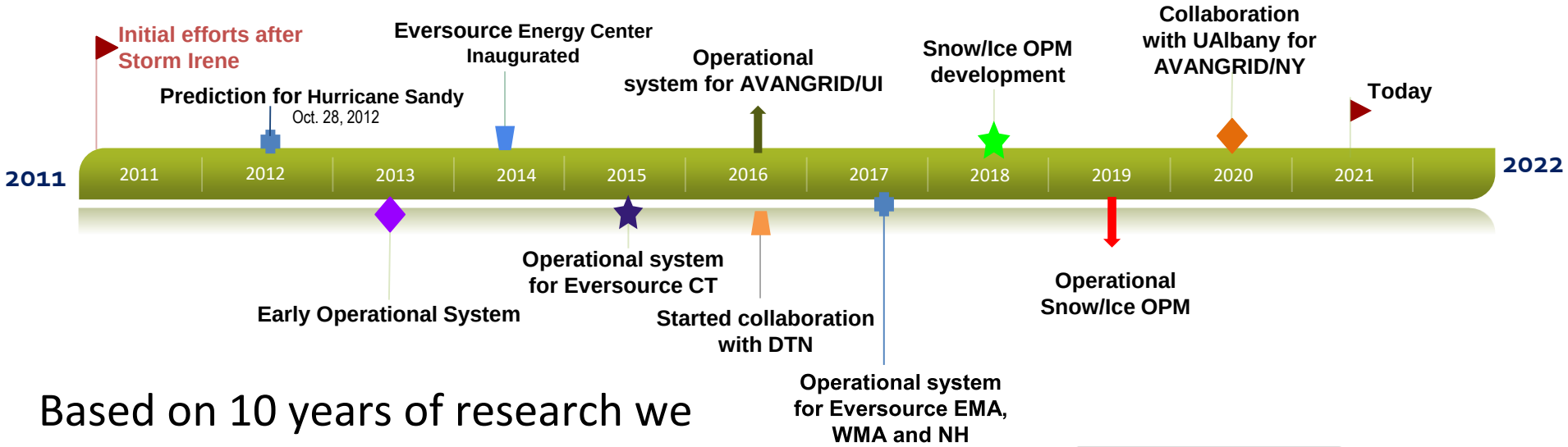
UCONN
SCHOOL OF ENGINEERING

UConnOPM
OUTAGE PREDICTION MODEL

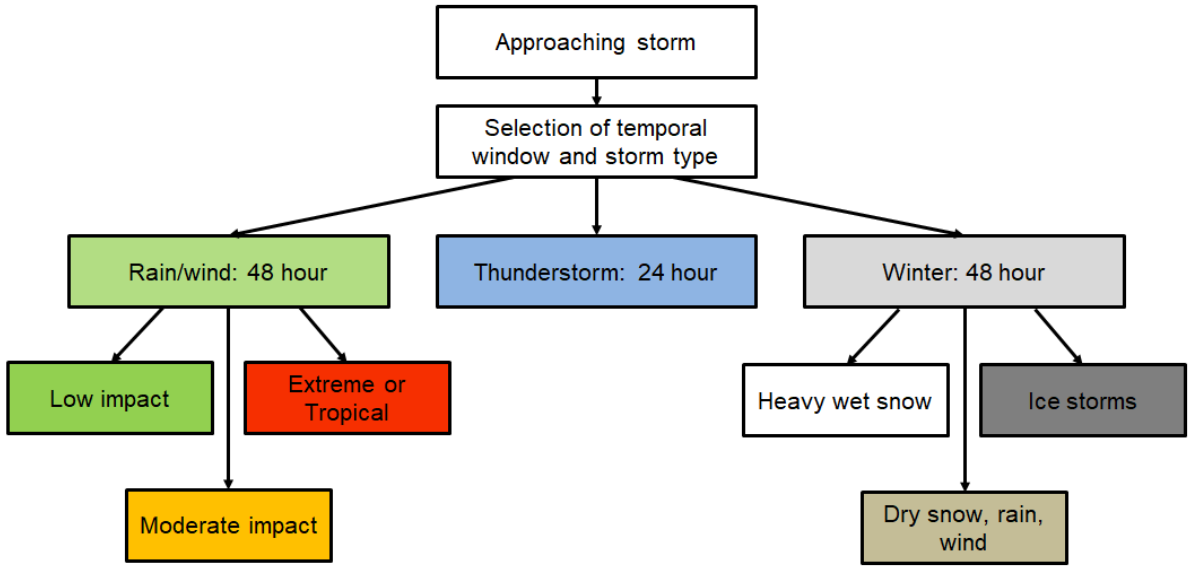
The UConn OPM

The Eversource Energy Center, University of Connecticut

The UConn OPM: history and operational system



- Based on 10 years of research we have developed the most comprehensive Outage Prediction Model both in academia and industry.
- UConn OPM is the only system capable of predicting outages caused by any weather event.

