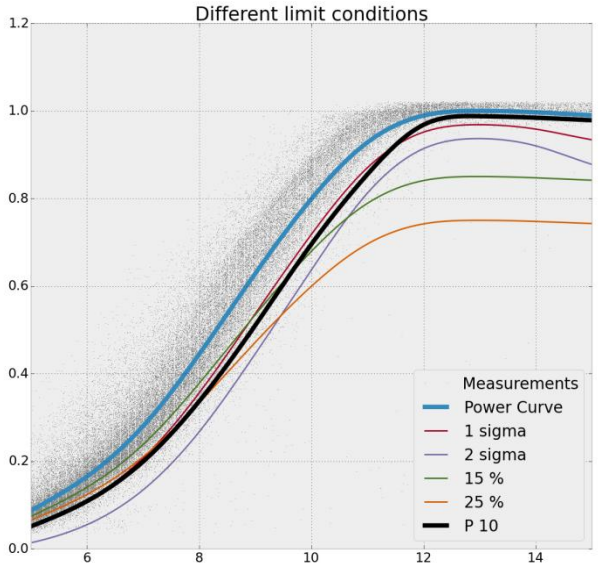

Standardized method to evaluate production losses due to icing using only SCADA data "T19IceLossMethod"

iea wind

WinterWind 2015, 2-4.2.2015, Piteå ,Sweden

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Outline

- What is IEA Task 19?
- How to calculate production losses due to icing?
- Validation of method results (4 sites, 3 countries)
- Conclusions & next steps

What is IEA Wind R,D&D Task 19?

- Task 19 – Wind Energy in Cold Climates – expert group
- Working group for
  - Acquaring information on the cold climate wind energy topic
  - Writing recommendations
  - Disseminating information
  - International research collaboration
- Task worked since 2002
- Next 3 year term is about to begin
  - Newest member: Belgium

How to calculate production losses due to icing?

- **The Challenge**:
  - Absolute correct answer for production loss calculations is never possible but we need to agree on method principles.
  - No standard method available:
    - Iced stand-stills included or not?
    - -15% or -25% of clean power?
    - σ, 2xσ OR 3xσ of clean power?
    - Percentiles P10 or P20 for 3x10min consecutive bins?
  - All methods lead to different AEP losses -> cannot compare sites to each other
  - Reliable, dedicated ice detection commonly not available

How to calculate production losses due to icing?

- **The Need**:
  1. Compare different icing site severities with each other
  2. To validate the IEA Ice Classification
  3. Evaluate effectiveness of various blade heating systems versus non-heated systems

➢**STANDARDIZED PRACTICES NEEDED!**

How to calculate production losses due to icing?

- **The Goal**:
  1. Develop and validated a robust method to assess icing losses from standard SCADA data
  2. The method should 1) focus on robustness and 2) minimize the uncertainties from false icing event alarms
  3. Maximize easiness of calculating production losses for any SCADA dataset with a free software

