



The University of Connecticut Outage Prediction Model (OPM)  
Post-Storm Report for Tropical Storm Isaias  
occurred on August 4<sup>th</sup>, 2020

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08/11/2020*

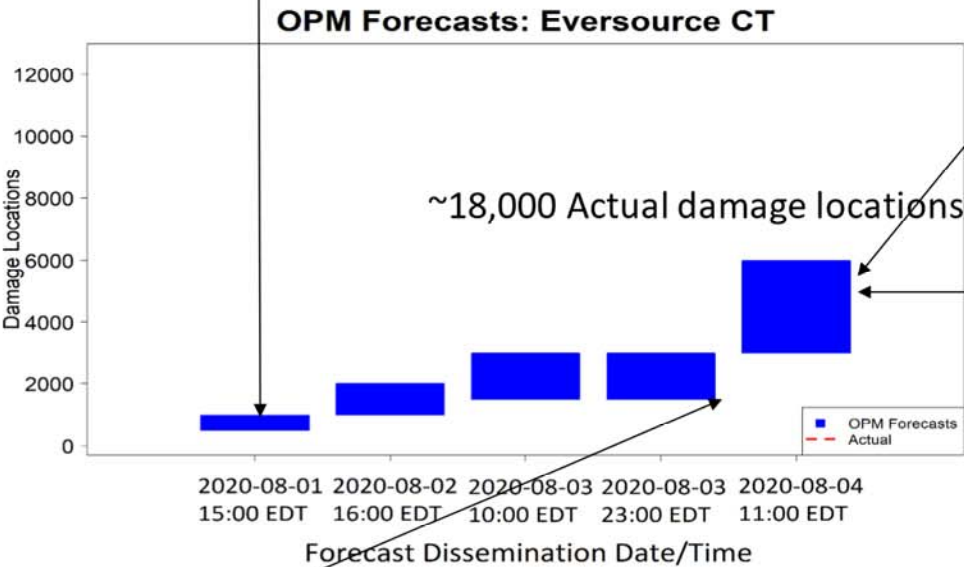
# Executive summary

- The University of Connecticut Outage Prediction Modeling (UConn OPM) team issued five predictions between August 1<sup>st</sup>, 2020 and August 4<sup>th</sup>, 2020 for the Eversource-Connecticut service territory, which were communicated to Eversource Energy emergency preparedness and response personnel, and 4 predictions (2 automated and 2 emails), which were communicated to United Illuminating personnel for their service territory.
- The object of each prediction was the amount of damages expected during Tropical Storm Isaias, and specifically the total number of “trouble spots” for Eversource Connecticut, and the total number of “outages and non-outages” for United Illuminating.
- For both Eversource and UI, each new update - except for one update on August 3<sup>rd</sup> - contained outage predictions significantly higher than the prediction released in the previous update. This trend in the predicted impact occurred for two reasons: the expected weather became more severe at each update, and the confidence in the impact increased.
- The last predictions, released during the morning of August 4<sup>th</sup>, a few hours before the beginning of the storm, was calling for an extreme impact of the storm in Connecticut.
- The actual damage caused by the storm, however, was even higher than the already extreme amount of damage predicted by the OPM.
- We attribute the models’ underestimation of the damage caused by Tropical Storm Isaias to the following main reasons:
  - The limited historical warm season severe storms of similar damage magnitude in the model’s database (only hurricane Irene and super storm Sandy, which were associated with drastically different tree conditions);
  - The significant meteorological differences between this storm and super storm Sandy or hurricane Irene;
  - The unprecedented stress on trees due to the recent moderate drought, mostly in the northern portion of the State;
  - The unprecedented forest mortality affecting the oak-dominated forests of Connecticut due to an extreme drought that affected the region in 2016 and canopy defoliations by Gypsy moth (*Lymantria dispar*) in 2016, 2017, and 2018.

