Snow and ice forecast based on machine learning

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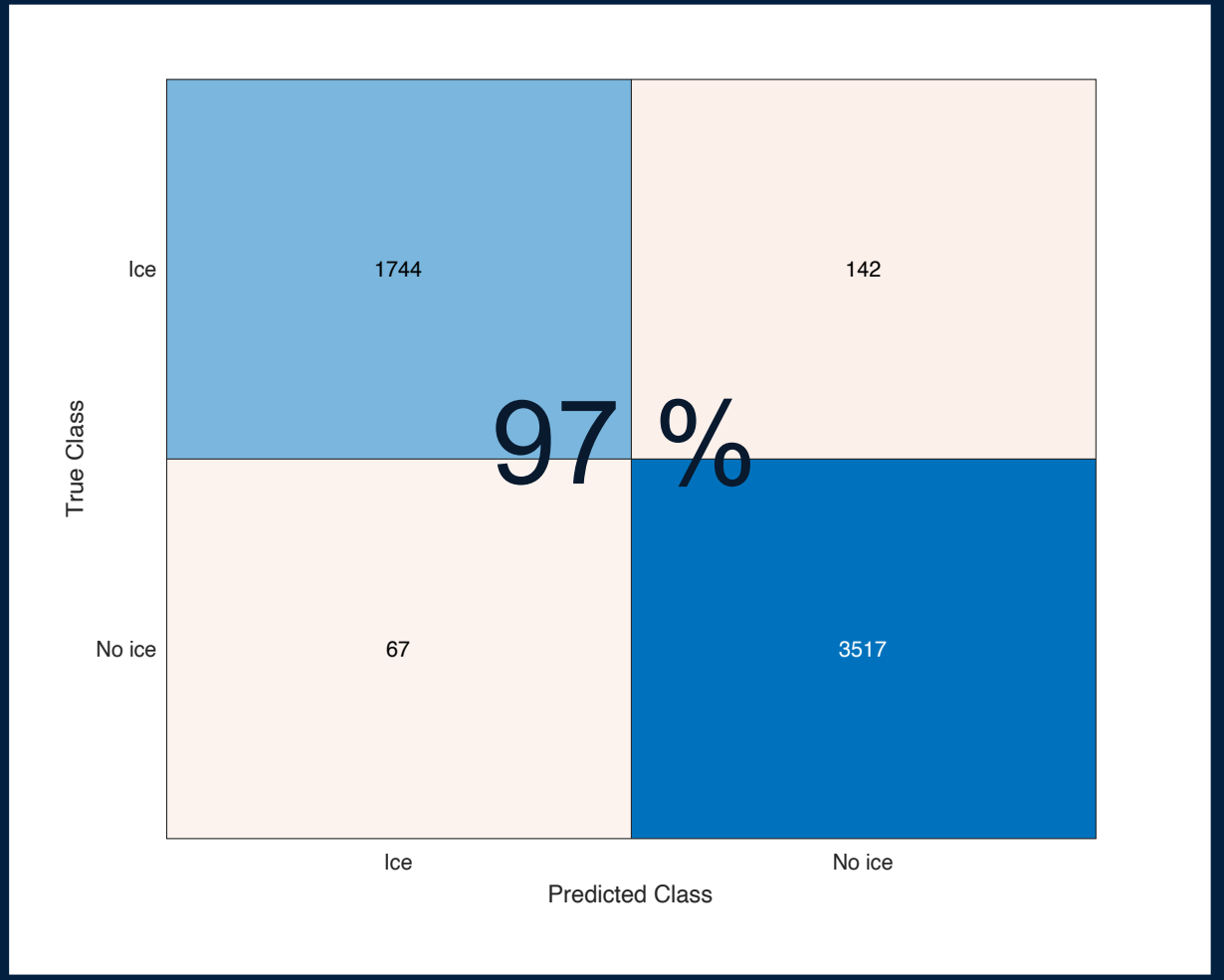
Background

- Snow and ice causes problems in production from wind power plants
- Snow and ice on the blades changes the loads and the aerodynamics
- Snow and ice detection is difficult in the harsh environment

New method to detect snow and ice

- Based on optical techniques
- High accuracy
- Tested on two different types of wind power plants
- Tested on data from 3 different winter seasons

