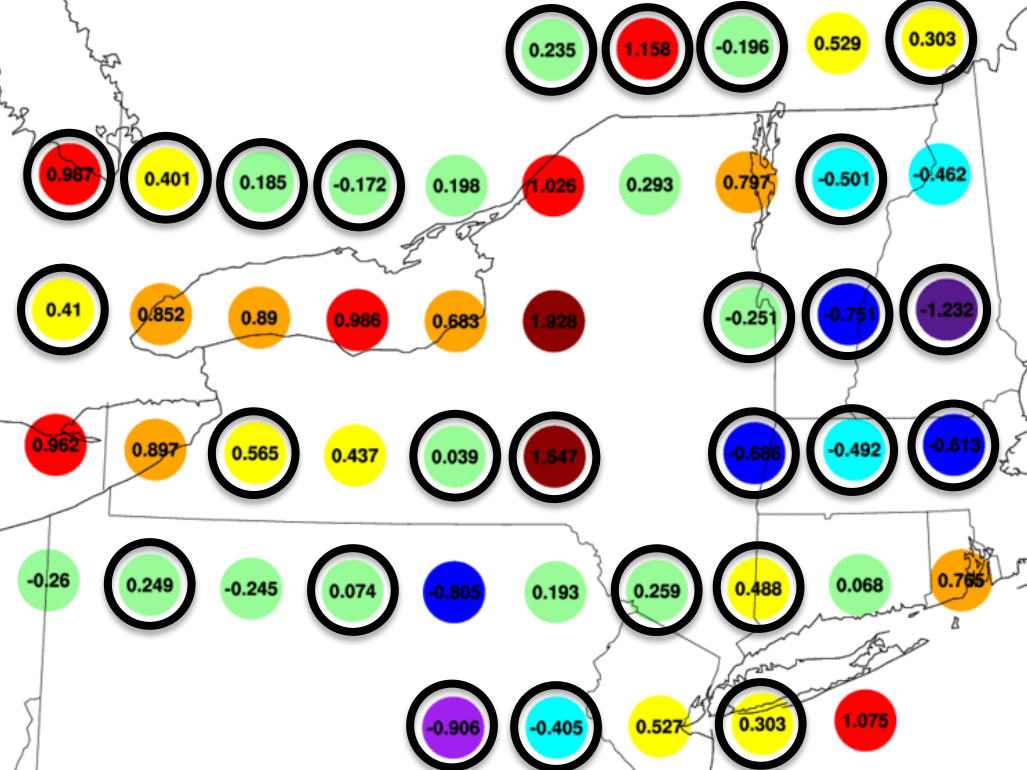




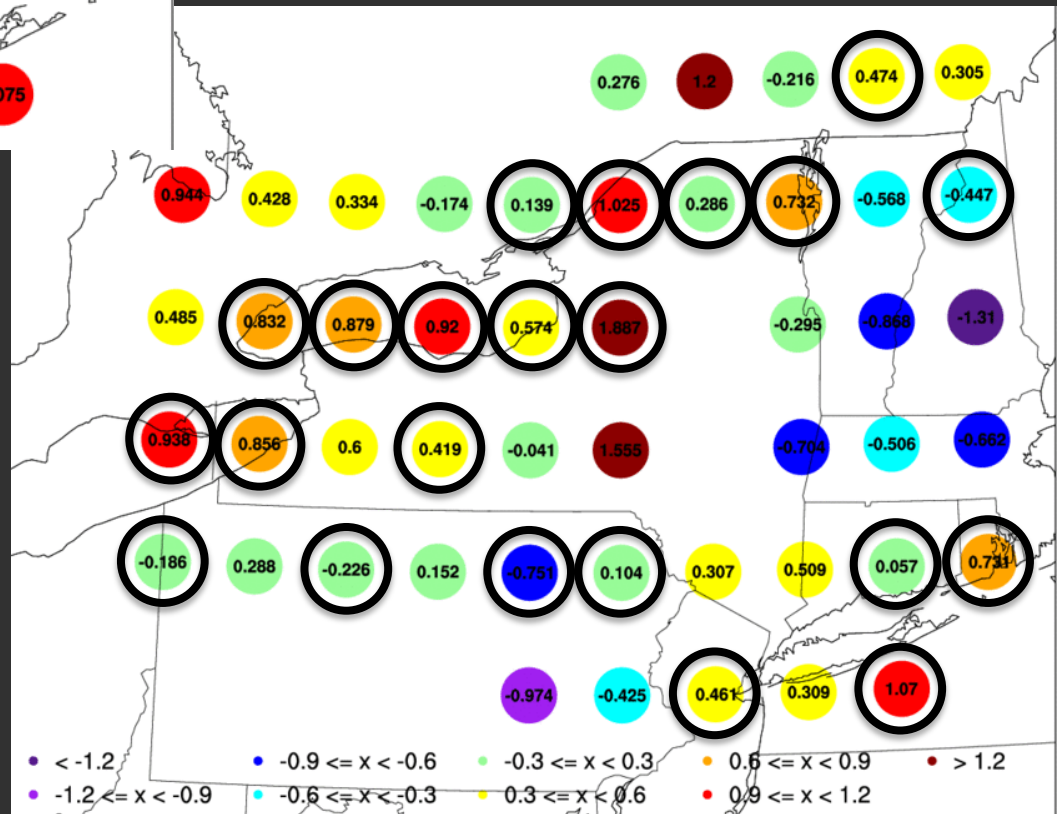
Experiment 1 (left)
Experiment 2 (below)