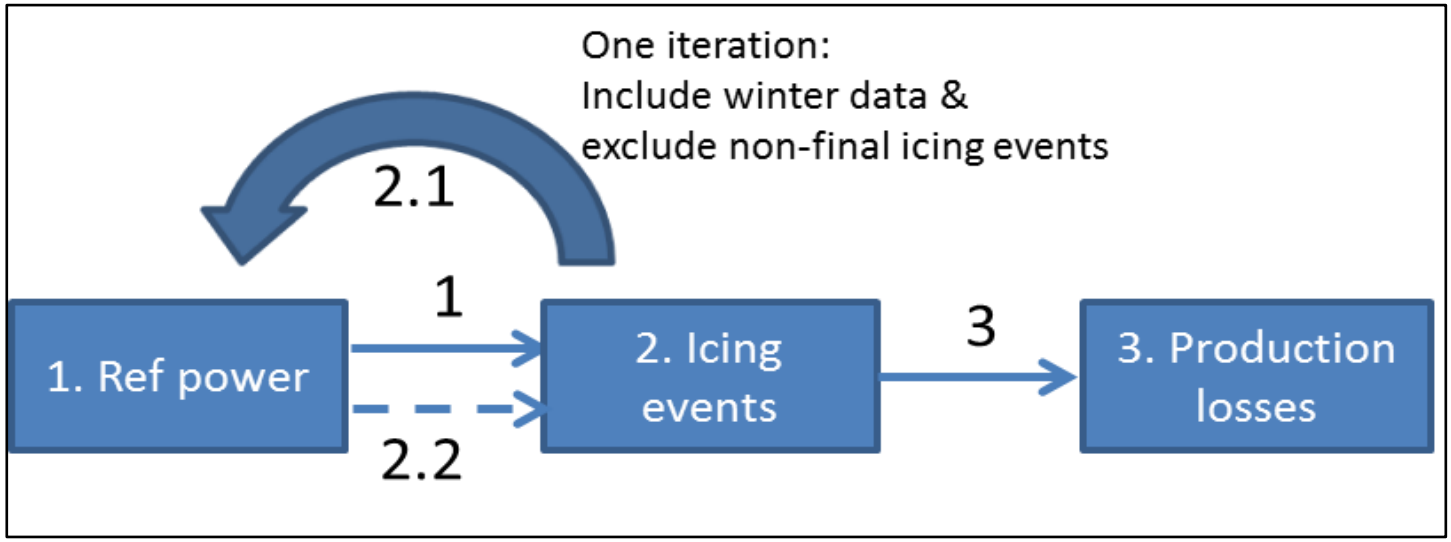
➢**TOWARDS STANDARDIZED PRACTICES!**

How to calculate production losses due to icing? Answer: *T19IceLossMethod*

- **The Approach**:
  1. Make publicly available free software for calculating production losses with "*T19IceLossMethod*" on any SCADA dataset
  2. The *T19IceLossMethod* uses the rotor as an ice detector
  3. Method robustness achieved by using 10th percentile of non-iced power curve
  4. False alarms minimized by including the "memory effect" of icing: more than one 10-min datapoints needed to trigger positive rotor ice detection

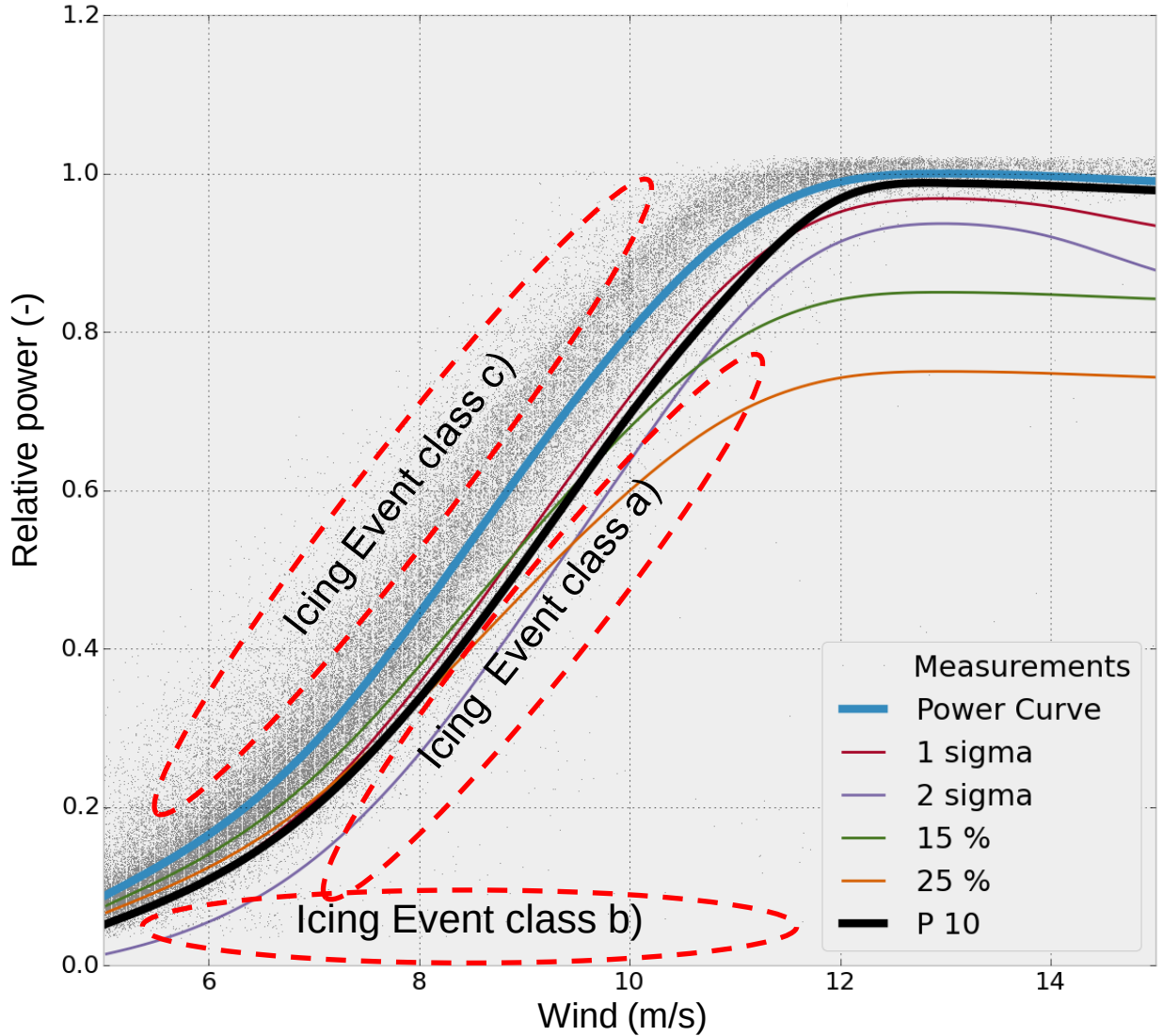
How to calculate production losses due to icing? Answer: *T19IceLossMethod*