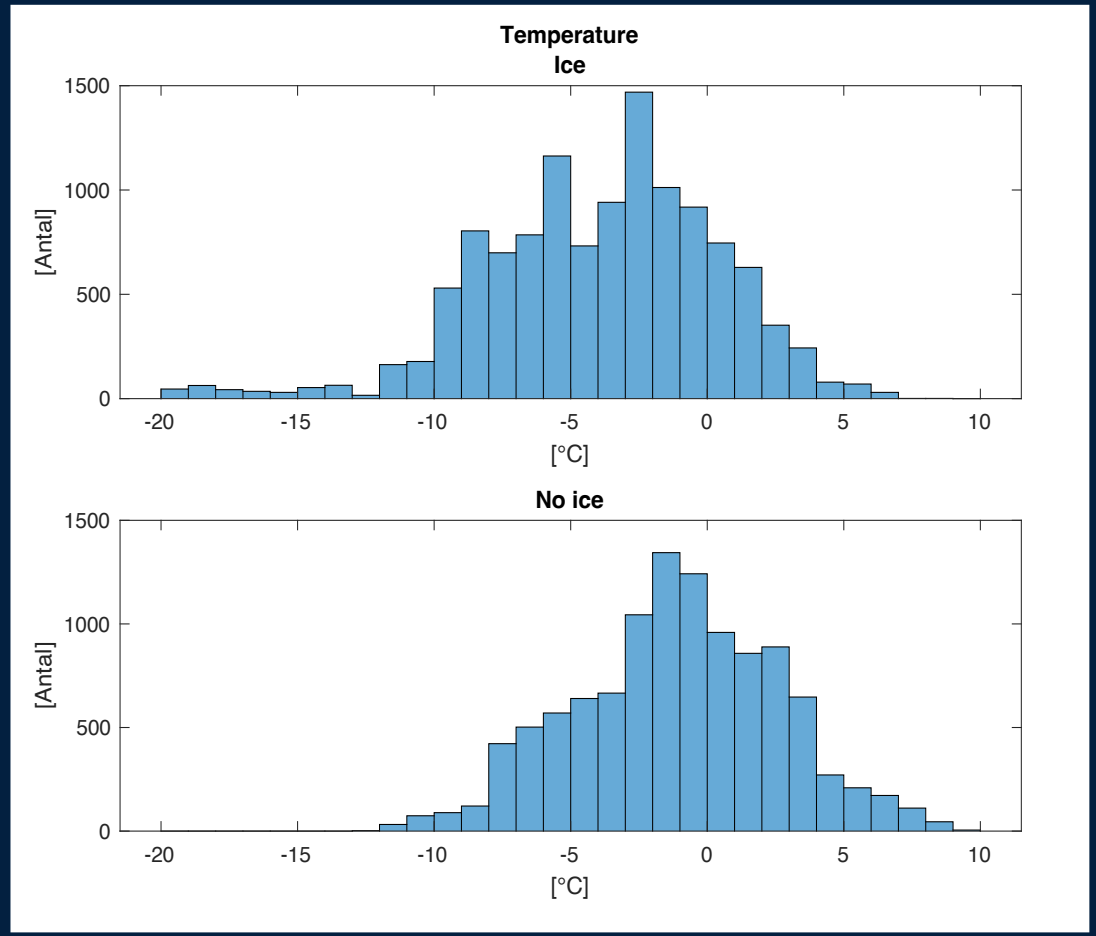


New method to detect snow and ice

- Based on optical techniques that are used on roads

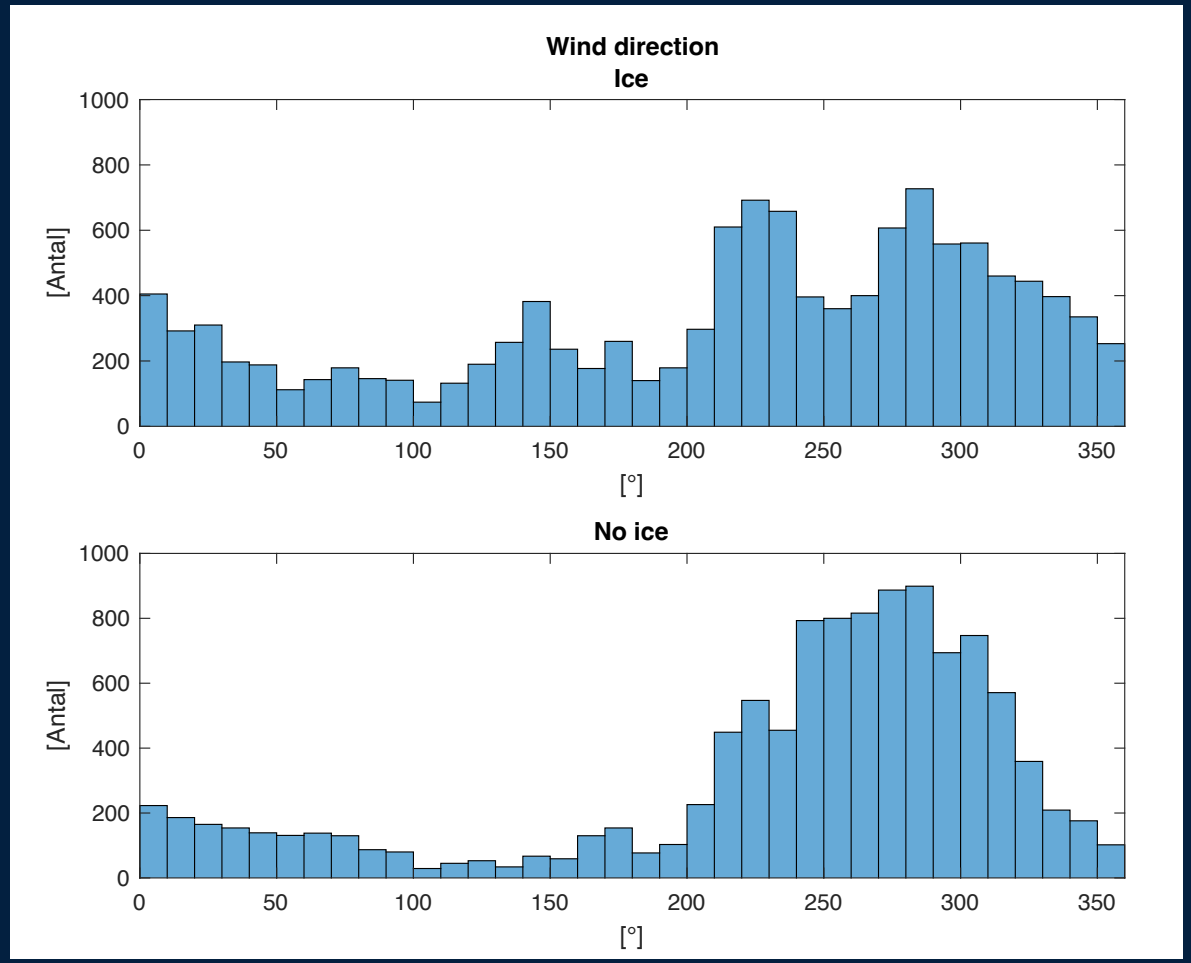
The benefits to know if there is snow or ice on the blade

- Investigating the influence of temperature on snow and ice build-up
- SCADA data with a frequency of 10 min



