Modeling Power Loss Due to Wind Turbine Icing

Davis, Neil; Hahmann, Andrea N.; Clausen, Niels-Erik; Zagar, Mark

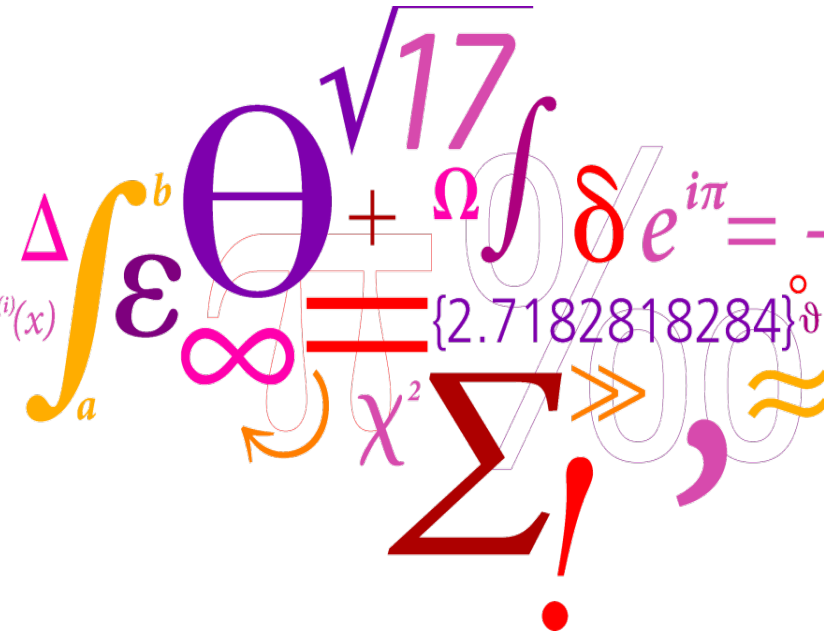
Publication date:
2014

Modeling Power Loss Due To Wind Turbine Icing

Danish Wind Industry
Annual Event 2014

Neil Davis[1,2], Andrea Hahmann[1], Niels-Erik Clausen[1], and Mark Zagar[2]