- **The Approach**:
  - 1) Calculate initial reference “non-iced” power curve for summer data
  - 2) Detect initial icing events
    - 2.1) Iteration loop: Include winter data & exclude initial icing events, calculate final reference power curve
  - 2.2) Re-calculate final icing events with new reference power curve
  - 3) Calculate operational & standstill losses due to icing

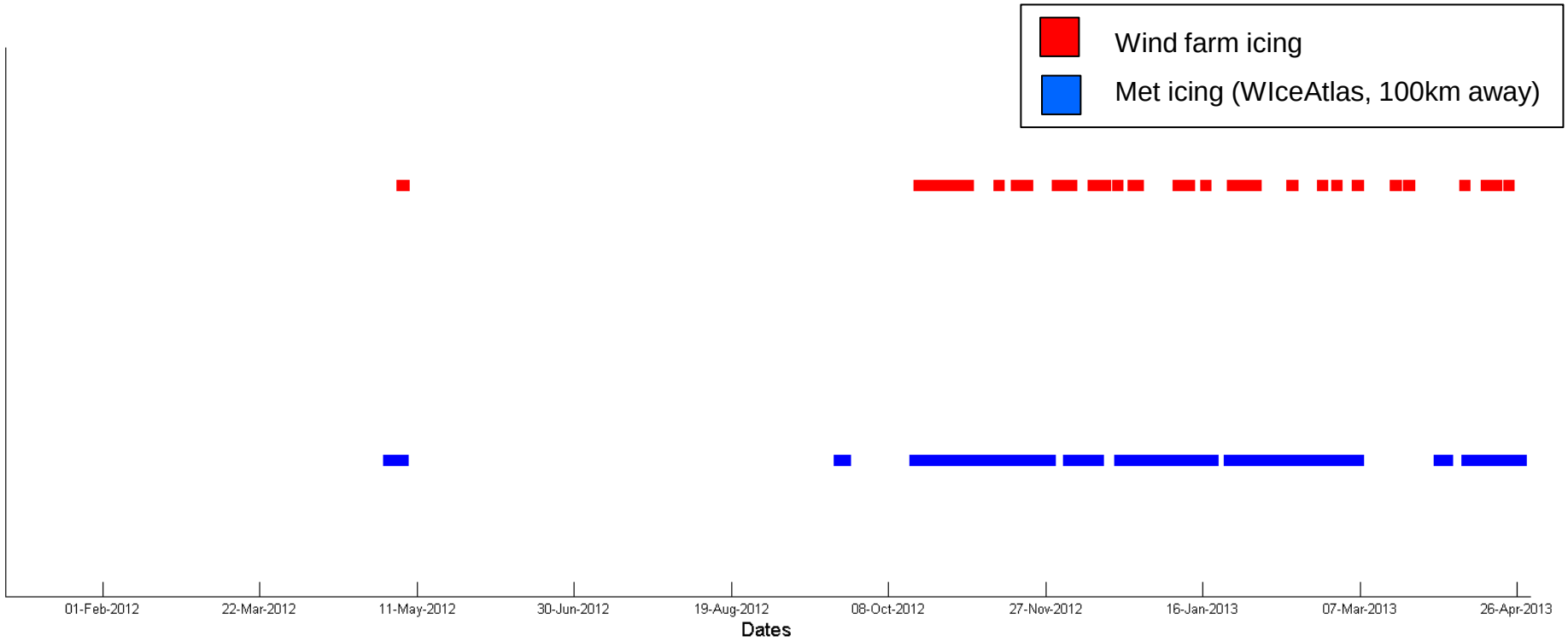


How to calculate production losses due to icing? Answer: *T19IceLossMethod*

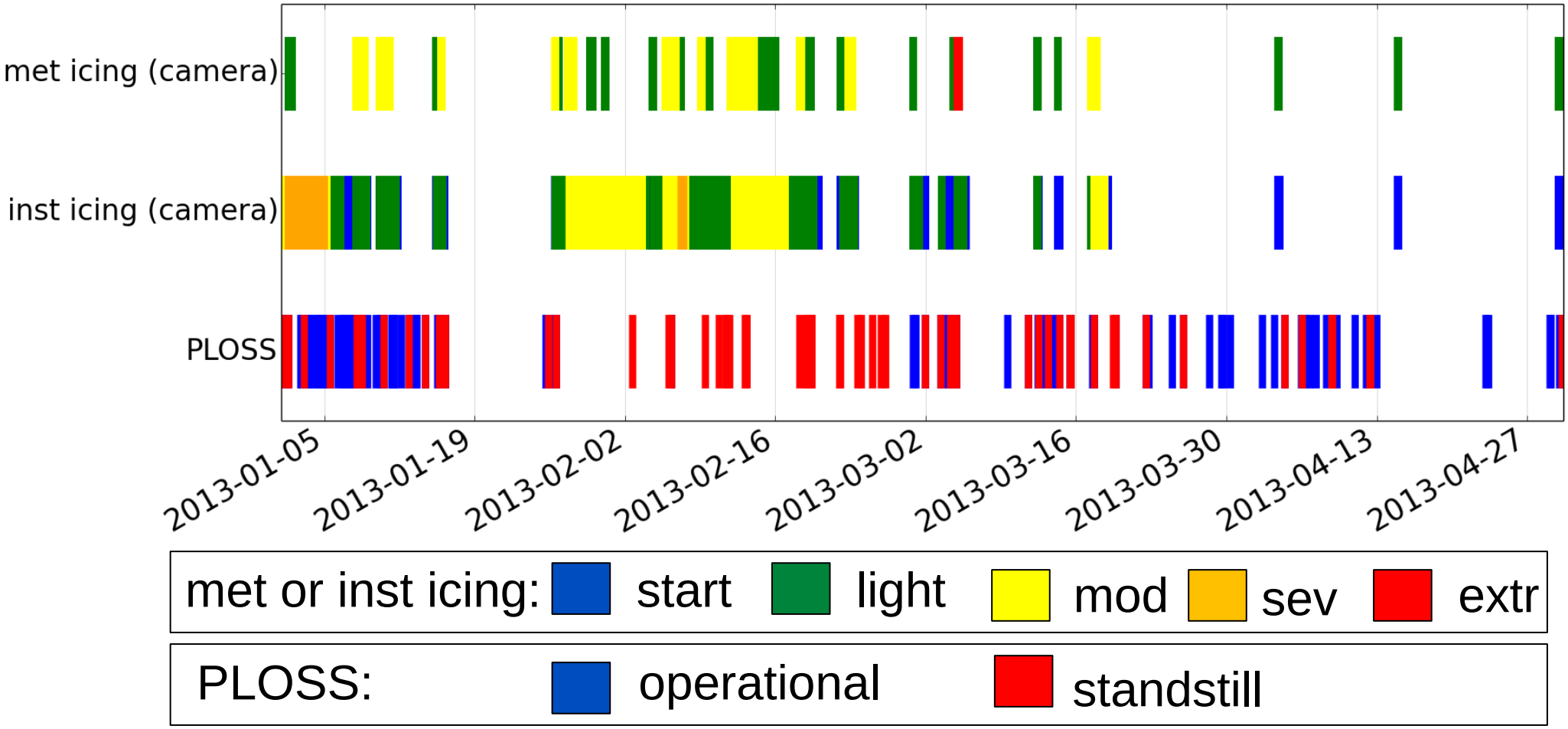
- **The Approach**: Different Icing Event classes