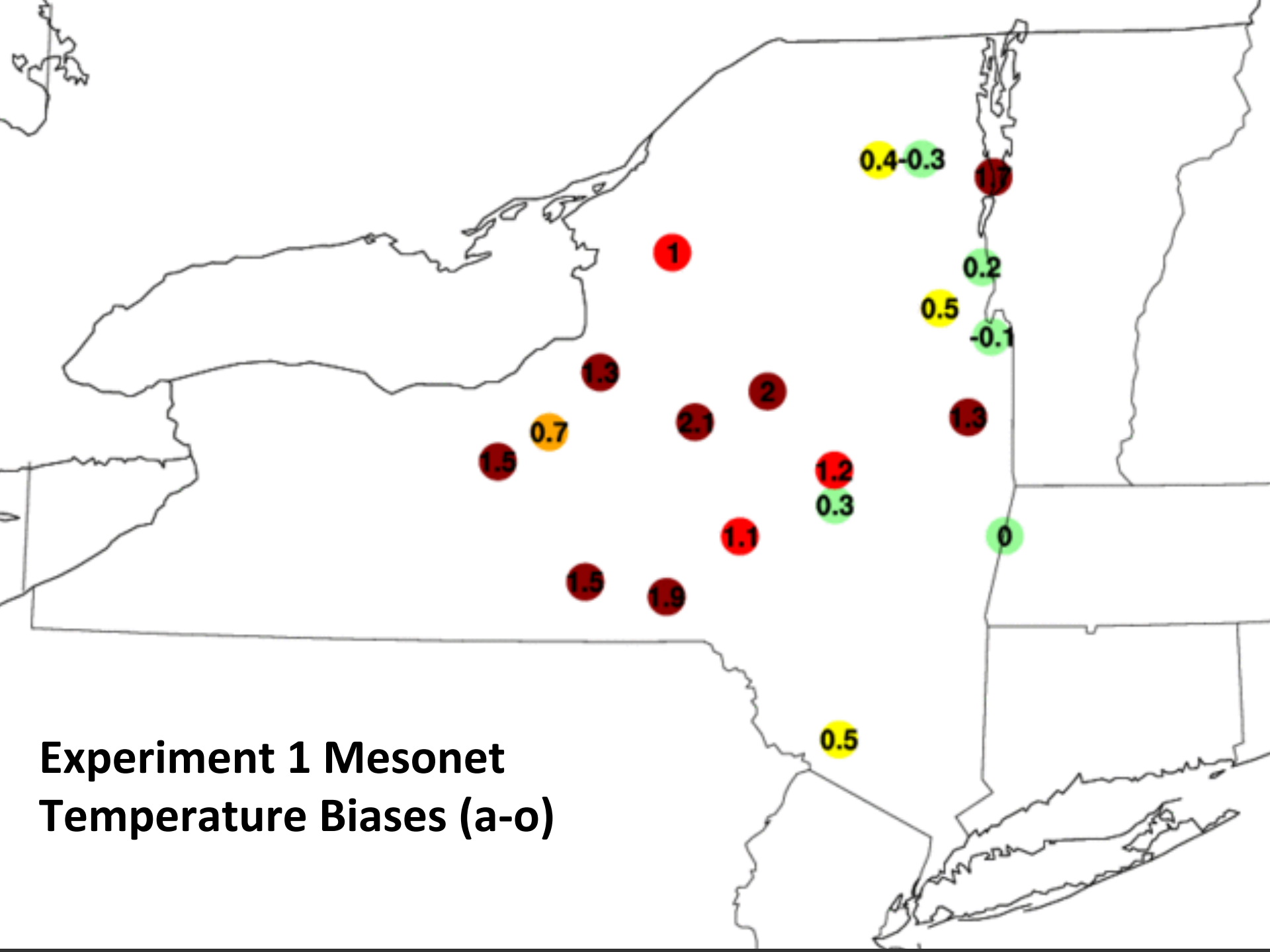
1°x1° Binned
METAR Biases



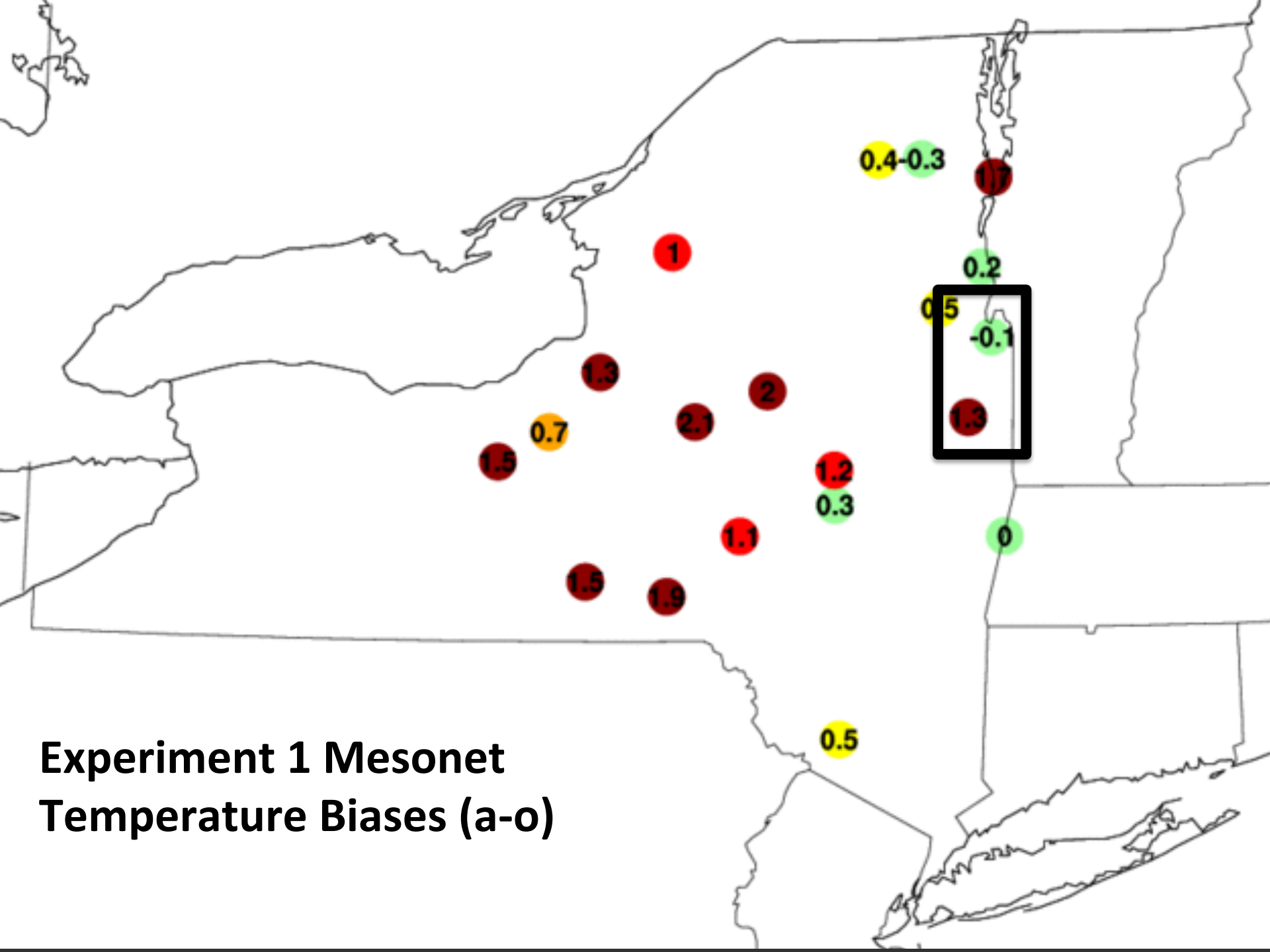


NY Area Biases (a-o):
 Exp. 1 -> Exp. 2
 0.1131° C -> 0.0983° C



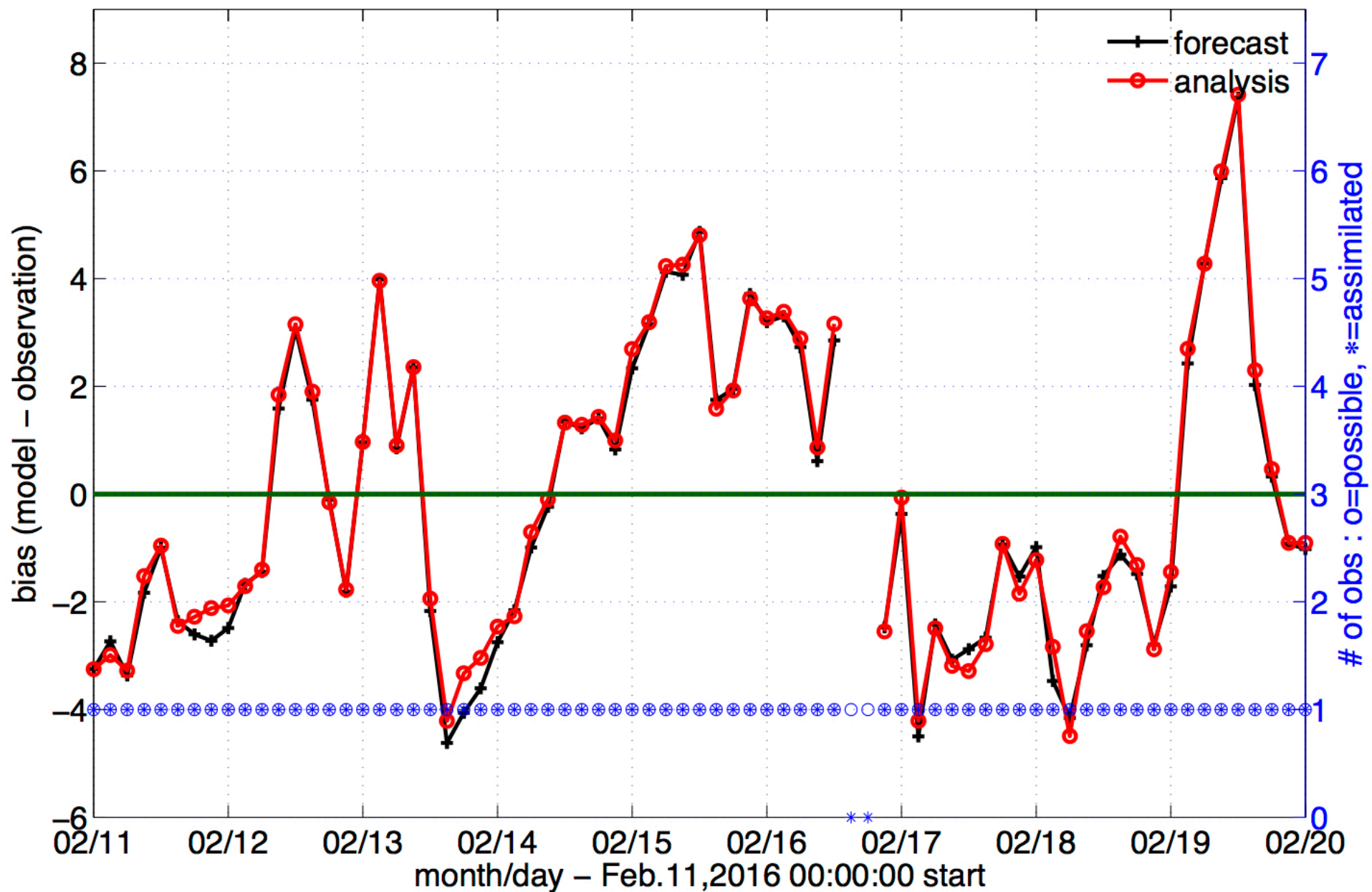


