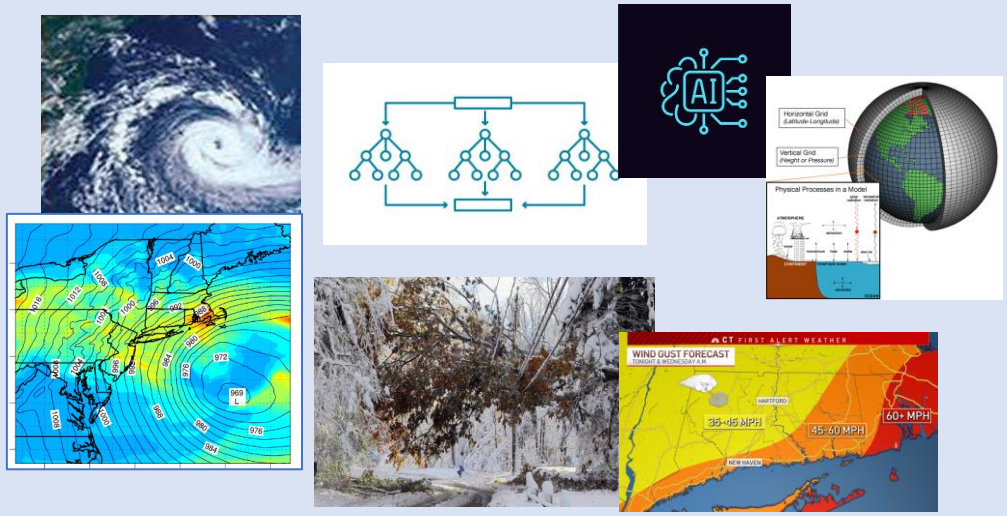
Improving Extreme Weather Forecasting Capabilities in support of Power Outage Prediction Activities: Phase II – wind gust and winter weather



09 February 2024

Prof. Marina Astitha, Civil and Environmental Engineering, *University of Connecticut*

Industry Relevance & Need

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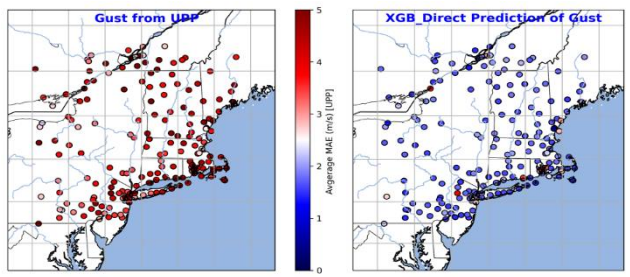
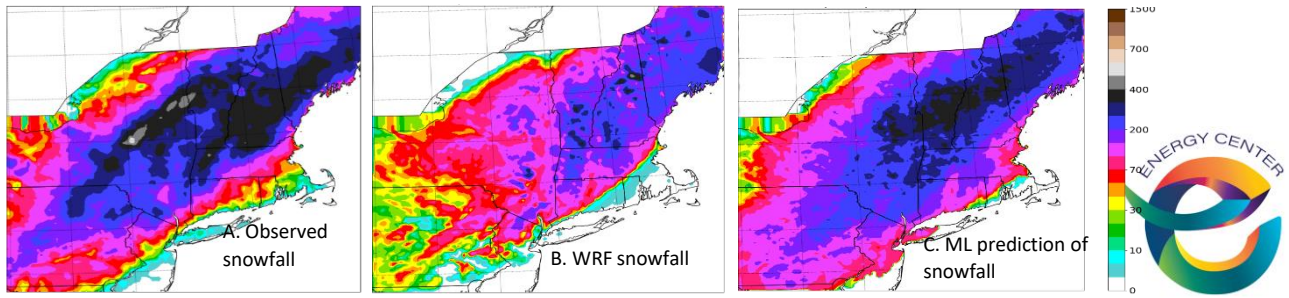
Phase II of the extreme weather forecasting project is the continuation of the 2020-2023 project and a long collaboration with EEC and Everource since 2013.

The project is essential to the OPM project activities. We work closely with the OPM team (research groups of Profs. Anagnostou and Cerrai) to ensure our improvements resonate with the future updates of the operational OPM.

The project is related to the first EEC pillar "*Grid Resilience during adverse weather and climate conditions*", since **advances and improvements in weather forecasting accuracy and reliability directly impact storm damage prediction and restoration modeling**.

Our work and expertise in extreme weather forecasting **have the potential to benefit other EEC projects related to grid reliability** under a changing climate.





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Project Goals and Objectives

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The **goals** for this second phase of the extreme weather forecasting improvements project are to:

- Develop two operational products for improved wind gust and temperature/snowfall forecasts based on the previous exploratory ML-based work, and
- Quantify the influence on OPM predictions

Research Approach

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Task 1: Real-time forecast uncertainty quantification for wind, temperature and precipitation forecasting.

Task 1.1 Develop an automated operational system to investigate discrepancies from our WRF storm forecast through wind, precipitation, temperature maps and frequency distribution plots.

Task 1.2 Develop an automated system to download probabilistic winter forecast.

Task 2: Integration of ML-based gust with operational WRF

Task 2.1 Assess the ML-based gust approach at individual station locations to better understand the ML model's capabilities and generalization potential.

Task 2.2 The station-based approach will be transformed into a gridded product to be directly utilized by the OPMs.

Task 3: Improvements in forecasting snowfall

Task 3.1 Winter temperature bias correction.

Task 3.2 ML-based snowfall prediction.

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Outcomes and Deliverables

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Project deliverables

- Automated system for storm forecast uncertainty quantification (Jan/Jul 2024)
- ML-based wind gust prediction improvements and operational product (Jan 2025, Jan 2026)
- Correction of WRF temperature bias in winter weather forecasts (Jul 2025)
- ML-based snowfall prediction operational product (Jul 2026)

Project Activities	2023		2024				2025				2026		
	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3
Weather forecast uncertainty (T1.1)													
Winter forecast uncertainty (T1.2)													
ML-based gust improvements (T2.1)													
Operational ML-based gust (T2.2)													
Winter temp bias correction (T3.1)													
Operational ML-based snowfall (T3.2)													

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Research Impact

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We are specifically targeting improvement of gust and snowfall forecasts as their uncertainty and misrepresentation have significant impacts on power outage forecast accuracy.

The development of the two products, ML-based gust and snowfall prediction, will lead to extramural funding proposals to federal agencies.

Expected publications: ~3-4 peer-review papers, ~4-6 conference presentations.

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