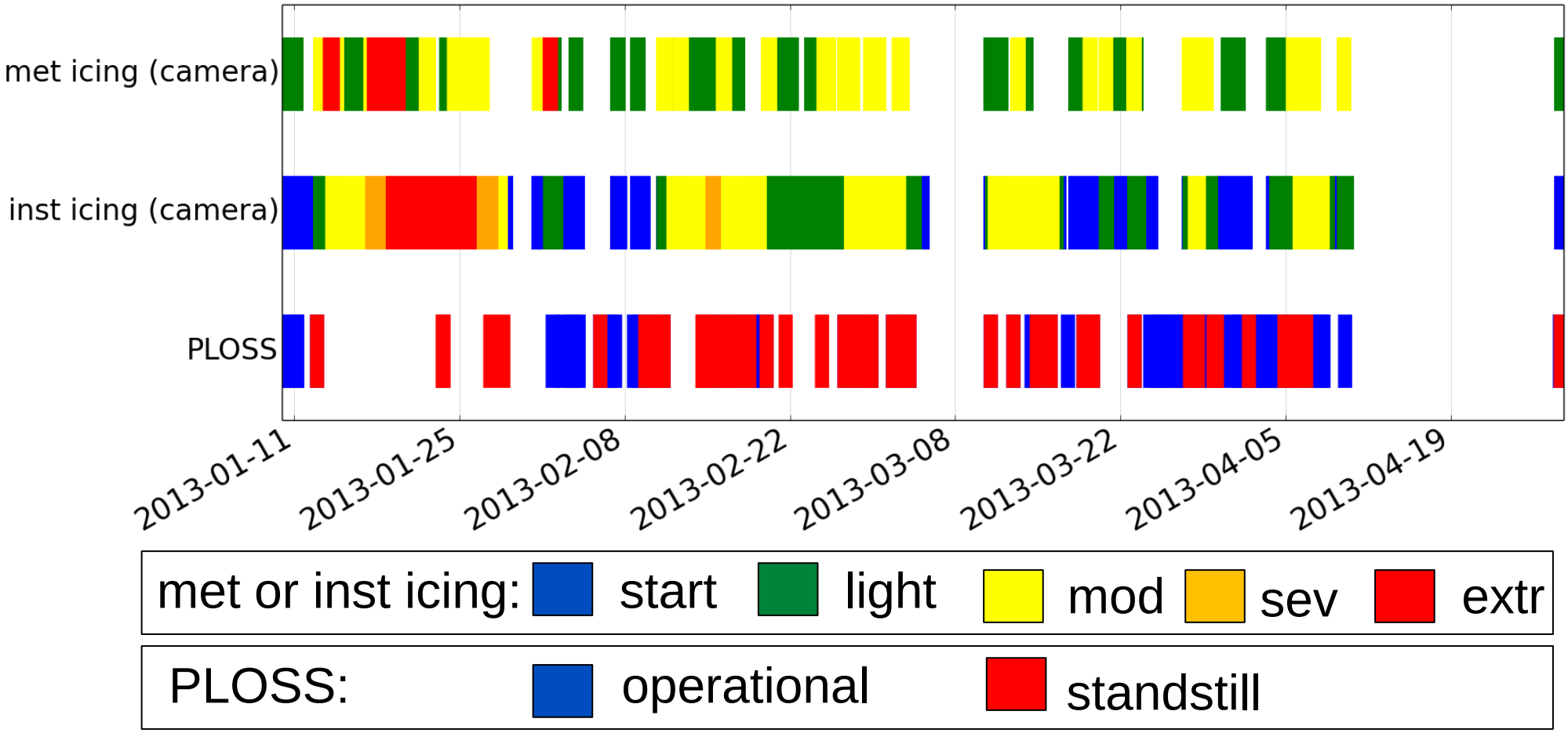
Validation results – site SWE 1 (2012/2013)