**Experiment 1 Mesonet
Temperature Biases (a-o)**

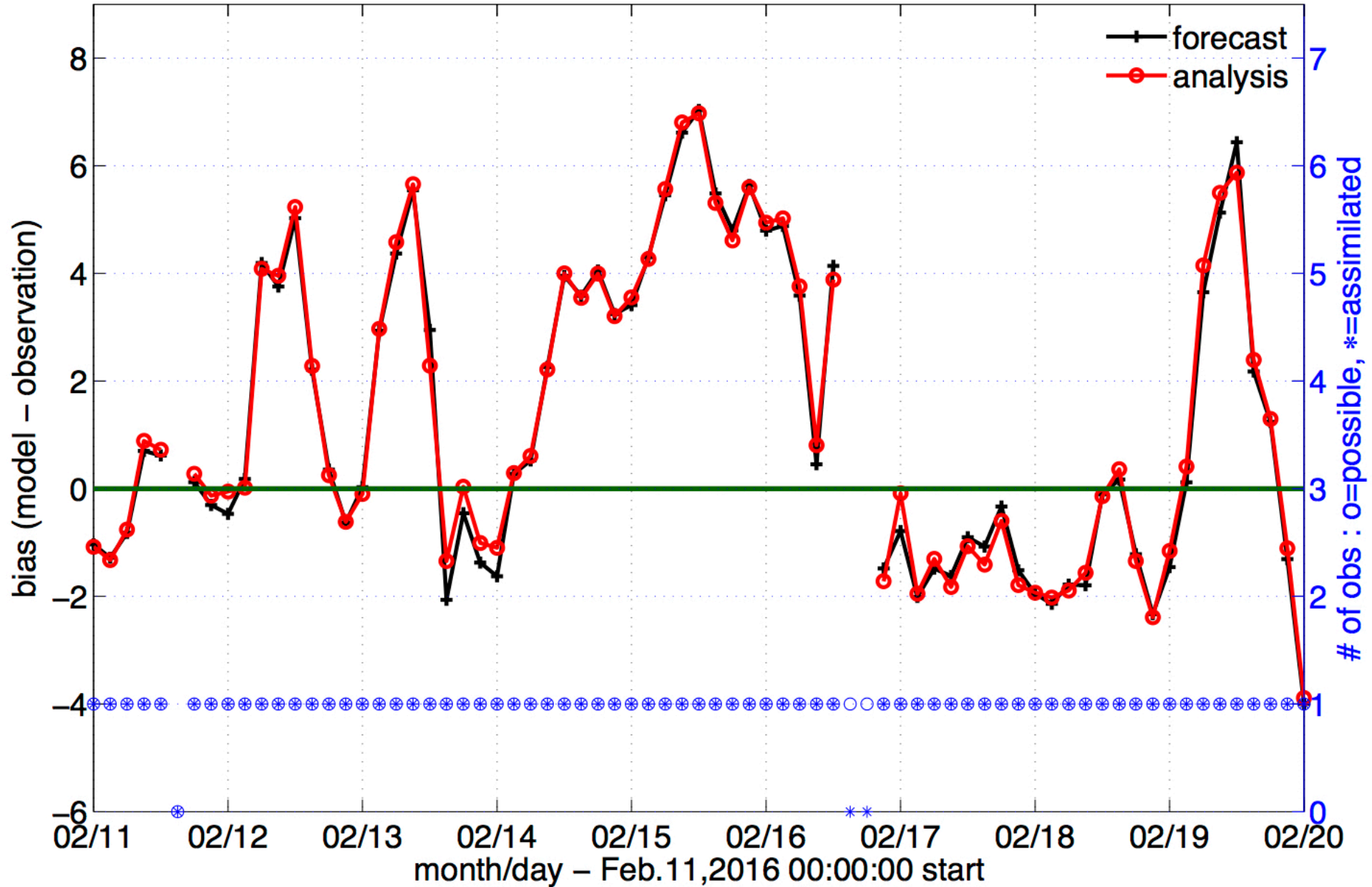


**Experiment 1 Mesonet
Temperature Biases (a-o)**

WHIT
LAND_SFC_TEMPERATURE @ 1 surface
forecast: mean=-0.14764 analysis: mean=-0.045191