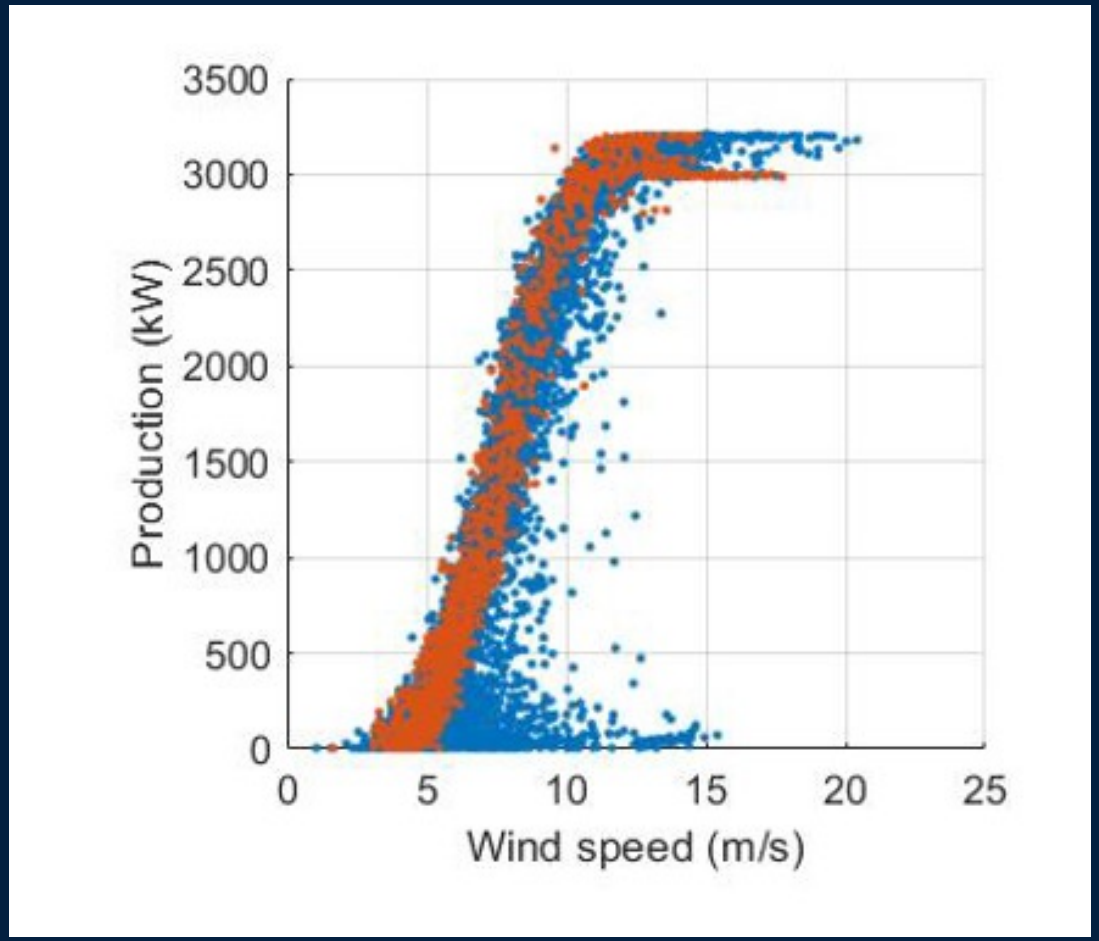
The benefits to know if there is snow or ice on the blade

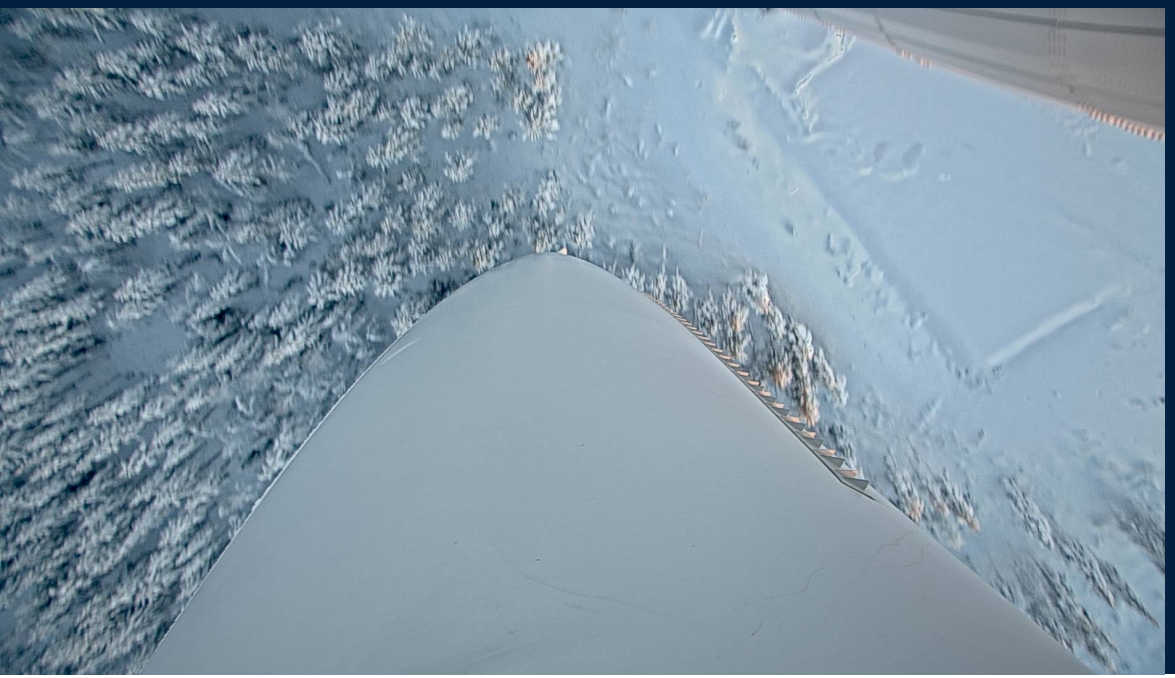
- Investigating the influence of wind direction on snow and ice build-up



