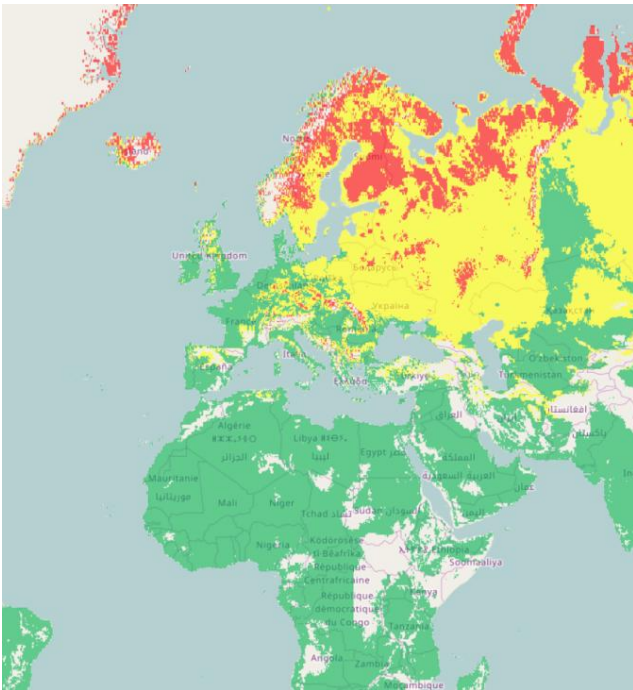


# WiceAtlas - Public Wind Power Icing Map

Winterwind 2017, Feb 6-8, Skellefteå  
Simo Rissanen, Ville Lehtomäki  
VTT Technical Research Centre of Finland Ltd





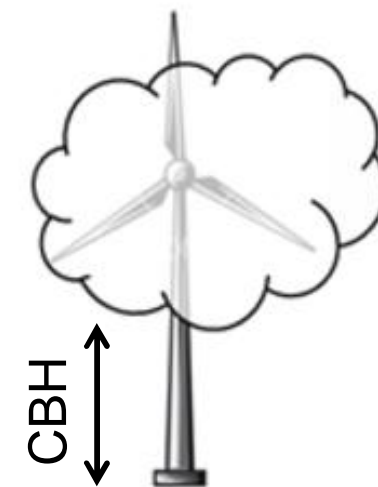
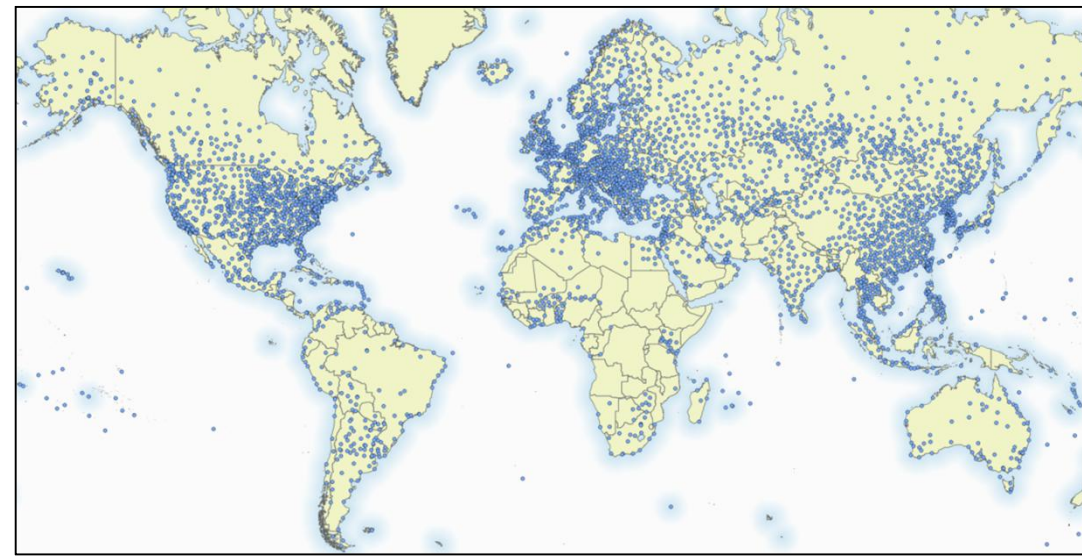
## Motivation