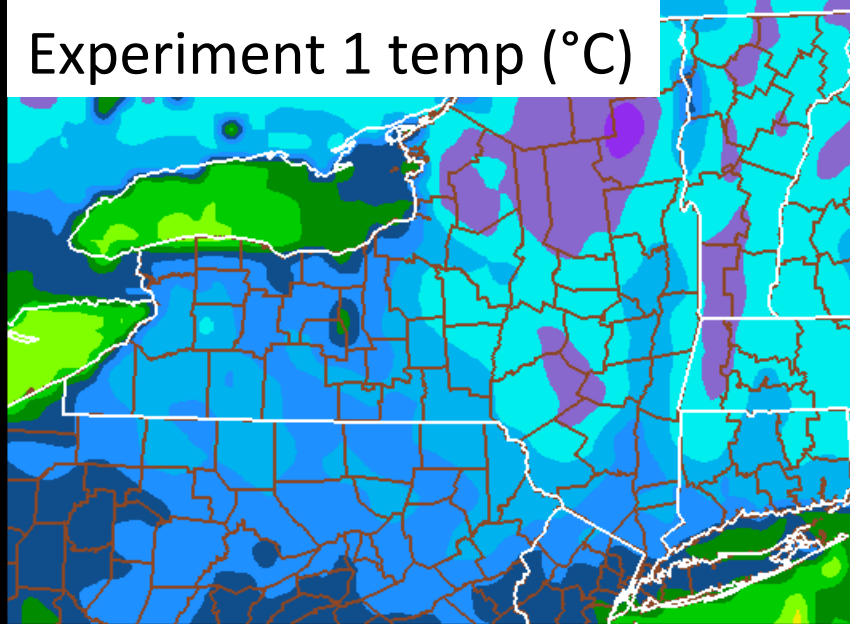
SCHU
LAND_SFC_TEMPERATURE @ 1 surface
forecast: mean=1.3009 analysis: mean=1.3645



Conclusions

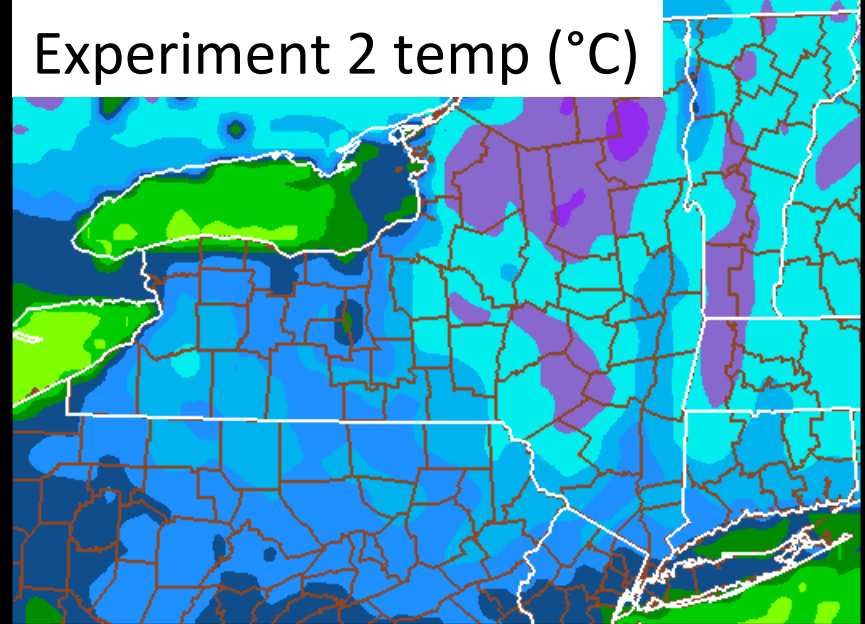
- Data from the NYS Mesonet, currently undergoing installation, will be used in conjunction with other data sources to create high-quality analyses for New York
- *Very* preliminary tests suggest possible value added by this data, but significant work remains to be done
- Future work:
 - Test additional cases (the current Mesonet has > 2x sites)
 - Add inner domain to test cases
 - Understand observation error characteristics of different Mesonet data (bias and observation error)

Experiment 1 temp (°C)



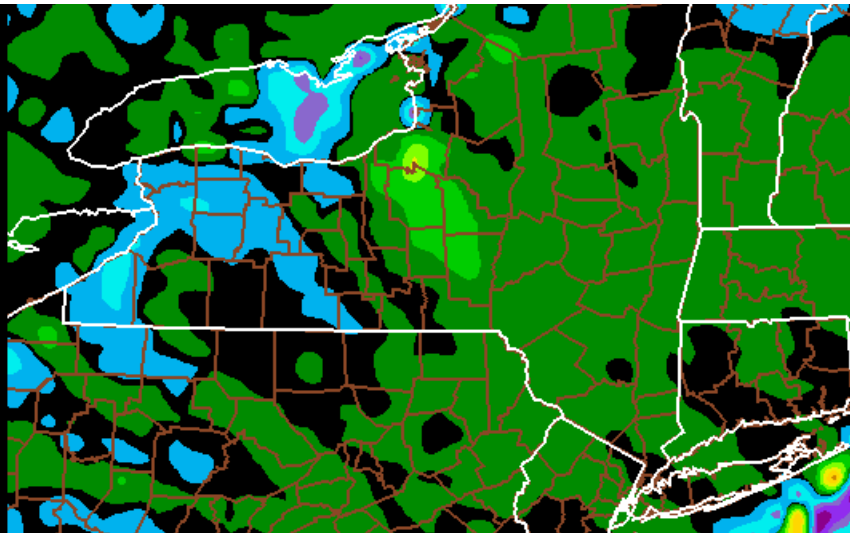
-33 -30 -27 -24 -21 -18 -15 -12 -9 -6

Experiment 2 temp (°C)



-33 -30 -27 -24 -21 -18 -15 -12 -9 -6

Experiment 1 minus 2 temp (°C)

