

VTT



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Task 19 Ice Loss Tool – v2020

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VTT

Winterwind 2020 4. – 5. 2. 2020, Åre, Sweden

29/01/2020 VTT – beyond the obvious

Contents

- Who
- Task 19 ?
- Method
- History
- What's new
- Next



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Who

- Timo Karlsson
- IEA Wind Task 19 Operating Agent
- Research Scientist @ VTT
- Lot of experience with cold climate wind



What is IEA Wind Task 19?

- Task 19 – Wind Energy in Cold Climates – international expert group
- Mission: *Boost safe and cost efficient wind power deployment in cold climates*
- Activities included:
 - Exchange information on international research collaborations and projects
 - Create recommendations, guidelines & best practices
 - Collect overview of available technologies and market potential
 - Disseminate reports, tools and findings
 - No research projects!
- Task active since 2001
- Funded through participating countries



Ice Loss Tool history

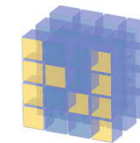
- Icing causes issues with turbine aerodynamics
 - Detectable as turbine output power dropping from the power curve
 - Questions remained
 - How large of a drop evidence of icing?
 - How to define limits, how to deal with differences between turbine models?
 - How to make sure people use the same definition for "an icing event"
- Make software available, using a robust, easy to understand, sensible definition of an icing event

T19 Ice Loss Tool

- Software to count icing losses for SCADA data
 - Python 3 script
- Reference method and one, Task 19 recommended, definition of an icing event
- No external measurements needed just the variables that are usually available in SCADA data



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NumPy

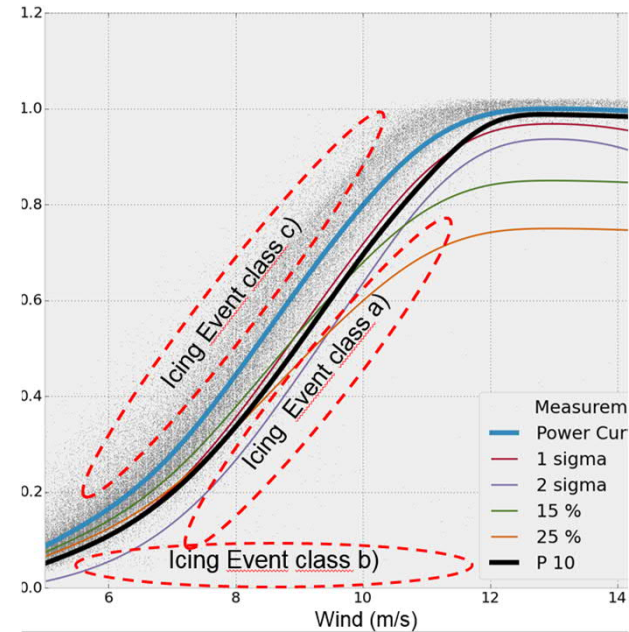


SciPy

matplotlib

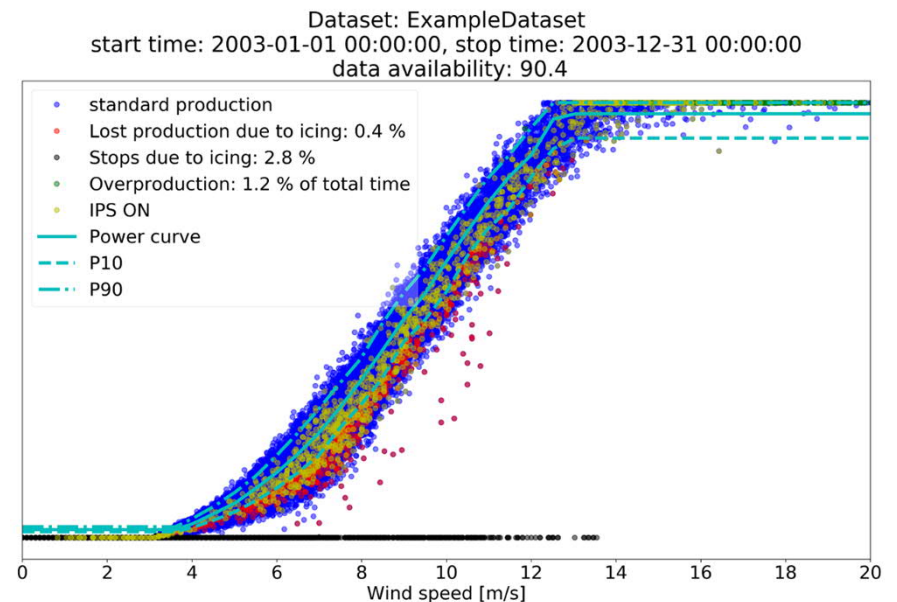
Ice detection method

- Splits a reference dataset from the data
 - No faults, no stops, temperature > 3 °C
- Puts the data in bins according to wind speed (and direction)
 - Calculates limits for alarm
 - P10 for icing
 - P90 for overproduction
- Runs the full dataset against the power curve and limits and flags possible icing events