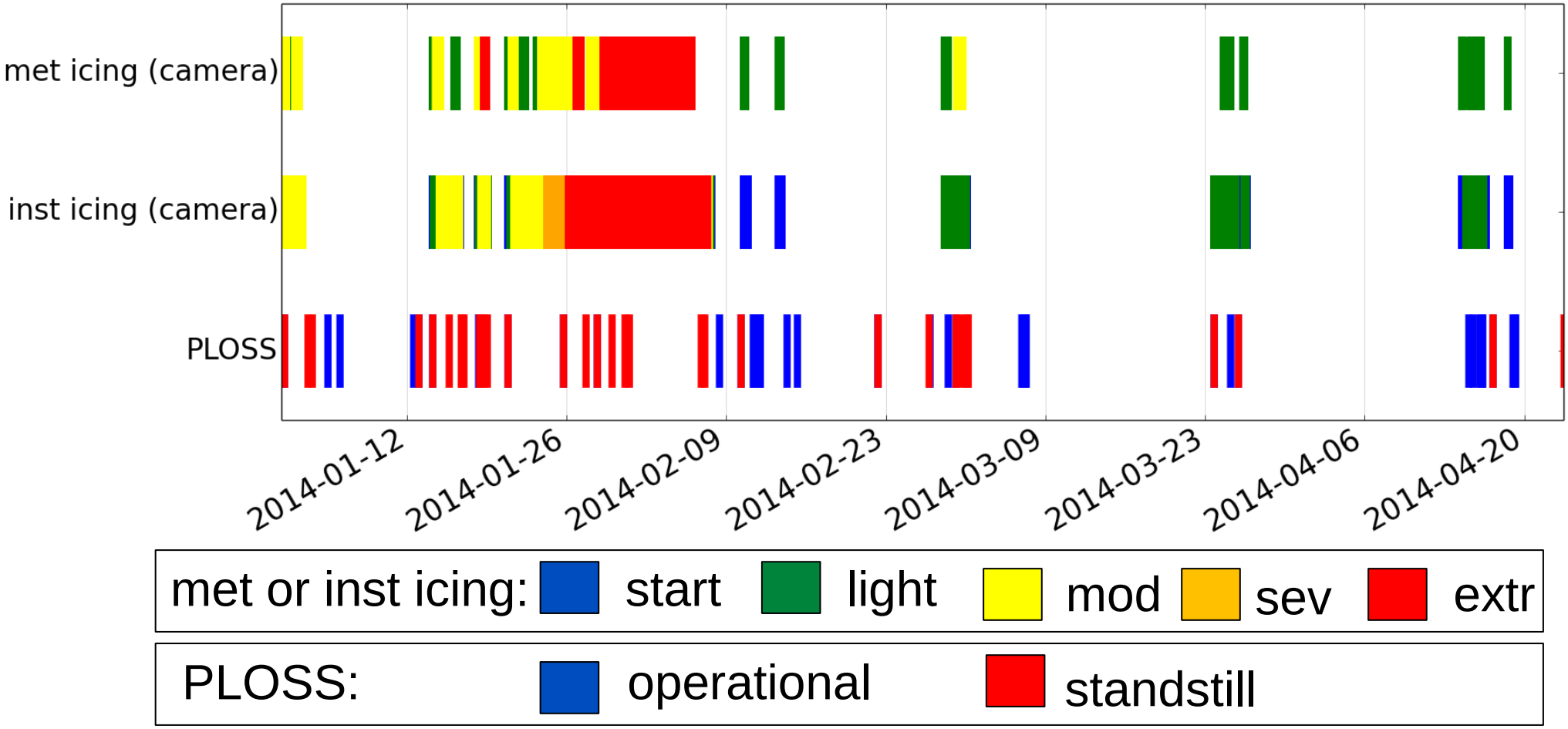
Validation results – site SWE 2 (2012/2013)