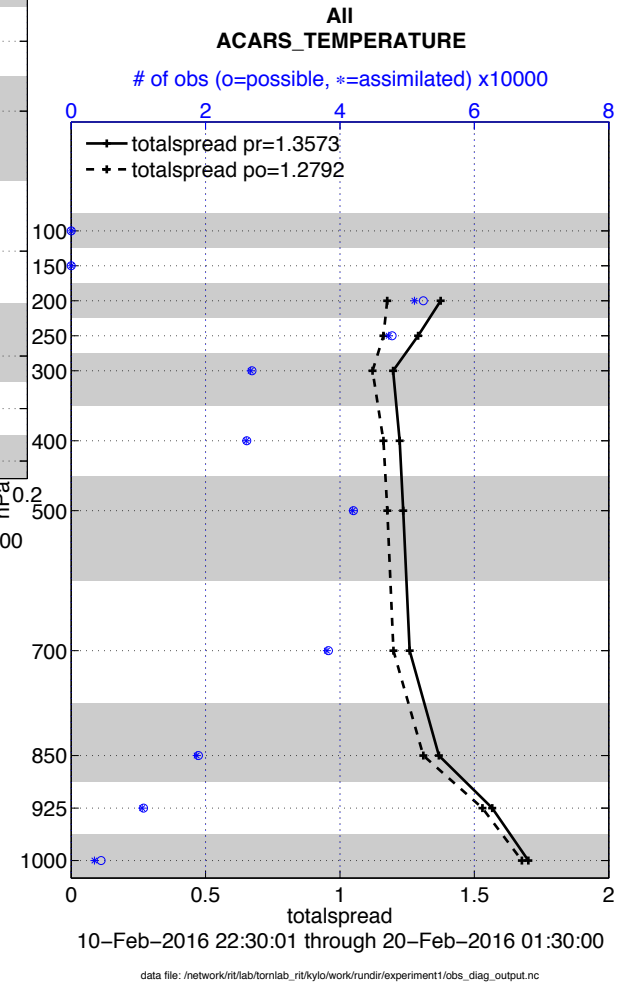
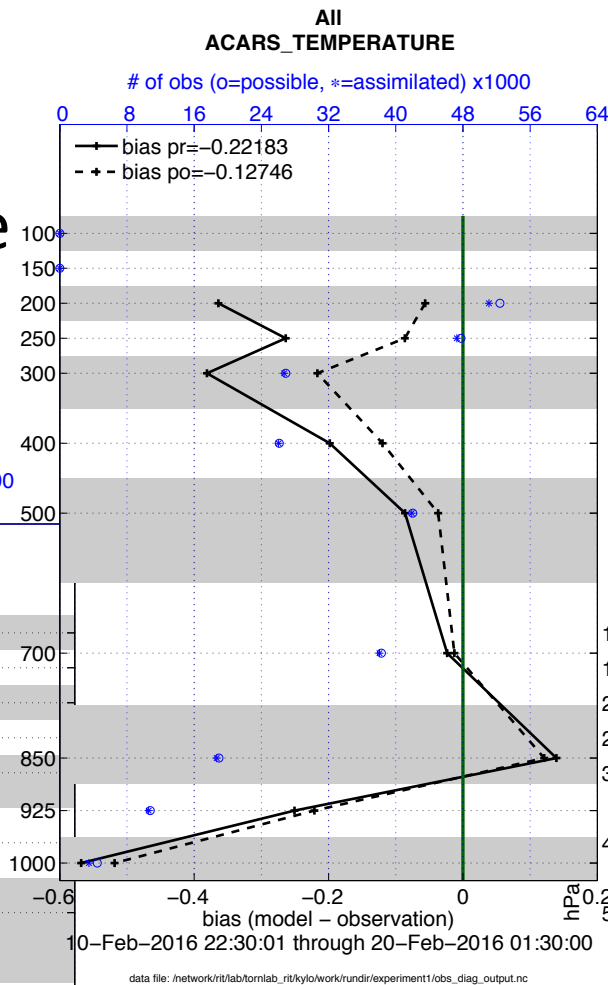
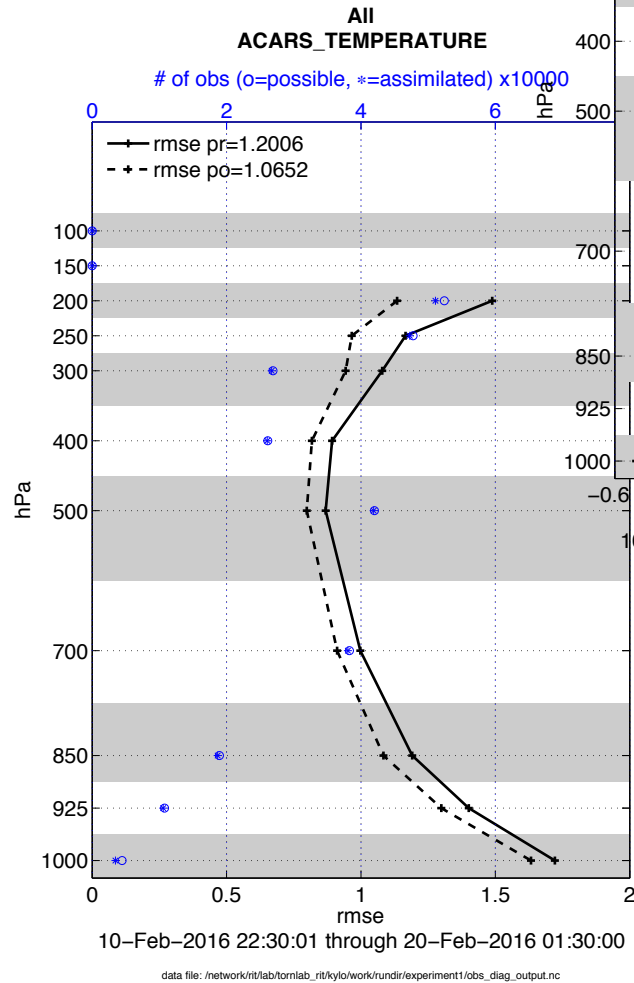