- Icing maps available for single countries. These are made with different mesoscale weather models and parameters and can't be compared
- Public global map is useful to get first impression about icing severity on planned site



## Methodology (1/2)

- WIceAtlas is based on cloud base height (CBH) measurements around the world
- Data from 4500 meteorological stations, >20 yr/station, >70% availability
- Merra data used for temperature
  - Vertical interpolation from different pressure levels



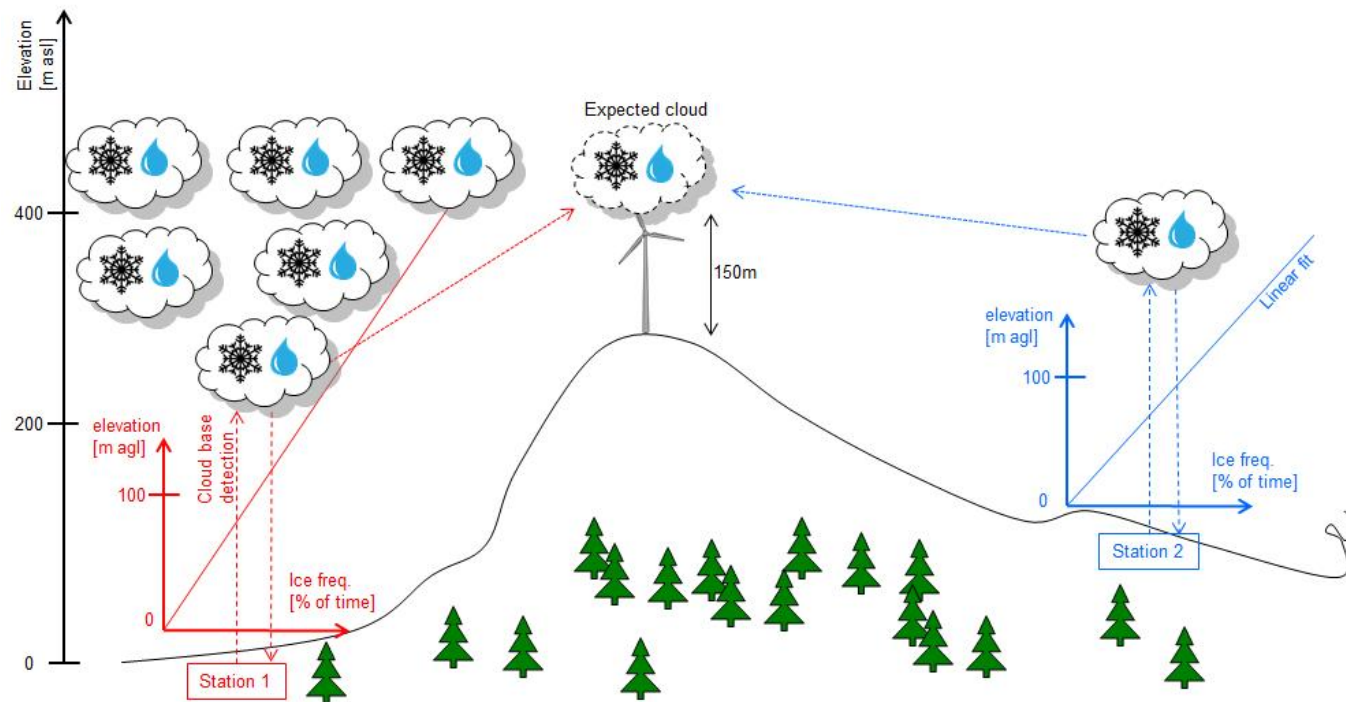
Criteria for icing:

$CBH \leq 150$  m and temperature  $< 0$

**Includ icing only!**

# Methodology (2/2)

- Data from multiple stations used for every point of map
- Data interpolated using inverse distance weighting
- Map calibrated with data from SE&CA
- IEA class from table