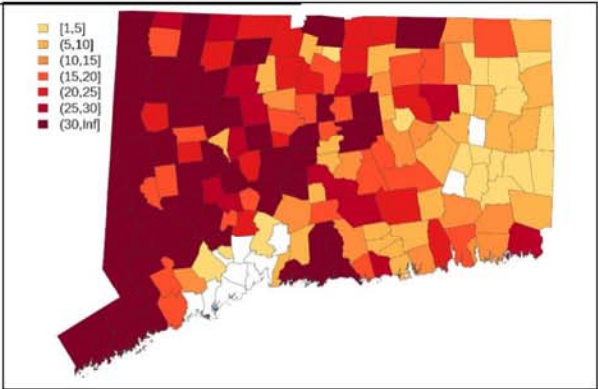
# Damage predictions: Eversource Connecticut

August 1<sup>st</sup>: “Hurricane Isaias is currently located in the Bahamas, and will be moving along the East Coast over the next three days. Isaias is expected to hit the New England area on Tuesday, April 4th as Tropical Storm.”

Trouble spots (TS)	0-30	30-70	70-150	150-300	300-500	500-750	750-1500	1500-5000	>5000
CT	0%	0%	0%	0%	0%	5%	25%	50%	20%



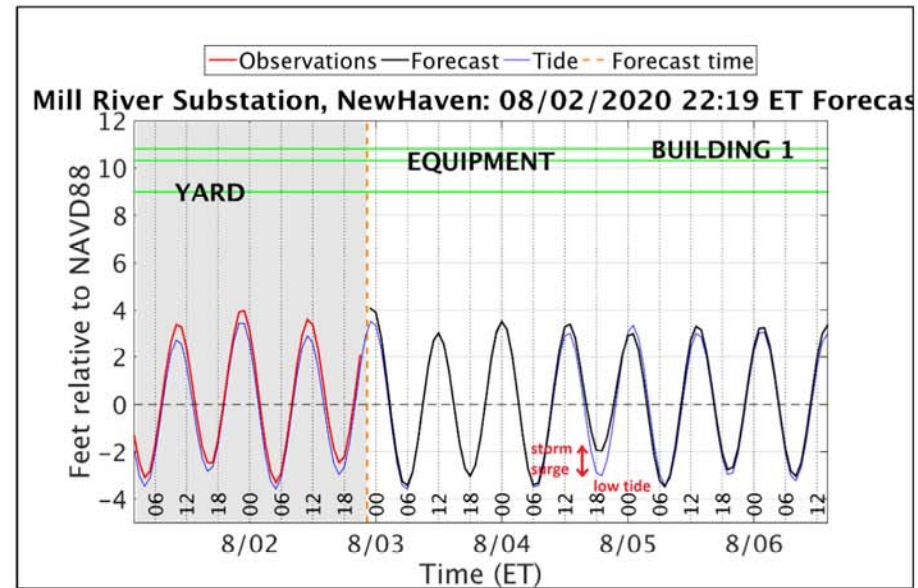
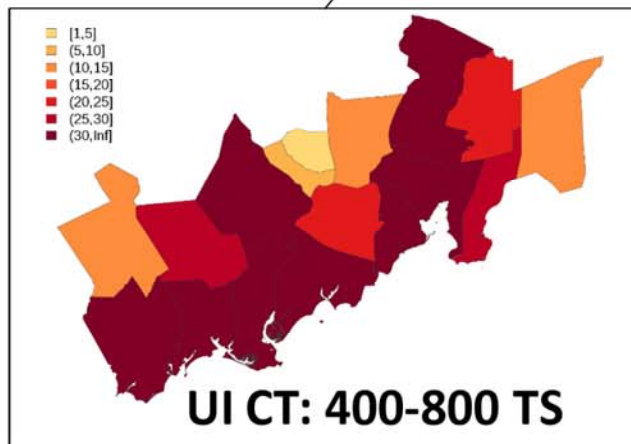
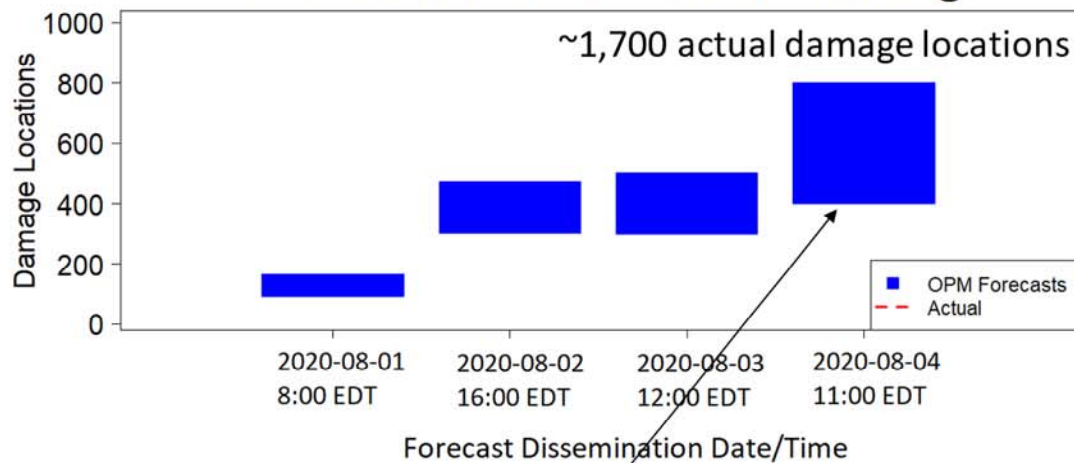
**ES CT: 3000-6000 TS**