The benefits to know if there is snow or ice on the blade

- Not all snow and ice build-up decreases the power production
- The need to understand and forecast when the snow and ice will decrease production or cause other problems is an important issue





What could this be used for?

- Turning on and of the anti- or de-icing system
- When service is needed, knowing if ice is present on the blade (ice throw)
- Forecasting snow and ice build-up, using the detection as feedback to check if the forecast is correct

Forecasting

- For both anti-and de-icing it would be beneficial to know 1 hour before the snow and ice would appear
- For the production and frequency market forecast for the next 24–48 hours are of interest

Weather forecast

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Image analysis + AI

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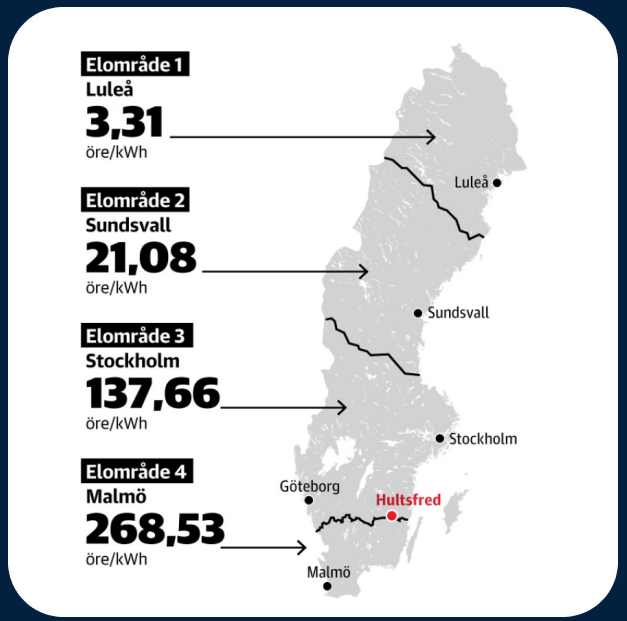
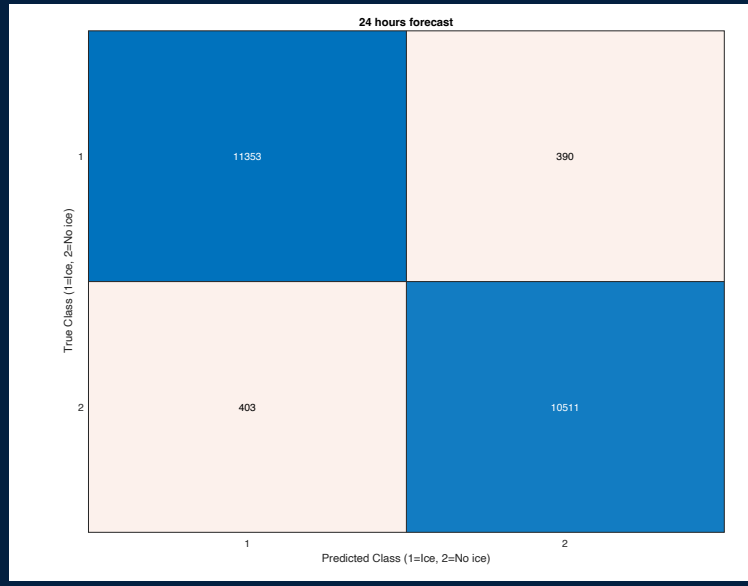