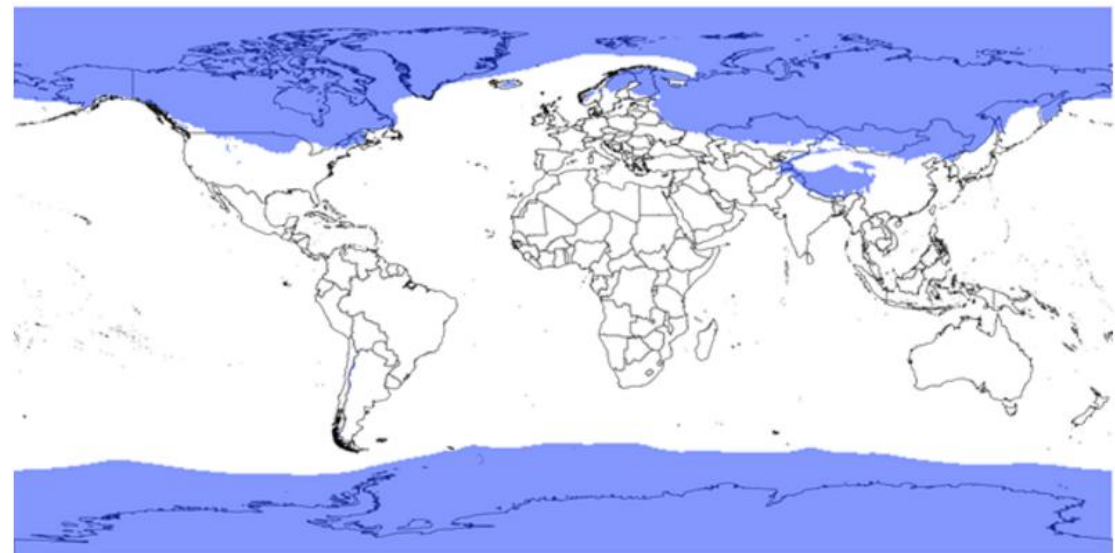
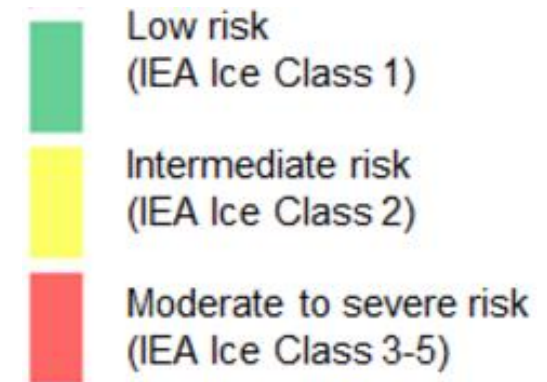
IEA ice class	Duration of Meteorological icing [% of year]	Duration of Instrumental icing [% of year]	Production loss [% of AEP]	WiceAtlas icing frequency (public version)
5	>10	>20	>20	Moderate to high
4	5-10	10-30	10-25	Moderate to high
3	3-5	6-15	3-12	Moderate to high
2	0.5-3	1-9	0.5-5	Intermediate
1	0-0.5	<1.5	0-0.5	Low

Source: IEA Wind Recommended Practices for wind energy projects in cold climates edition 2011