August 3<sup>rd</sup>: “There is agreement between UConn and NWS in terms of maximum expected gusts across all the service territories. However, NWS is predicting significantly higher (differences up to 10-15 mph) sustained winds than UConn in Connecticut and Western Massachusetts. There is therefore the possibility that in CT and WMA the number of trouble spots can be even higher than the recommended range.”

# Damage and flooding predictions: United Illuminating

## OPM Forecasts: United Illuminating

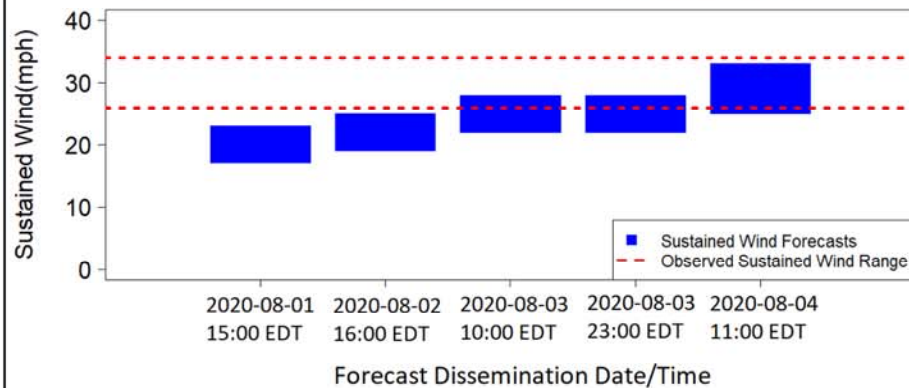


August 3<sup>rd</sup>: "This storm is expected to occur during the peak of low tides, therefore, the total sea level is expected to be below normal during the peak of the storm (see image below as an example, for the Mill River Substation)."