1: DTU Wind Energy; 2: Vestas Wind Systems

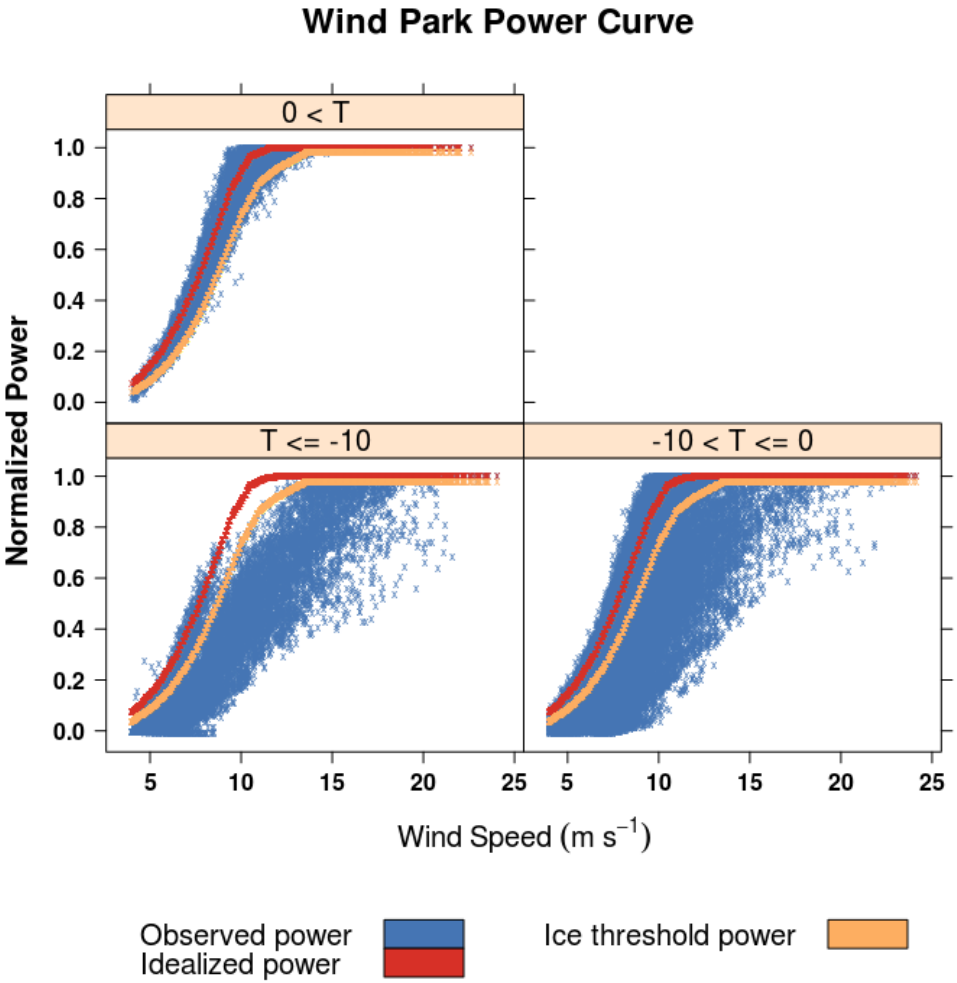


DTU Wind Energy
Department of Wind Energy

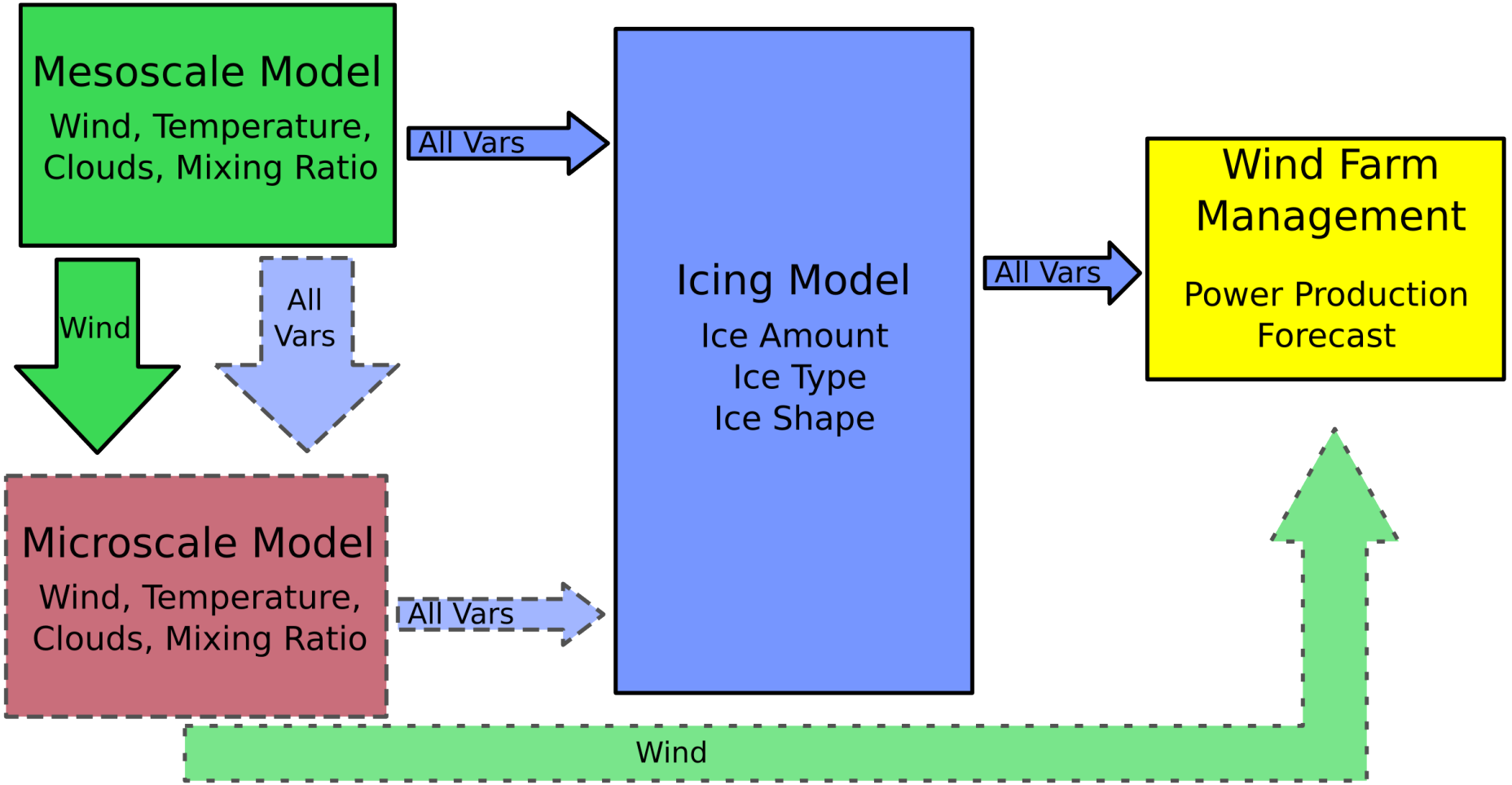
Motivation

- Site location
- Wind park planning
- Energy market pricing

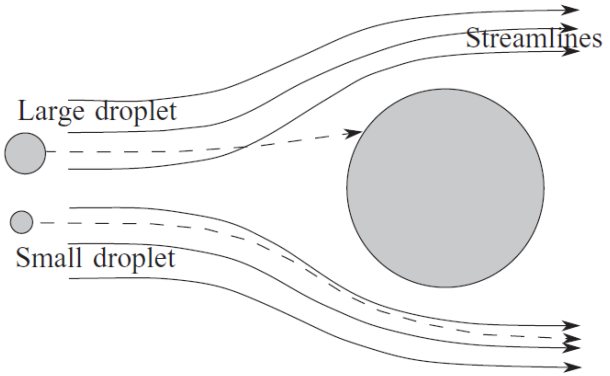
Wallenius, T. and Peltola, E, 2011: Current issues on wind energy production in cold climate. NordVind seminar Vindkraft I kaldt klima, Copenhagen.