## Public version

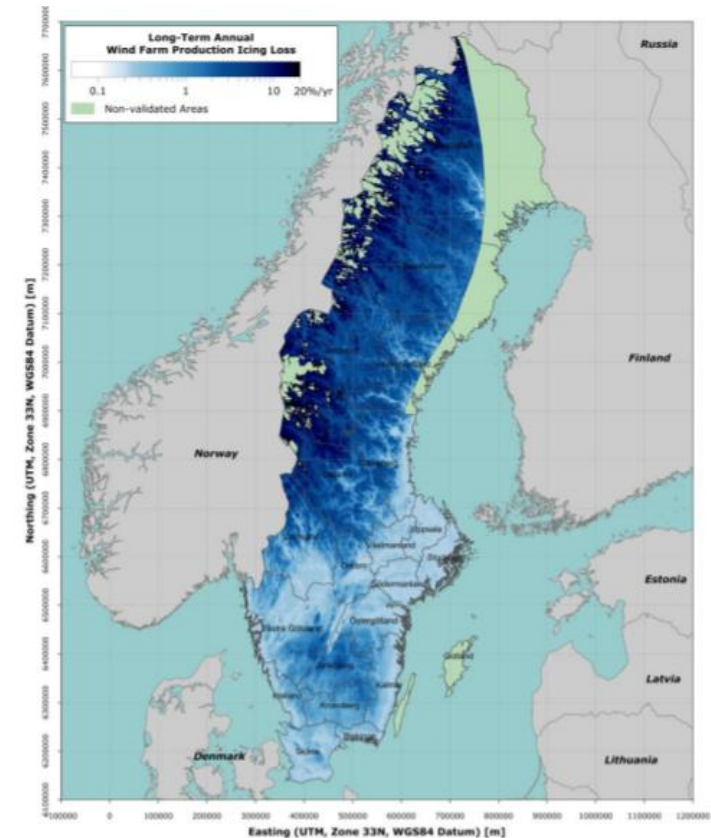
- Map resolution reduced to 0.05x0.05 deg
  - High res maps can be created
- Icing resolution reduced to three classes (based on IEA ice classification table)
- 150 m a.g.l.
- Low temperature map layer






# Validation & filtering

- CBH based method creates on-off signal and icing intensity is not known -> Method overestimates icing.
- Map calibrated with data from Sweden and Canada
- Accuracy decreases if height difference between site and station is large. Elevation diff > 500m filtered.
- Extensive validation by Cattin "Blind icing map validation, Winterwind 2017".



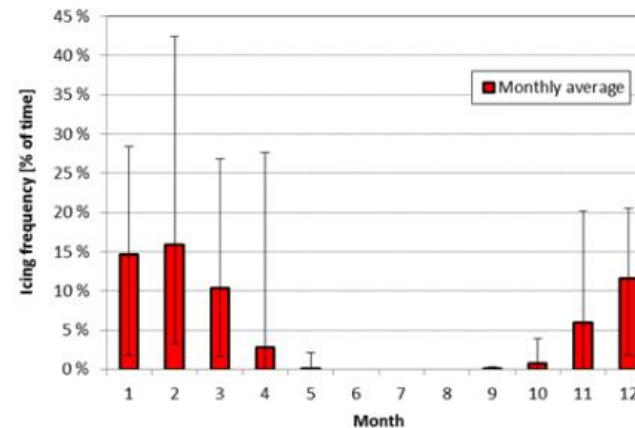
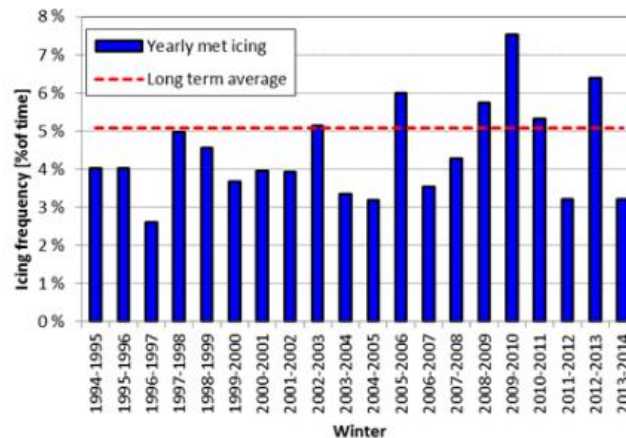
 Insufficient data

## Sources:

- Till Beckford, "Estimating energy losses caused by blade icing from pre-construction wind data", in Winterwind, Piteå, 2015.
- Antoine Lacroix, "Atmospheric Icing Effects on Wind Energy Production in Canada", in Winterwind, Östersund, 2013.

# Customer offering

- High res maps
- Yearly/monthly site analysis
  - Long term comparison to measurement data



Try it!



# <http://www.vtt.fi/sites/wiceatlas>

