

Evaluation of the new OPM winter model

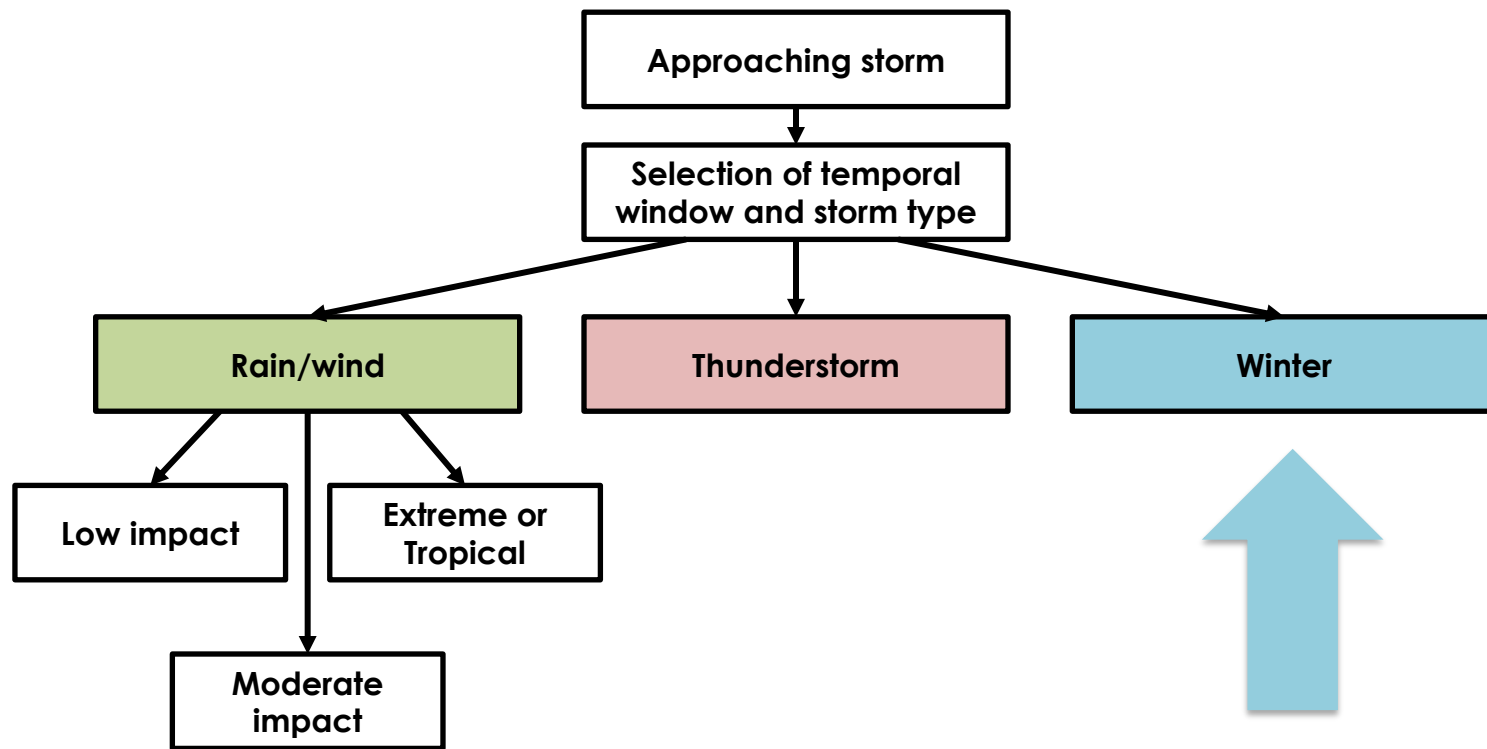
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November 19, 2021

* OPM: outage prediction model

The OPM operational system:



* OPM: outage prediction model

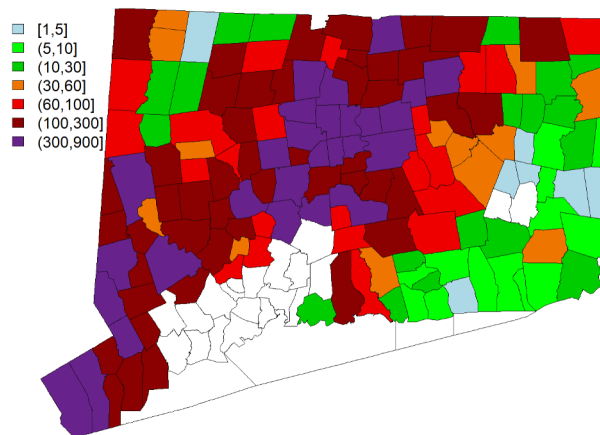
Winter storms

When wintry precipitation occurs, there are three main factors responsible for outages

- Strong winds and gusts.
- Snow and ice accretion.
- Leaves on trees.



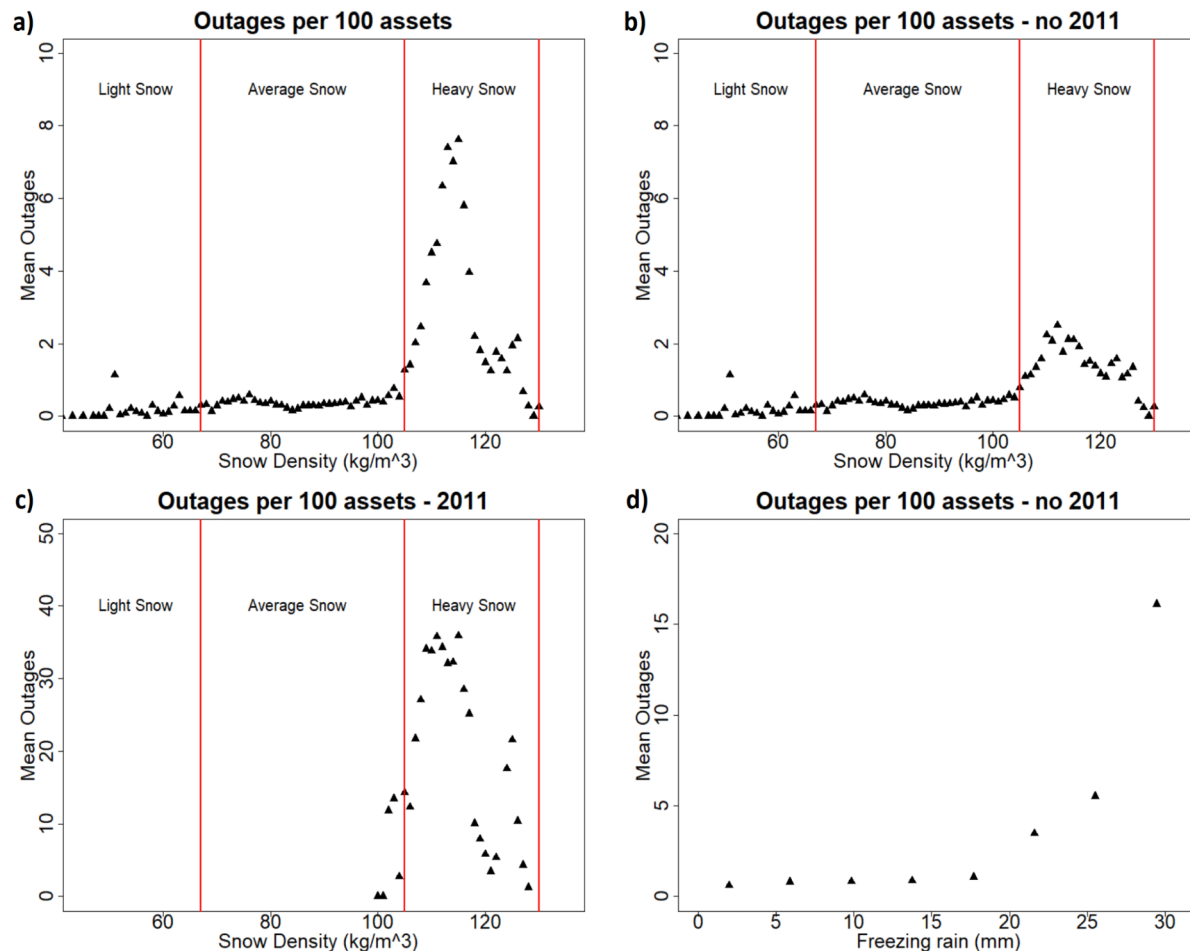
When these factors combine together, catastrophic events can occur.