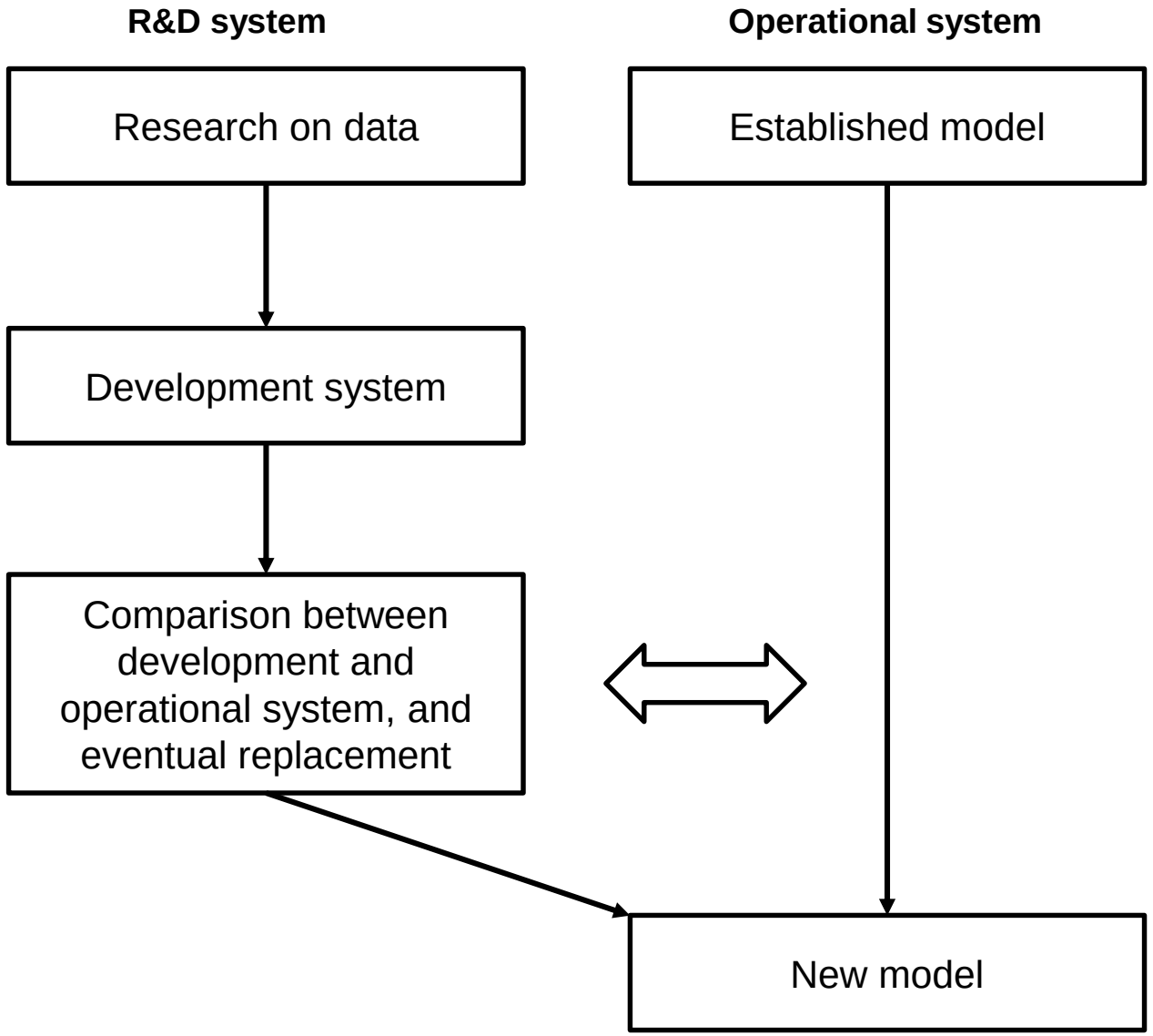


From research to operations:

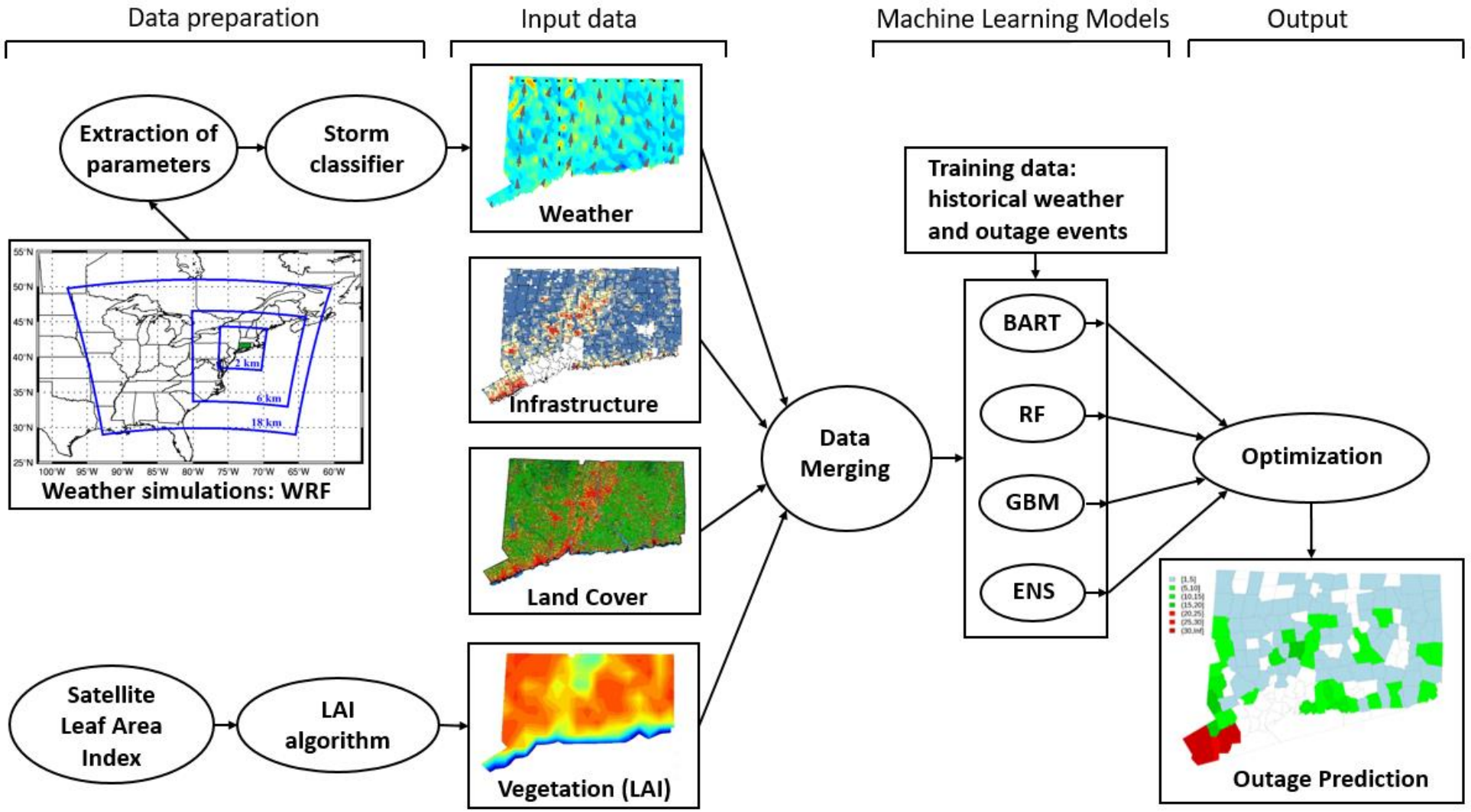
1st stage: 3-6 months

2nd stage: 3 months to 1 year

3rd stage: 3 months



The OPM architecture:



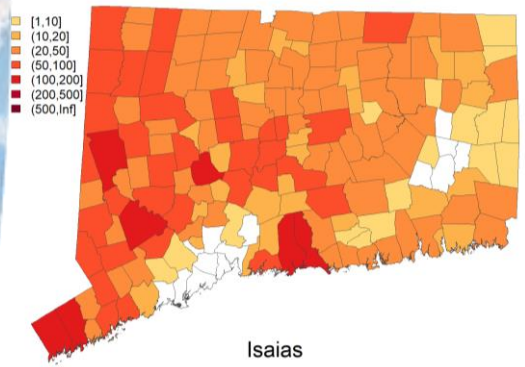
Adapted from: Cerrai et al., 2019a

New Developments in this project:

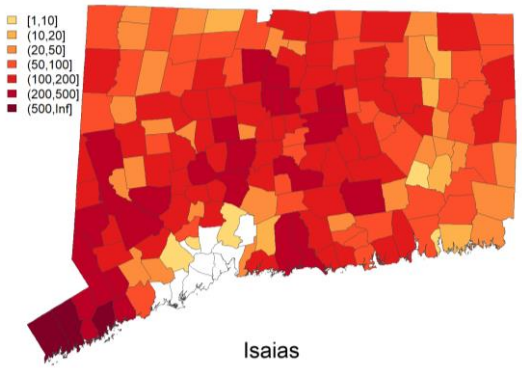
- **Extreme weather events**

Tropical Storm Isaias was expected to be the fourth largest storm of the past 15 years, after Hurricanes Sandy and Irene, and the October 2011 nor'easter. It ended up being the second strongest.

Predicted: 6000 TS



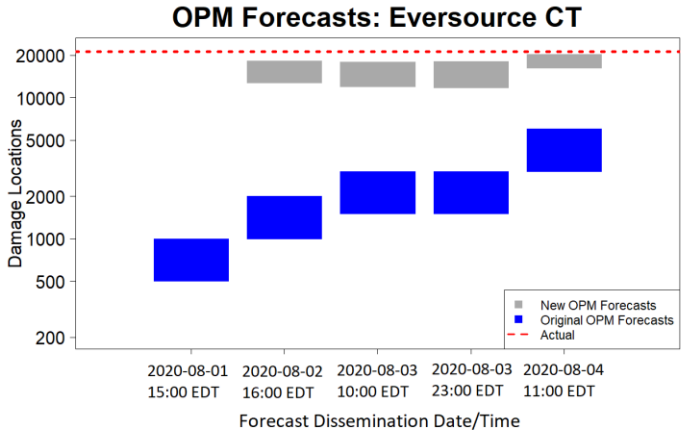
Actual: 21,328 TS



Its prediction was challenging for several reasons:

- Tree health conditions were unclear due to unprecedented tree mortality and drought;
- Storm intensity was increasing at every update.

After the storm, we extensively investigated the reasons why Hurricane Isaias, despite having significantly lower winds than Hurricane Sandy, caused many more outages.



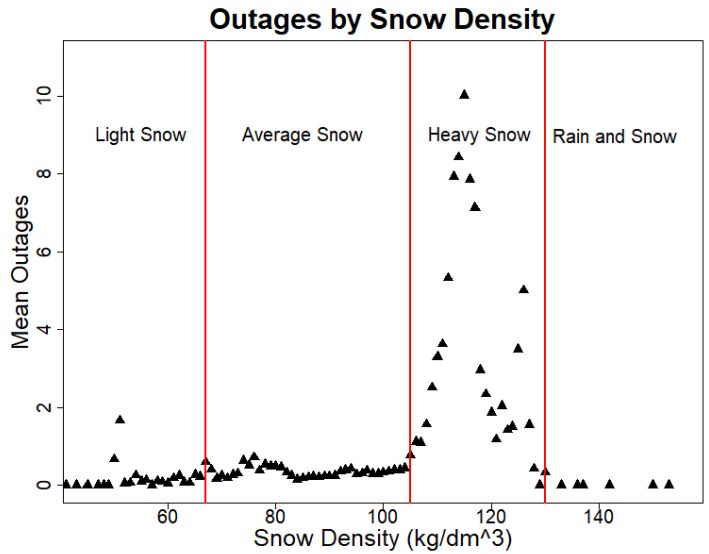
We included drought and tree health conditions into the OPM and found that a model with such variables would have better predicted Isaias. We are investigating additional improvements