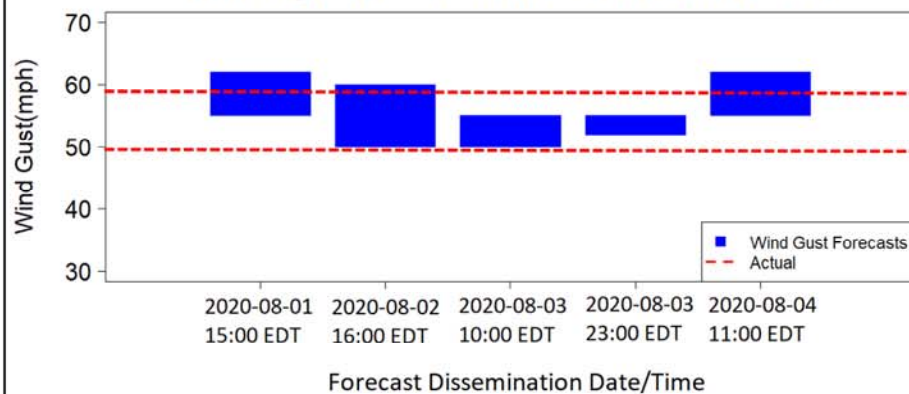


# UConn weather forecasts and verification

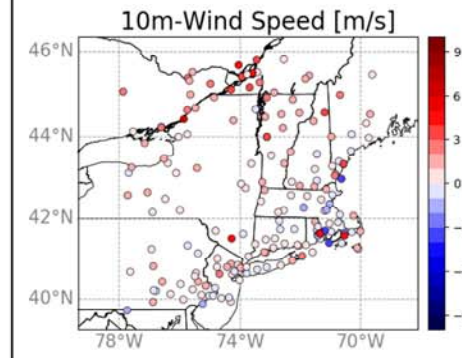
## Sustained Wind Forecasts: Eversource CT



## Wind Gust Forecasts: Eversource CT



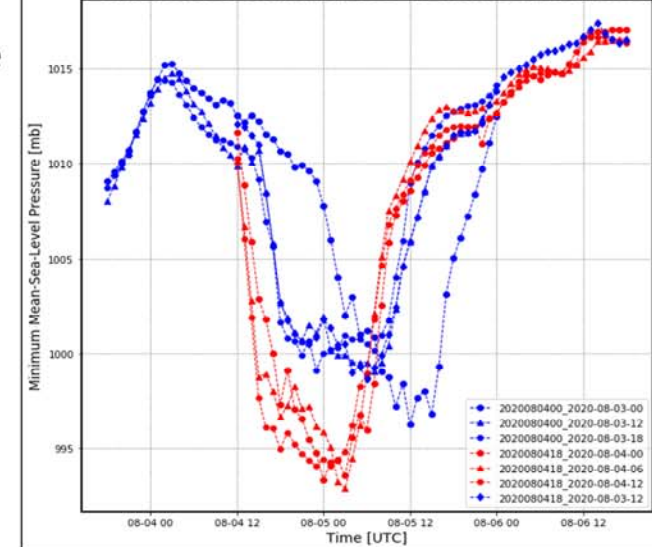
## Bias [NWP-Obs.]



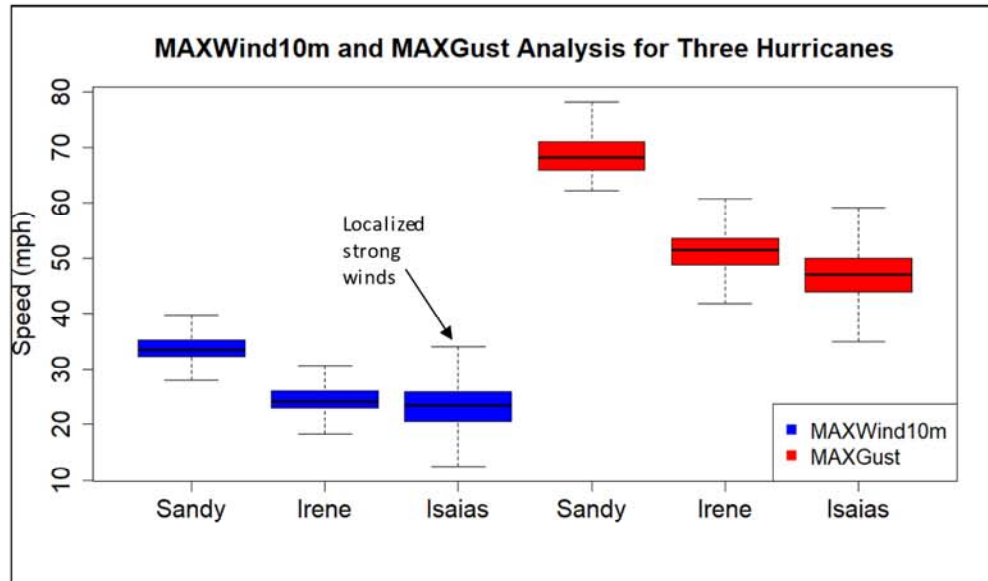
Both the range and the peak intensity of sustained wind speed were well predicted by the last weather model run. However, previous runs were underestimating the storm intensity, as shown in the wind speed timeseries, and in the MSLP comparison between the most recent runs (red) and earlier ones (blue).