-4.0 -3.0 -2.0 -1.0 -0.2 0.2 1.0 2.0 3.0 4.0 5.0

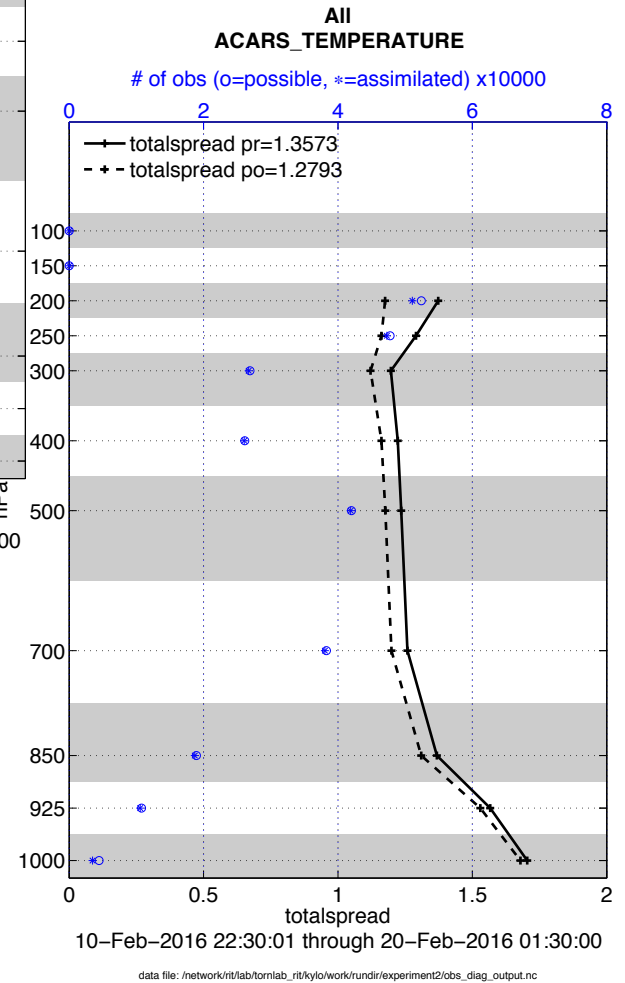
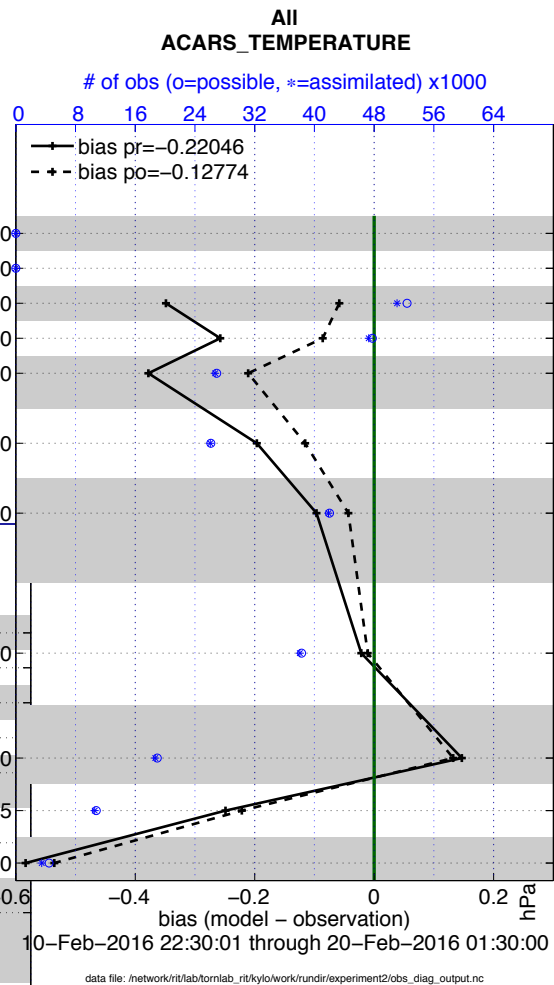
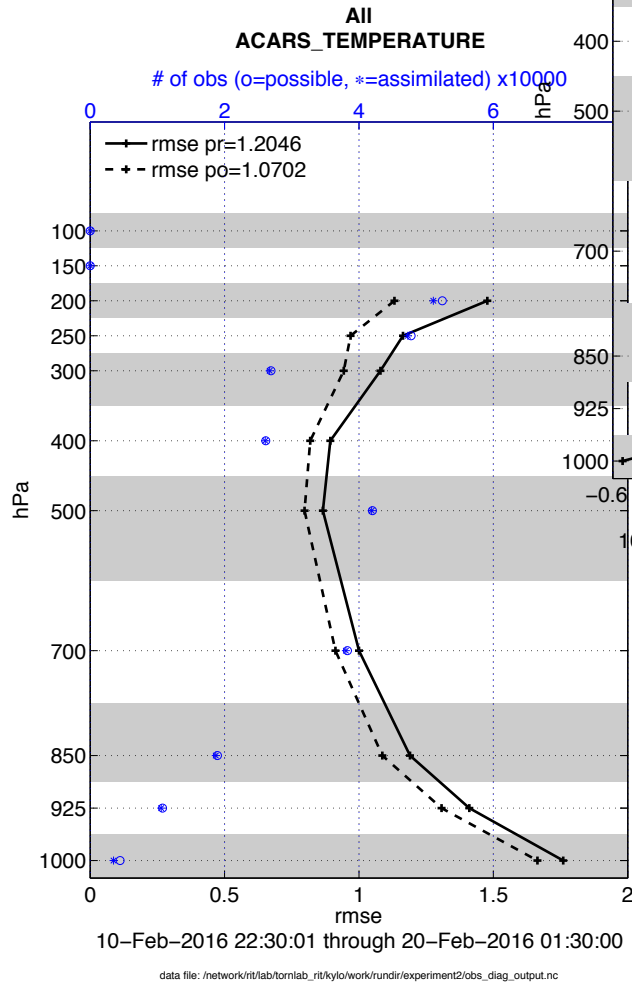
2 m temperature 12 UTC, 14 Feb