Damaged power line (left) and trouble spots (right) during the 2011 nor'easter.

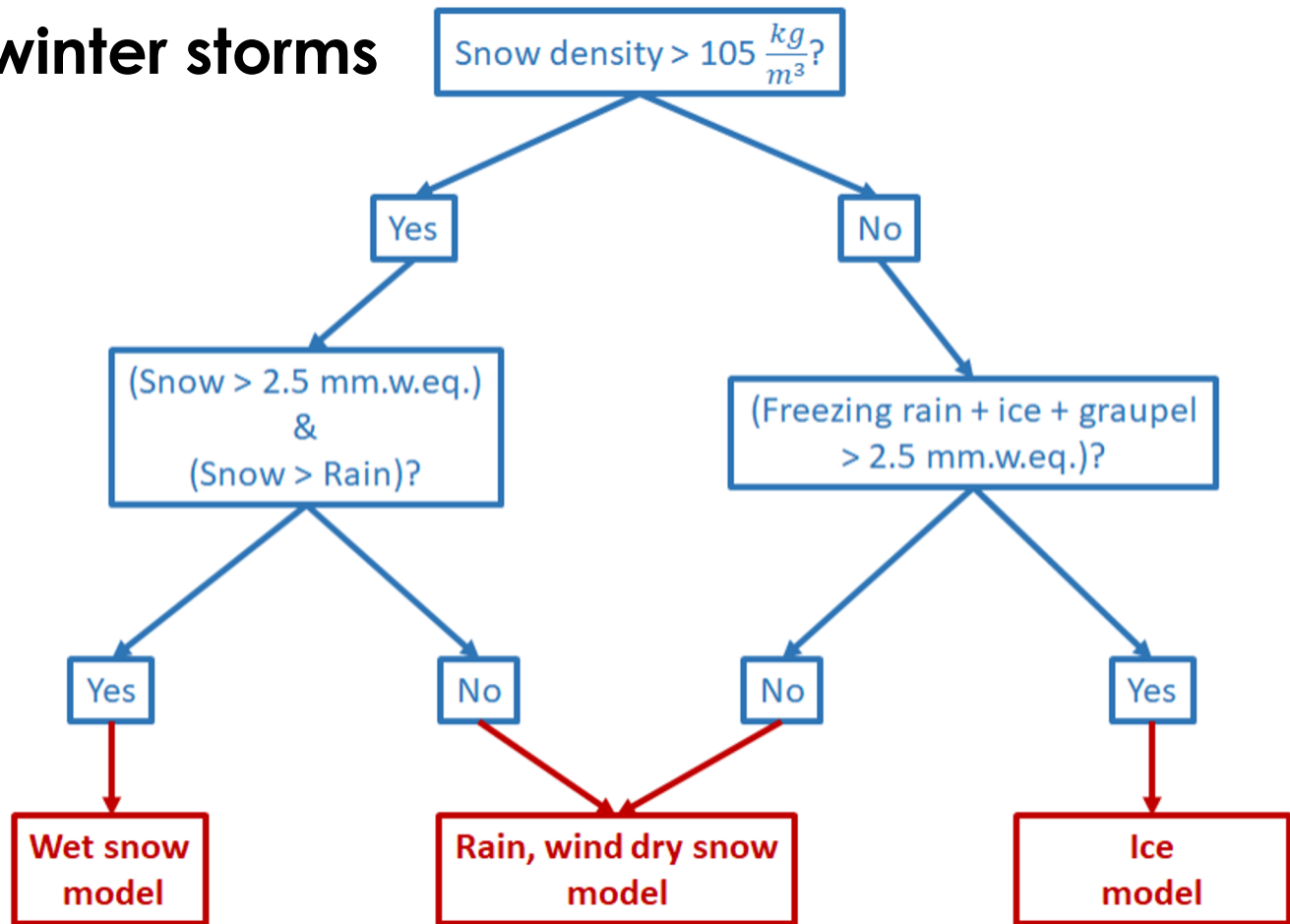
Winter storms: what we know

- Linear trend of mean outages per grid cell for snow density between 50 and 105 kg/m³.
- Spike of outages between 105 and 130 kg/m³, peaking at 115 kg/m³: heavy, wet snow.
- Increase of outages for freezing rain above 20 mm.