Price

Forecasting

- Data from different sources combined with snow and ice data
- Based on 1 season of data, tested on next season data
- Machine learning with Neural networks
- Good results for for snow and ice detection forecast
  - 96,6% accuracy 24 hours
  - 96,6% accuracy 12 hours
  - 96,3% accuracy 1 hour



Next step

- Start to investigate which snow and ice types that effect production
- Increase the precision of the 24 h forecast by including some more data sources and then increase it to 48 h

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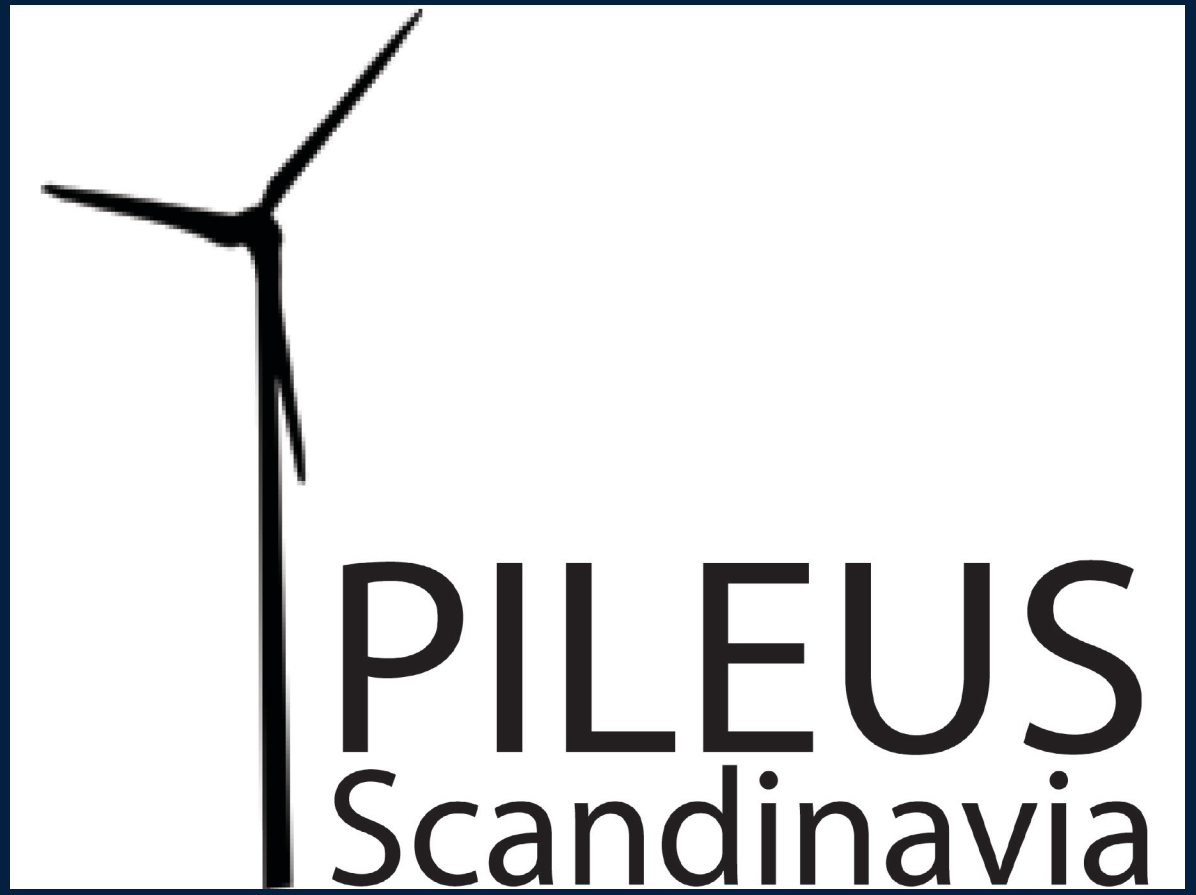
- Start to investigate which snow and ice types that affect production
- Increase the precision of the 24 h forecast by including some more data sources and then increase it to 48 h
- This results are so good so as a researcher I have gotten help from LTU Business and in august last year me and some colleagues started Pileus Scandinavia AB to sell this as a service



Summary

- Present snow and ice detection increase the accuracy of the forecast for snow and ice build up
- Not all snow and ice effects the production
- 24 hours forecasts of snow and ice show good results with high accuracy with the new method

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