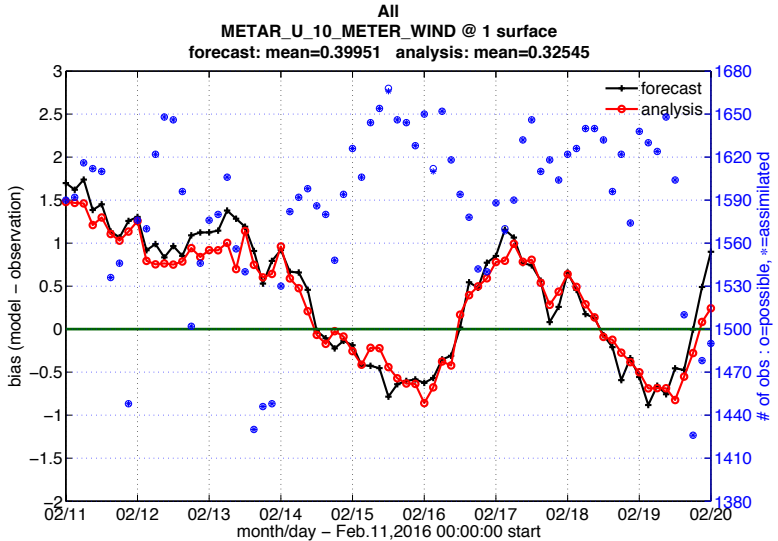
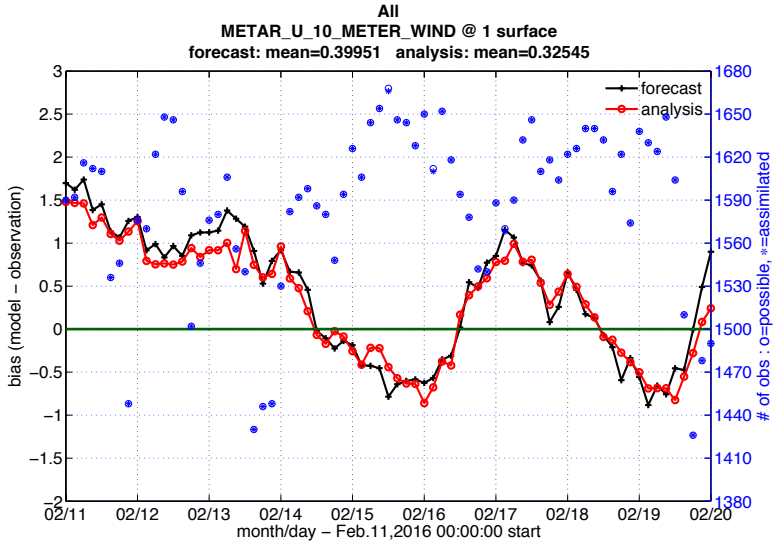
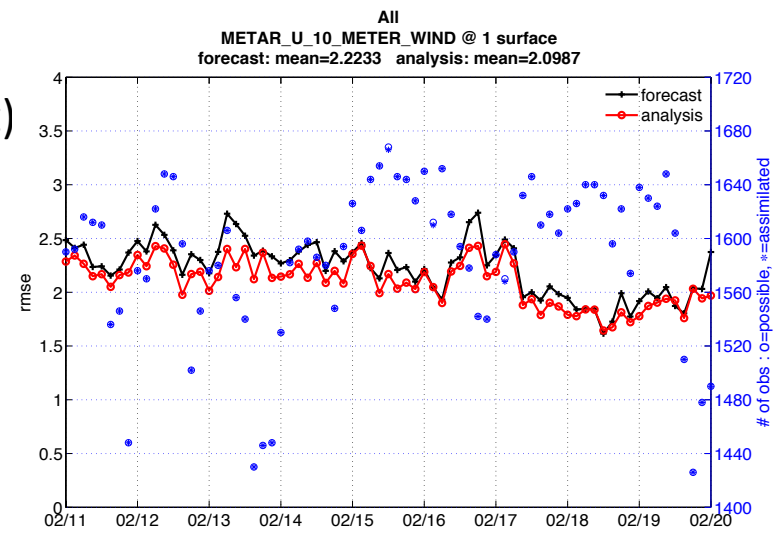
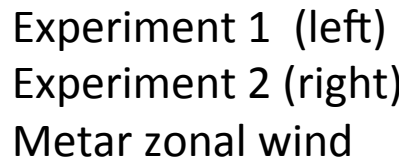
Actual Mesonet temperatures
were between -25°C and -34°C
across the state