Maximum wind gusts were expected to be in the range 50-65 mph since the first forecast. Gusts of this intensity occurred also during the October 2017 bomb cyclone, and during the two strongest storms occurred in October 2019. Sustained winds were, however, weaker.

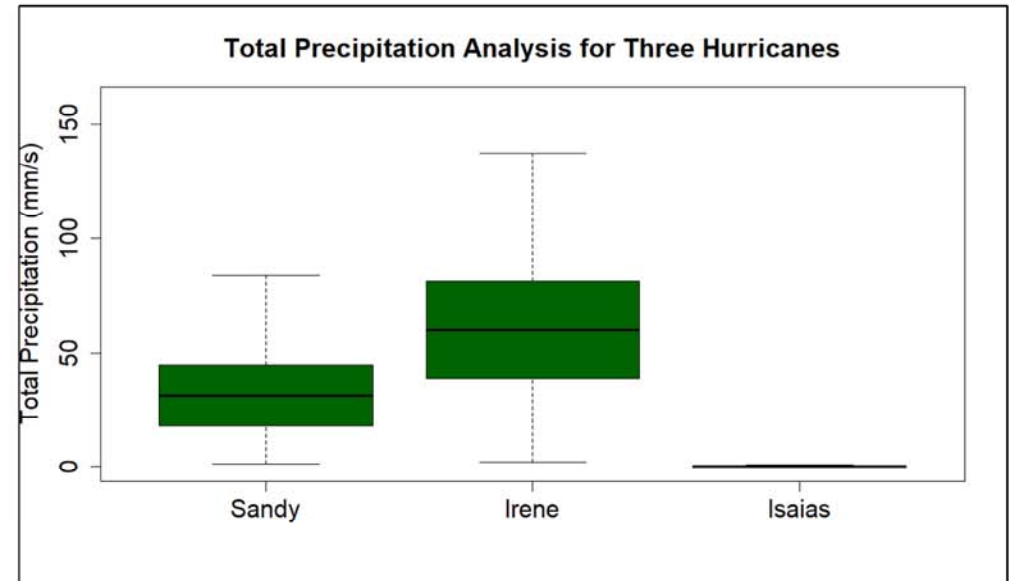
## WRFv3.8.1 Minimum MSLP: Hurricane Isaias



# Storm Isaias versus super Storm Sandy and hurricane Irene



On average, Isaias was characterized by much lower sustained winds and gusts than Hurricane Sandy and Irene. However, there were some localized areas in which sustained winds have been more extreme than the maximum winds occurred during Irene, and stronger than most of the winds occurred during Sandy. Moreover, a tornado has been reported in Westport, associated with 95-105 mph maximum winds.



Tropical Storm Isaias's main characteristic over Connecticut was the long duration of strong sustained winds. Those winds were generally dry, and not associated with significant precipitation. Isaias produced a much lower amount of precipitation than Sandy and Irene.

# Factors contributing to underestimation of storm impact

From our meteorological analysis it appeared that super storm Sandy and hurricane Irene were stronger than Isaias in terms of winds, gusts and precipitation. However, we believe there are several non-meteorological factors that brought the impact of this storm at levels comparable to the impacts of Sandy and Irene:

- Despite being much weaker than Sandy, in terms of winds and gusts, this storm came much earlier in the season, with much higher leaf areas.
- For hurricane Irene the combination of saturated soil, due to the extreme amount of precipitation, with strong winds and gusts enhanced the outages. In this case, outages may have been enhanced by factors related to different tree conditions that are not yet accounted for in the UConn OPM.
- Specifically, most of Connecticut is currently at a state of drought, and the stress on trees due to this is very high.
- Recently, the region experienced an unprecedented forest mortality event affecting the oak-dominated forests beginning in 2018.

This event appeared to be related to the interaction of an extreme drought that affected the region in 2016 and canopy defoliations by Gypsy moth (*Lymantria dispar*) in 2016, 2017, and 2018. This kind of coupled biotic and abiotic factors can potentially increase the vulnerability of trees to damaging wind conditions. The Center is currently conducting research to derive fine-scale maps and characterization tree health, including Gypsy moth affected roadside forest, using multi-source earth observation sensors (satellite manned- and unmanned-aerial imagery) to leverage vegetation risk modelling efforts.