New Developments in this project:

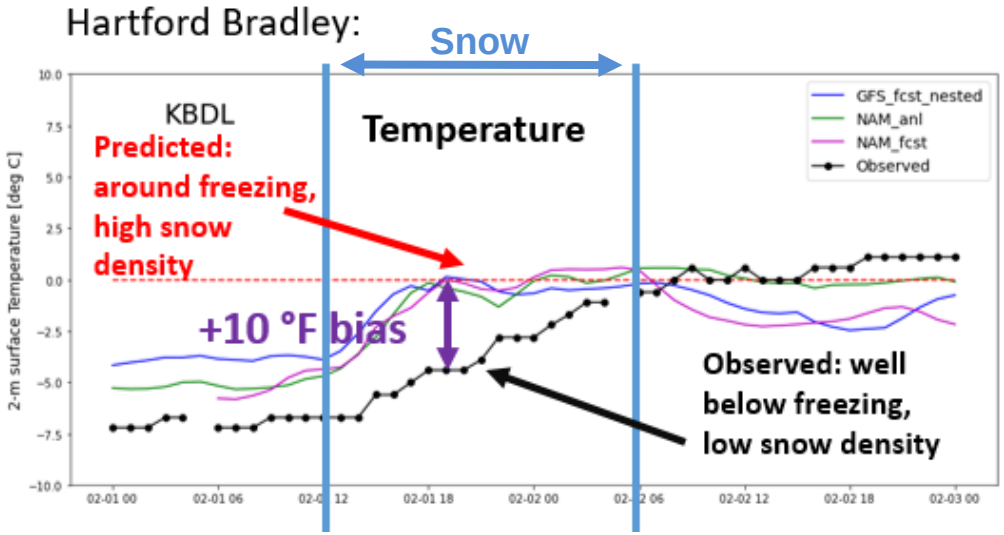
- Extreme weather events

- **Snow and ice storms**

Snow density is the most important variable in the winter OPM



An incorrect temperature forecast (e.g. February 1st, 2021) leads to errors in snow density, causing model bias.