Experiment 1: Acars Temperature



Experiment 2: Acars Temperature

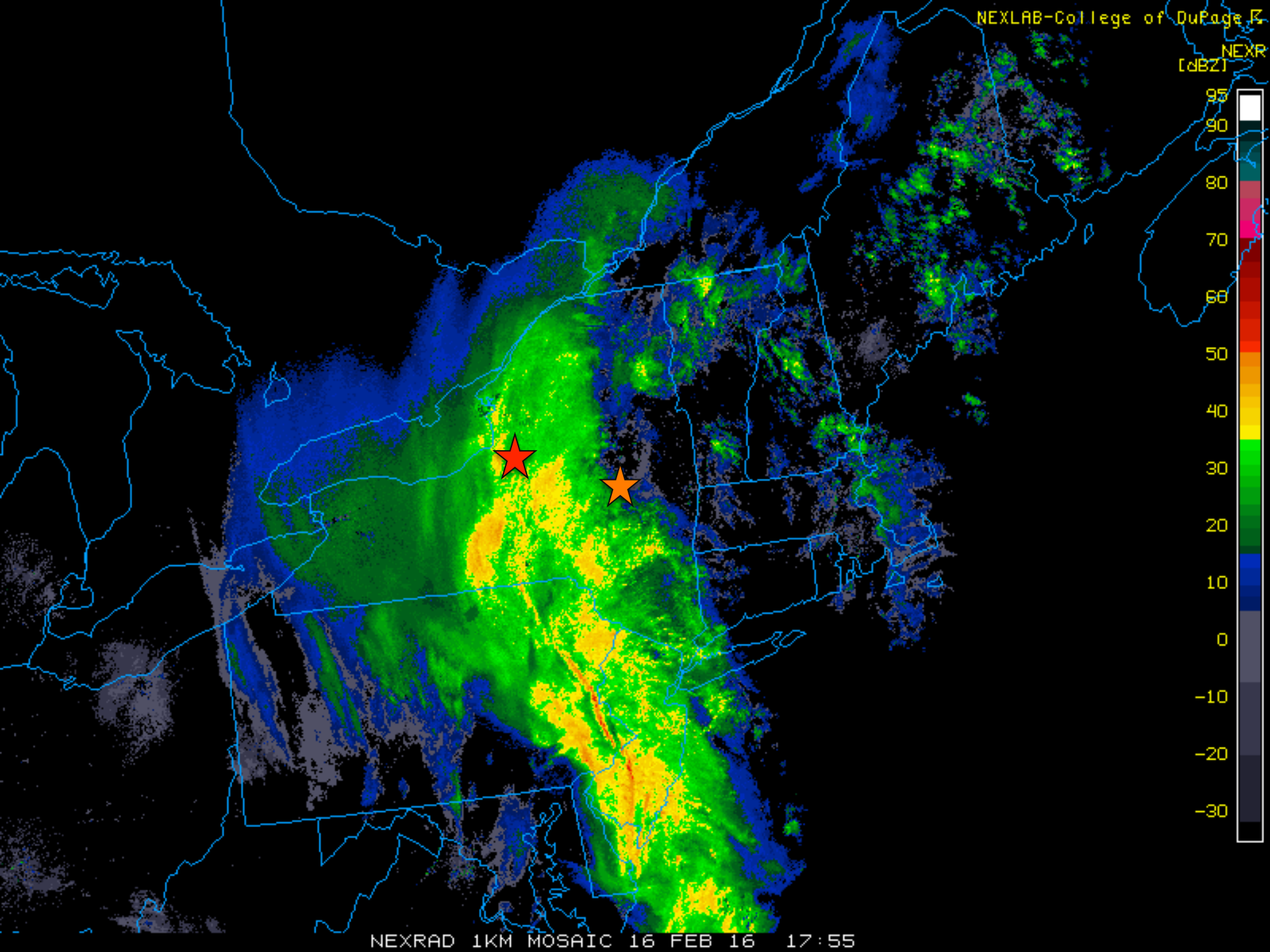


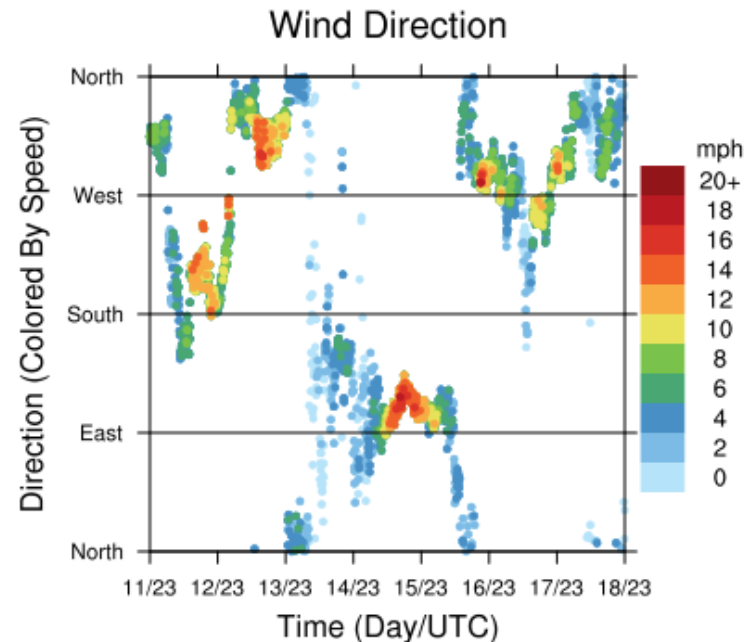
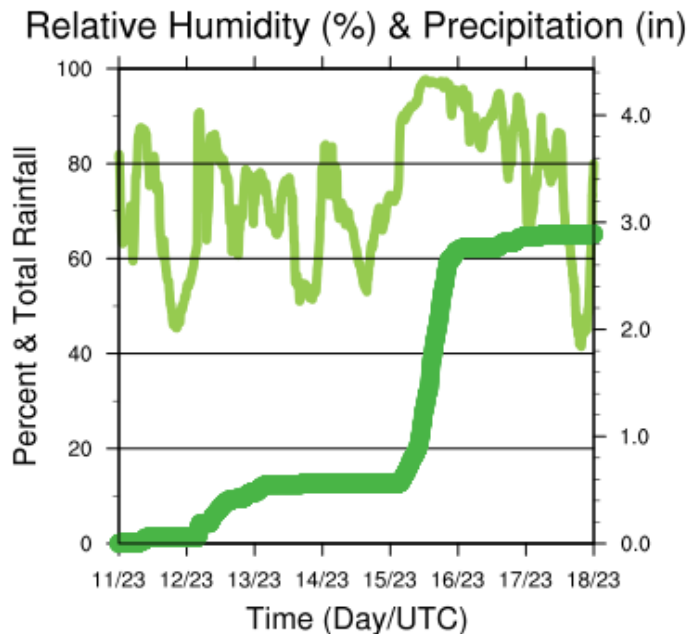
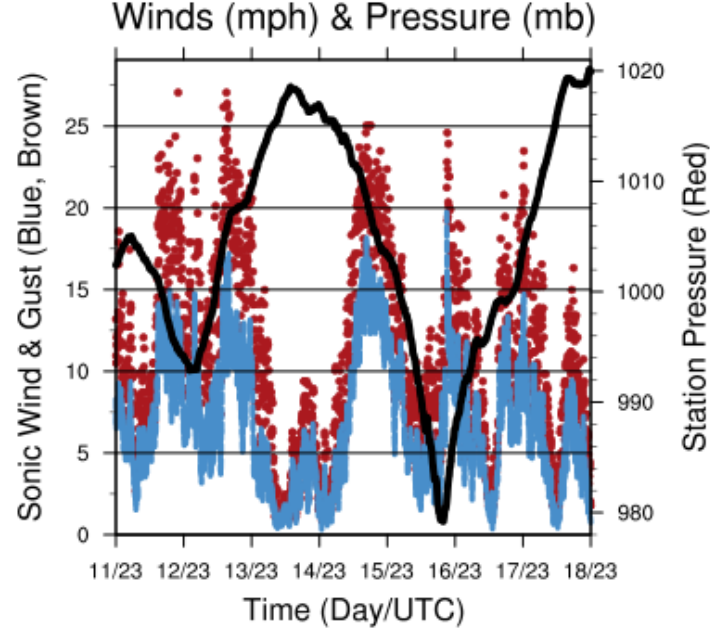
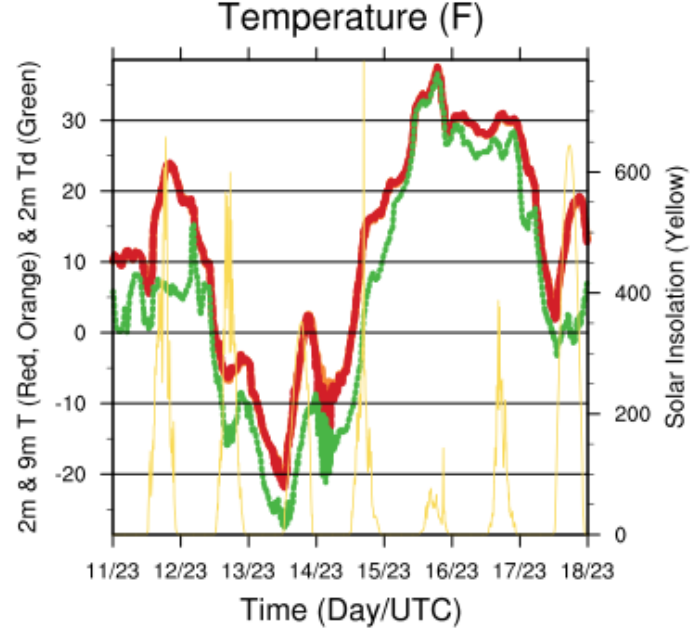


Test Case Overview

- February 10-20th was an extremely active period across NY
- February 13-15th was noteworthy for extreme cold weather (as cold as -30° F across operating mesonet sites)
- February 15-16th featured a dramatic “warm-up” as temperatures rose across the state roughly 60° F from their lows just 36 hours earlier
- This was accompanied by significant precipitation, ranging across a number of types (FZRA, RA, SN)
- After a brief cool-down, the 19-20th experienced strong southerly winds, with portions of the state reaching 60° F

NEXR
[dBZ]





Location: Central Square
Station elevation: 138.01 m
Station lat/lon: 43.3261; -76.1044
Figure created on Thu, 2016-02-18, at 23:52 UTC
Most recent data timestamp: "2016-02-18 23:50:00"

Extremes For Past 7 Days
(High/Low/Max Wind/Total Precipitation)

37.5/-21.9/19.8/2.89