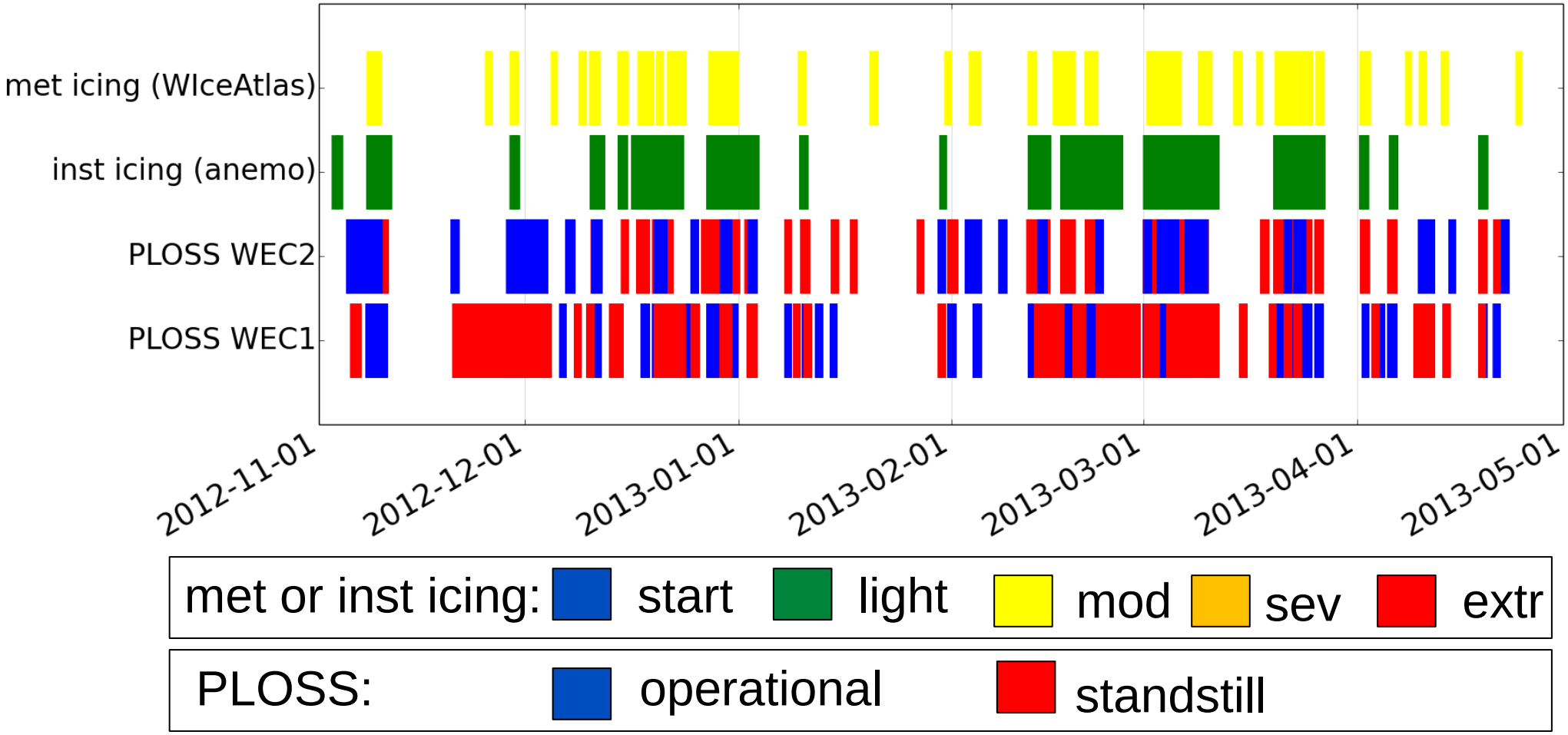
Validation results – site EU (2012/2013)