Ice detection method

- Icing event definition:
 - If temperature below a limit (+ 1 °C) and power below P10 for 30 consecutive minutes
→ icing event starts
 - If temperature above the limit for 30 minutes
→ icing event stops
- Code flags stoppages separately
- Apparent overproduction is flagged with a similar criteria
 - If temperature below a limit (+ 1 °C) and power above P90 for 30 consecutive minutes
→ icing event starts
 - If temperature above the limit for 30 minutes
→ icing event stops

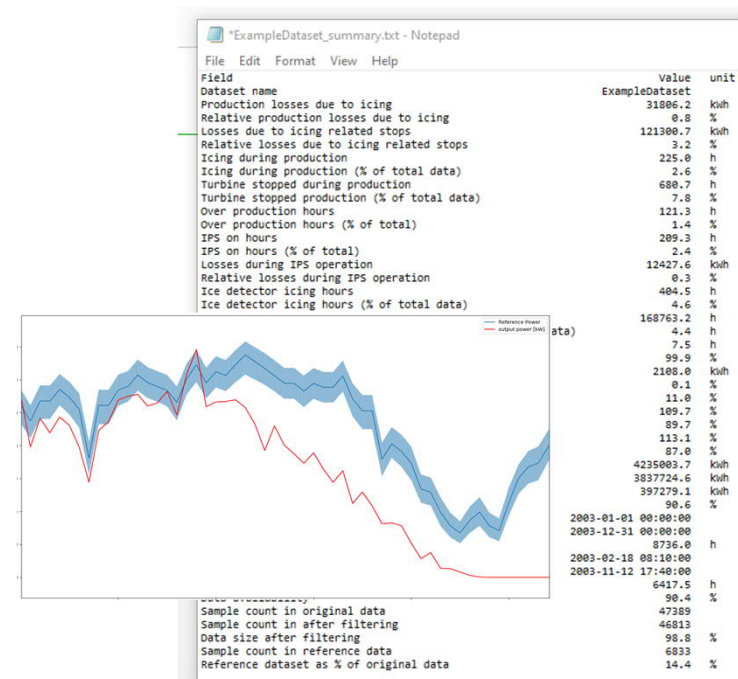




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Tool outputs

- Outputs:
 - Summary
 - Alarm time series
 - Power curve, with lith limits and uncertainty
 - Filtered full time series with Alarm limits, for plotting
 - Icing event statistics

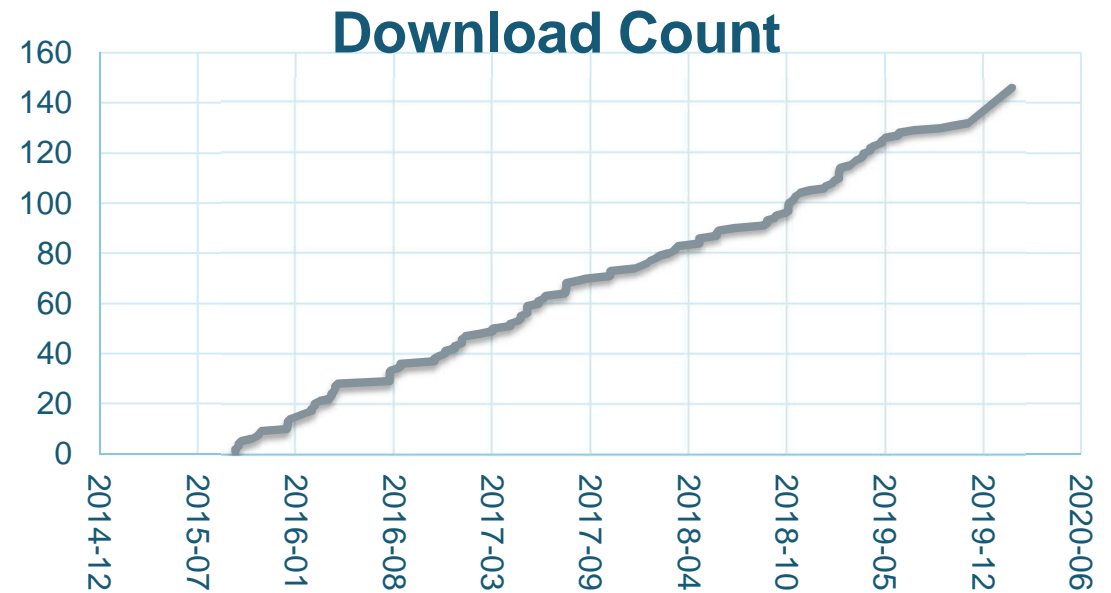


User Base

- Download count since first release
- Widespread interest in the industry
- Steady growth in userbase