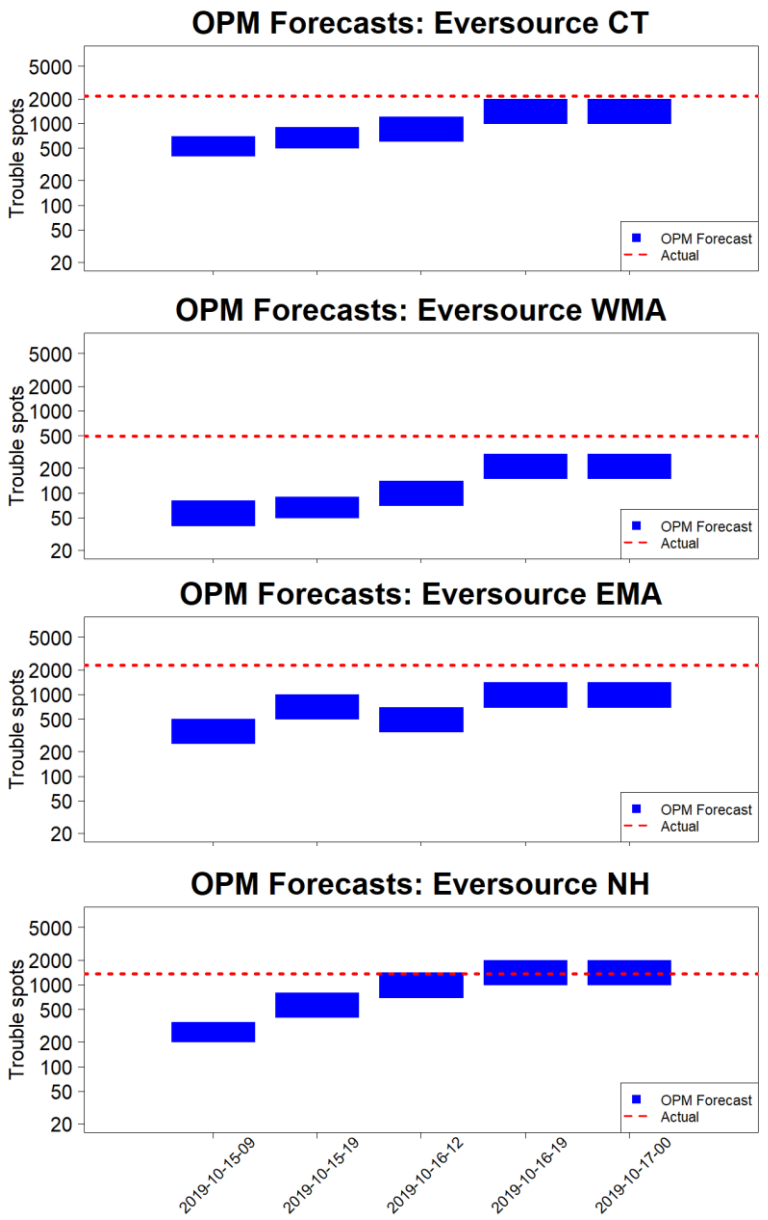


We will analyze historical winter OPM forecasts, and the weather modeling group will help us address the predictability of outages caused by heavy snow events.

New Developments in this project:

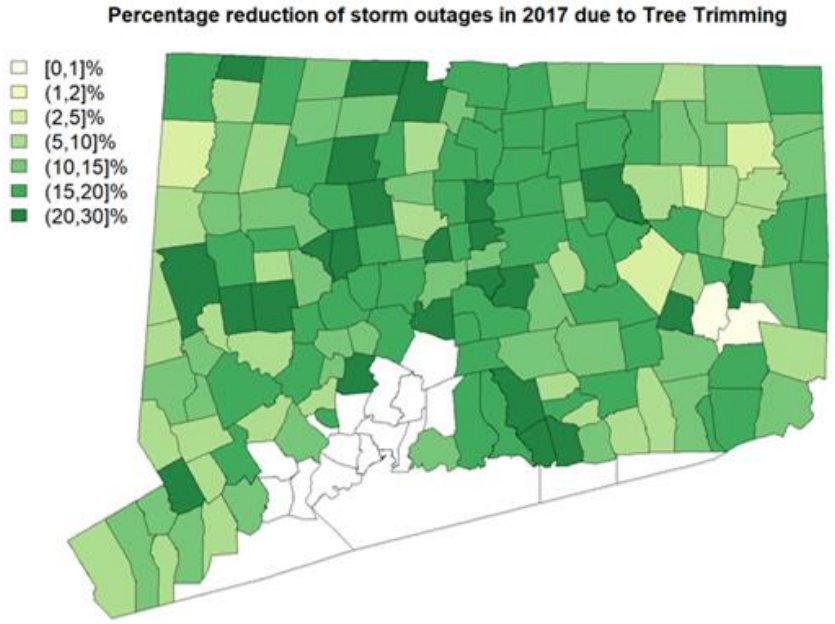
- Extreme weather events
- Snow and ice storms
- **Extending lead time**
  - Storm preparedness can benefit from a timely communication of outage predictions.
  - Weather - and consequently outage - forecast uncertainty increases with lead time.
  - Currently, our system is set to provide forecasts up to 2 ½ days in advance.
  - In this project we will investigate extending the predictions up to 5 days in advance.

October 16-17, 2019 bomb cyclone



New Developments in this project:

- Extreme weather events
- Snow and ice storms
- Extending lead time
- **Climate and infrastructure changes**



- We will investigate how infrastructure changes affect the resilience of the electric grid.
- Using OPM we have shown that tree trimming reduces the number of outages.
- We are currently assessing the effects of other electric grid hardening activities.
- Including grid hardening and tree trimming into the OPM we will further improve OPM prediction accuracy.
- New OPM will be used to evaluate infrastructure changes for current and future climate resilience assessment.

Project timeline

- Q2 2021: extreme events model operational;
- Q4 2021: improve the winter model and transition to operational;
- Q2 2022: test extended lead time (5 days) system and transition to operational;
- Now-Q4 2022: architectural changes (OPM at the circuit level) and infrastructural changes included in a new OPM version.
- After 2022: a new OPM version for each storm type will be released every year.

Questions can be addressed to: diego.cerrai@uconn.edu, and Emmanouil.Anagnostou@uconn.edu