Cerrai et al., 2020a

OPM for winter storms



Cerrai et al., 2020a

- ❑ The OPM winter model has been operational in CT since early **2018**;
- ❑ Updated in **2020** for CT, included EMA, WMA, and NH;
- ❑ A new version is available in Nov. **2021**.

New OPM winter model: Version 2021

Highlights

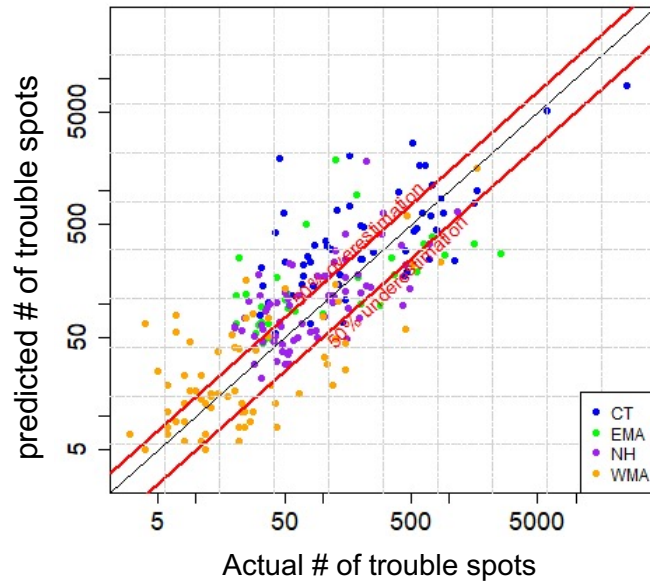
- **188 historical winter storms (2005-2021)**
Newly added 30+ storms to the database since the last model version
- **Two machine learning methods**
Random Forest (RF)
Gradient Boosting Machine (GBM)
- **Model optimization (final product of the winter model)**
Combine and optimize the RF and GBM methods
- **Improvements**
Winter model v2021 versus Winter model v2020



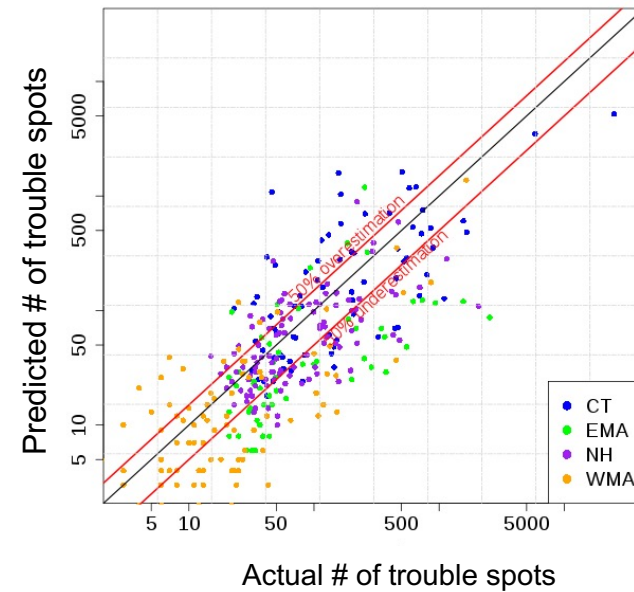
The current model employed
in the operational system

OPM winter models: version 2020 versus version 2021

Winer model v2020



Winer model v2021



v2020	APE q50	MAPE
All territories	66%	157%
CT	78%	255%
EMA	78%	200%
NH	45%	90%
WMA	64%	130%

v2021	APE q50	MAPE
All territories	60%	84%
CT	59%	133%
EMA	68%	76%
NH	48%	58%
WMA	67%	77%

APE q50: median absolute percentage error
MAPE: mean absolute percentage error

Summary

- With updating the winter storm database and the model optimization approach, the new winter model outperforms the current one.
- Future work
 - Continue to collect new winter storms for model updating.
 - Improve the classification method for winter precipitation.
 - Improve the weather prediction for winter storms.