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New version, out now

- New version on GitHub
- <https://github.com/IEAWind-Task19/T19IceLossMethod>
- Follow this page for new releases
- Report issues or feature requests here

A screenshot of the GitHub repository page for 'IEAWind-Task19/T19IceLossMethod'. The page shows a list of commits with their descriptions and dates. The most recent commit is by 'timok-vtt' on 14 Nov 2019, titled 'Corrected the summary file calculation.'. Below the commit list is a preview of the README.md file, which features a banner image of wind turbines and the text 'Task19 Wind Energy in Cold Climates'. The README text describes a standardized method to assess production losses due to icing from wind turbine SCADA data.

Task19/T19IceLossMethod

Branch: master | New pull request | Create new file | Upload files | Find file | Close or download

Latest commit c793c12 on 14 Nov 2019

File	Description	Time
docs	Added the IEA wind disclaimers to the documentation as well just to b...	3 months ago
images	Added example data + a functioning example.ini	3 months ago
T19_ice_loss	Corrected the summary file calculation.	3 months ago
CHANGELOG	Populate the repository for publishing.	3 months ago
DISCLAIMER.txt	Populate the repository for publishing.	3 months ago
LICENSE	Update LICENSE	3 months ago
README.md	rename the banner image to not include caps or spaces	3 months ago
example.ini	Changed the data availability lines in the summary file to	3 months ago
fake_data2.csv	Added example data + a functioning example.ini	3 months ago
multifile_T19_counter.py	Populate the repository for publishing.	3 months ago
setup.py	Fixed the behaviour of status code stop in order to	3 months ago
T19_counter.py	Corrected the summary file calculation.	3 months ago
task19iceloss.pdf	Added the documentation, pdf to repo for convenience	3 months ago

README.md

Task19 Ice Loss Method

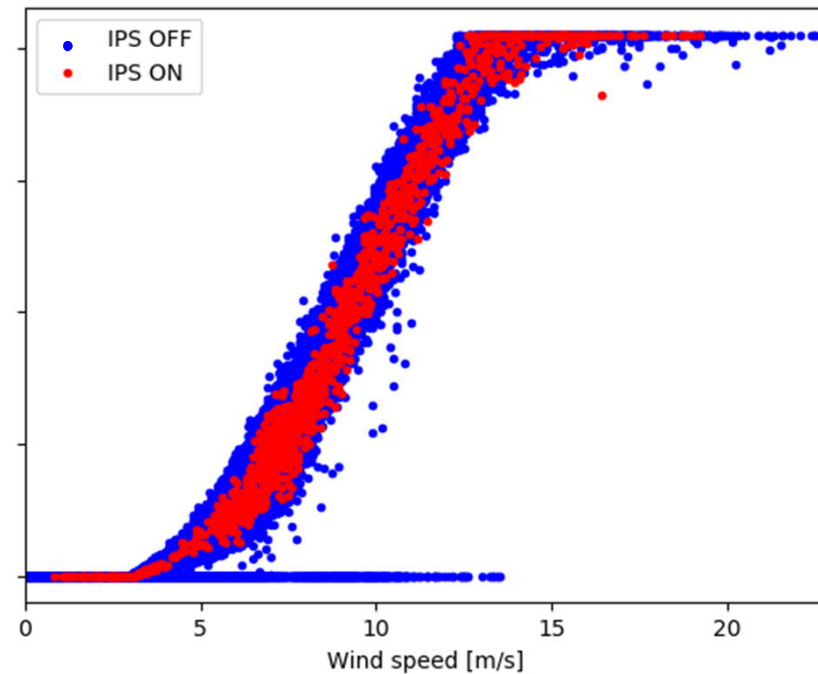
A standardized method to assess production losses due to icing from wind turbine SCADA data. This site describes a method to assess production losses due to icing based on standard SCADA data available from modern wind turbines.