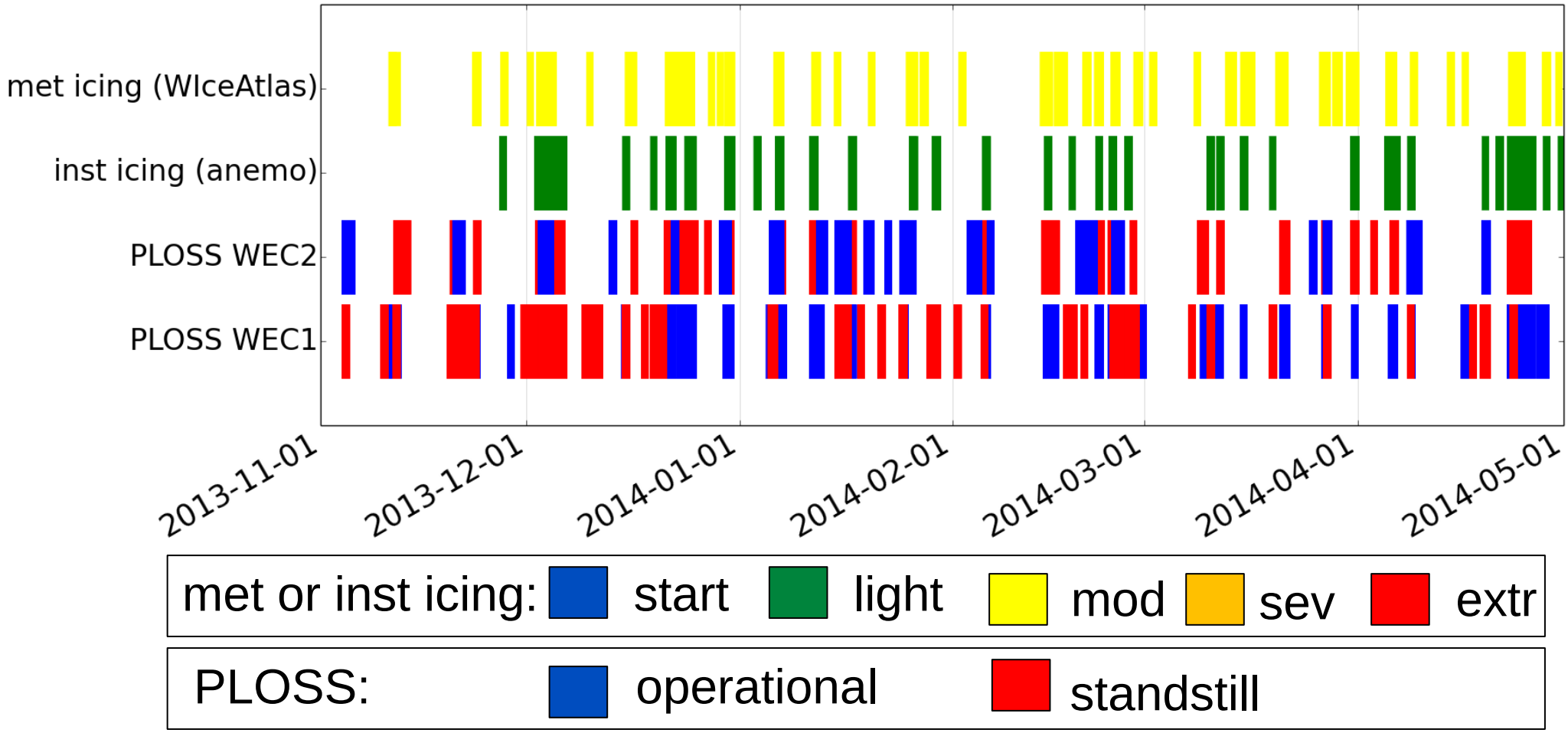
Validation results – site EU (2013/2014)



Validation results – site CAN (2012/2013)



Validation results – site CAN (2013/2014)



Challenges faced during validation

- The software is “semi-automatic”, human intervention needed still the check validity of results & troubleshooting
  - Eg “NaN” MW not kW, “-999”
- Status code of controller VERY IMPORTANT, especially for
  - calculating ”non-iced” power curves and
  - detection of standstill events due to icing
- During winters with heavy icing, all ice detectors “beeping” most of time, challenging to assess the timing of *T19IceLossMethod*

Conclusions

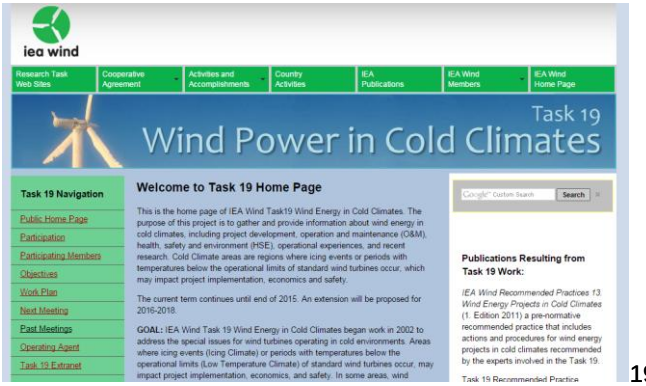
- Standardized practices for cold climate needed to:
  - Boost further deployment
  - Decrease financial uncertainties and
  - Increase project bankability

- New *T19IceLossMethod* will “standardize” one element in the cold climate wind industry
  - Extensively validated & robust method

- Free software launched to accelerate dissemination of information, download soon at http://ieawind.org/task_19.html

Next steps & visions

- Public version out in Q1/2015 – please download and use it!
- **Developers, consultants and researchers**: Task 19 is looking forward in seeing a lot of sites analysed and results published in WinterWind 2016!
  - Why?
    - To validate current icing maps
    - Validate ice classification
    - **Lower uncertainties of future projects, steps towards increased bankability**
- Stay tuned to Task19 website for more info! http://ieawind.org/task_19.html



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