Production Forecast Model

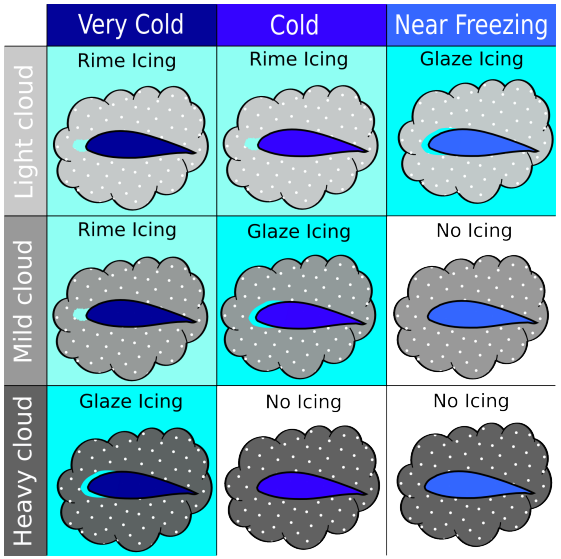


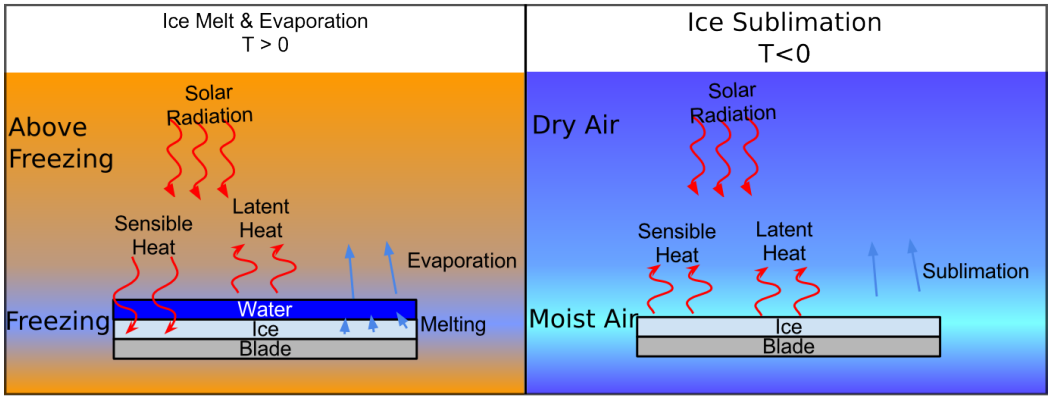
Icing Model



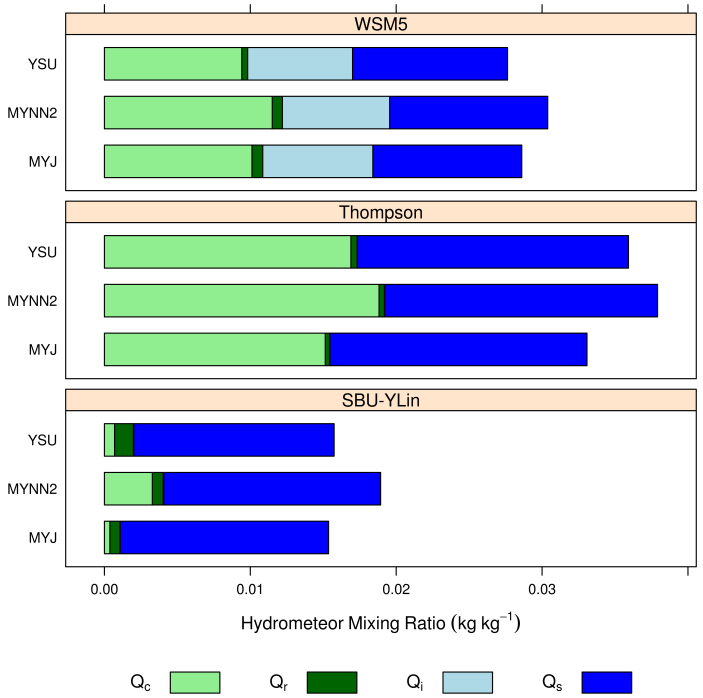
Homola, M.C. et al., 2010. The relationship between chord length and rime icing on wind turbines. Wind Energy, 13(7), pp.627–632.

- Accretion
  - Makkonen Model
  - Collision efficiency
  - Freezing Fraction
- Ablation
  - Sublimation
  - Total Shedding
  - Wind Erosion