New Since the previous update in 2017

- Added a stop code to the code
 - Stop code can be used to highlight icing caused stops if there is a separate status code in scada for that.
- Added IPS handling capability to loss counter
- Added ice detector as a separate state class
- Added Power curve uncertainty to power curves:
 - uncertainty defined as $\text{std_dev}/\text{mean}$
- Added Status code based stops as a separate case for output
 - Allows counting production losses during a certain status code
 - Added IPS and status code stops to summary file
 - Added power curve uncertainty to summary file and printed power curve
- Time Based Availability and Energy Based Availability

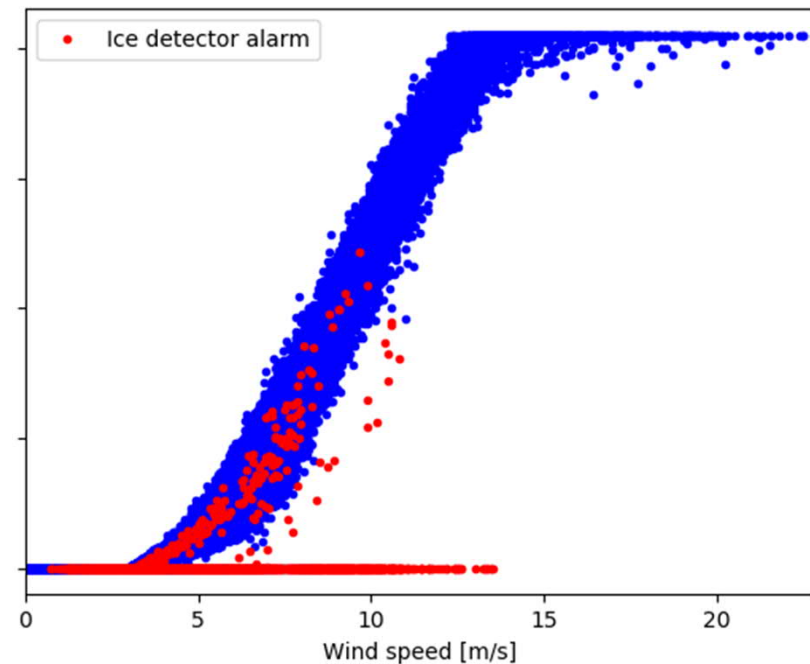
IPS Handling

- Turbine heating is handled as a special case
 - All data points where IPS is on are separated into one special class
 - Production losses during heating are separated into its own set
- Icing losses can still be calculated for the times heating is not on



Ice detector

- If there is an ice detector, possible to flag the moments ice detector given alarm is on
 - Compare to power curve based detection
- Can sometimes have interesting results

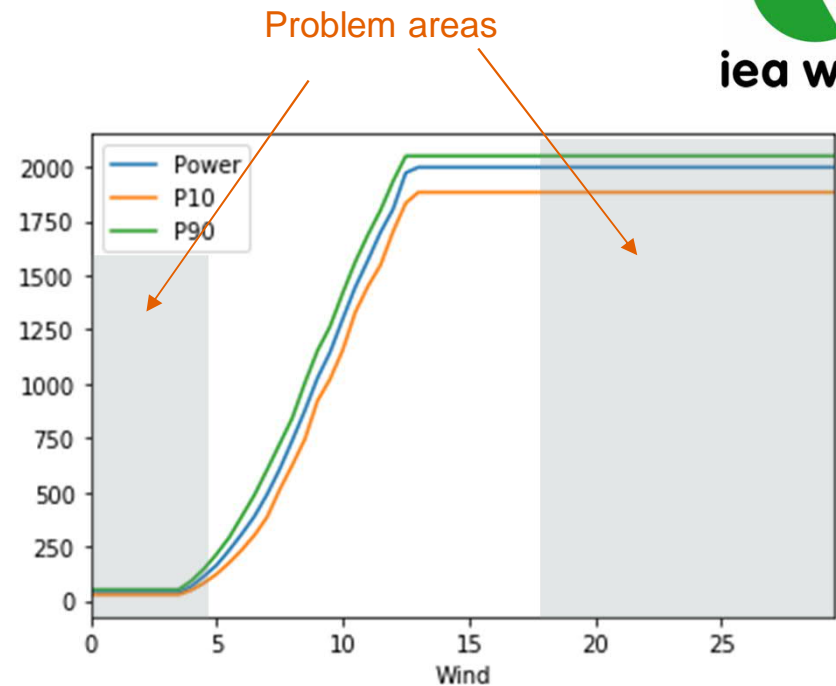


Lessons learned

- State, status, fault codes, data cleanup
 - The more time spent creating a clean, well behaved reference dataset, the better results are
- Anemometry
- Nacelle temperature measurement
 - Bias?
- Variability in power measurements
 - Power curve sometimes really wide
 - Big differences from turbine to turbine
 - Has an effect on accuracy of method

Lessons learned

- Dataset size
 - Reference dataset size has an effect on results
- Large and small wind speeds
 - Method has issues at above nominal wind speeds
 - Likewise close to cut-in
 - Might make sense to limit the icing event detection by wind speed in the future



Next

- New hosting, more open development updates should be quicker
- More experiences needed
- Feedback, issue reports improvements welcome
- <https://github.com/IEAWind-Task19/T19IceLossMethod>



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