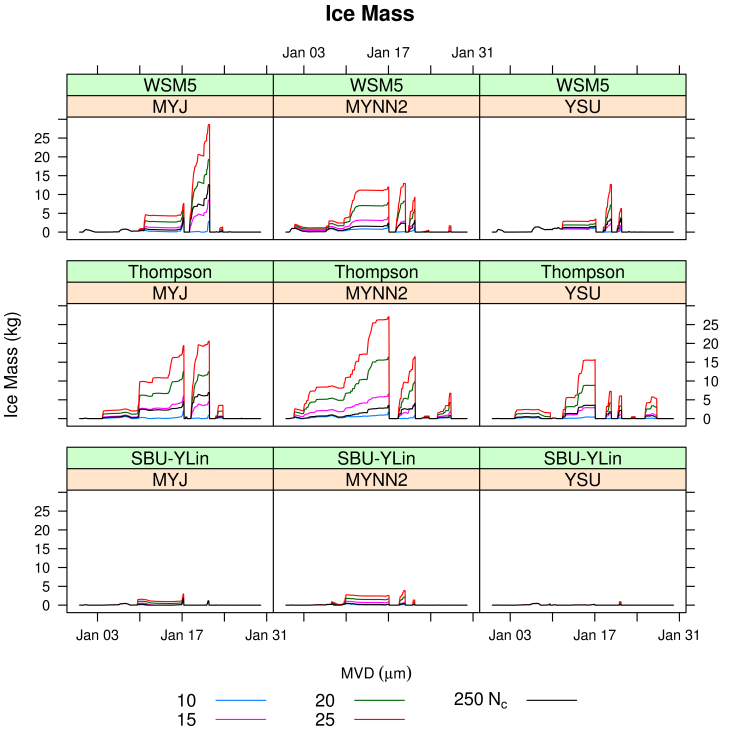




Sensitvity to Mesoscale Model



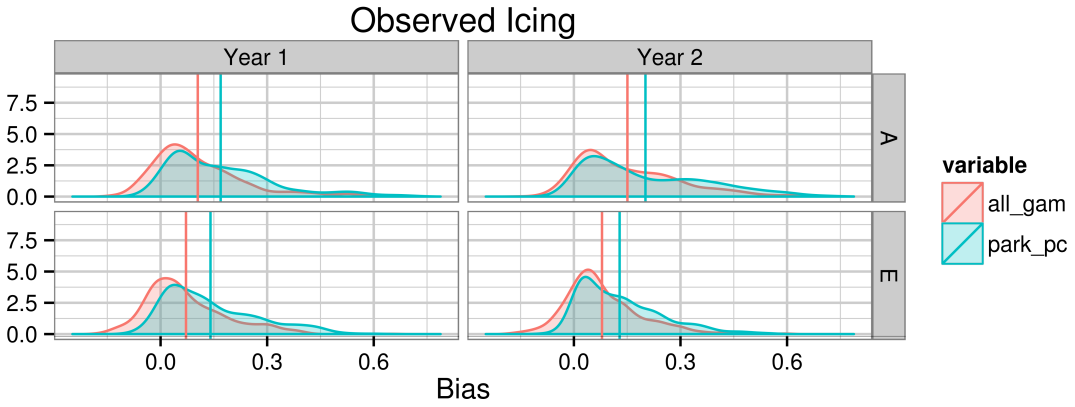
Davis, N. et al., 2014. Forecast of Icing Events at a Wind Farm in Sweden. Journal of Applied Meteorology and Climatology, 53(2), pp.262–281.

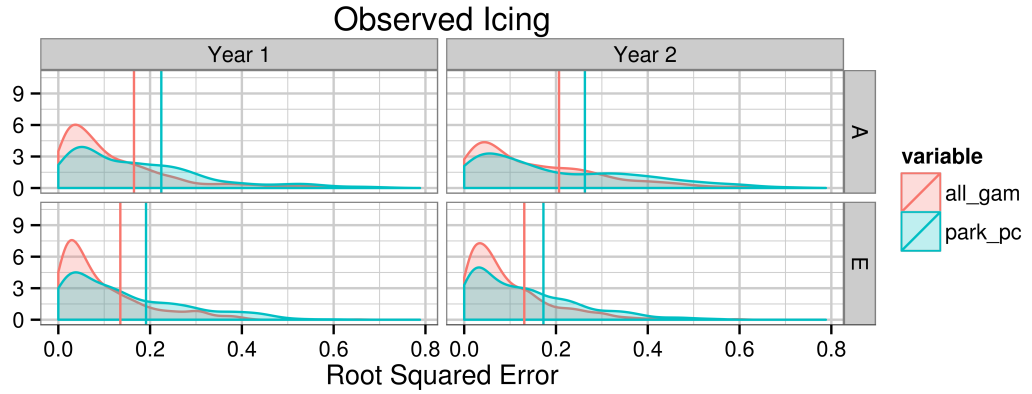


Davis, N. et al., 2014. Forecast of Icing Events at a Wind Farm in Sweden. Journal of Applied Meteorology and Climatology, 53(2), pp.262–281.

- Large impact on clouds from physics options
- Feeds to a large difference in projected ice mass

Power Loss Model





- Fit on ice model results reduces estimated power bias and error
- Park_pc is unadjusted power curve
- all_gam is the statistical model fit
- Better results are near 0.0