

Technical University of Denmark



## Experimental investigation of ice accretion on wind turbine blades

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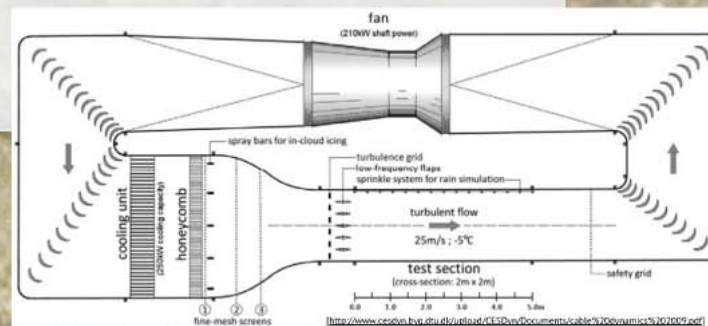
## Experimental investigation of ice accretion on wind turbine blades

Winterwind 2013 – International Wind Energy Conference

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Martin O. L. Hansen

- Climatic wind tunnel with icing conditions at Force Technology in Kgs. Lyngby, Denmark
- Naca 64-618 profile - from LM Wind Power
- Different angles of attack and temperature
- Glaze and mix ice tests
- MVD~25 micron
- Ice accretion for 60 minutes
- $Re=900.000 - 1.000.000$

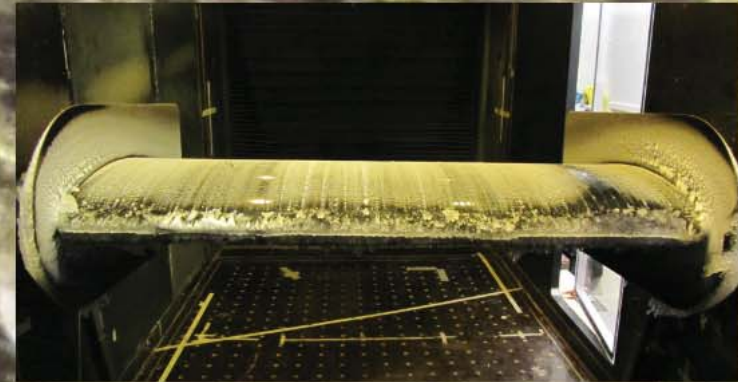


# Wind tunnel tests

Before

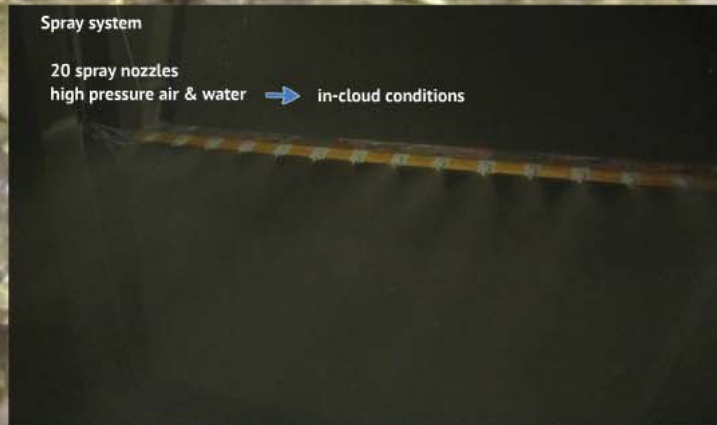


After

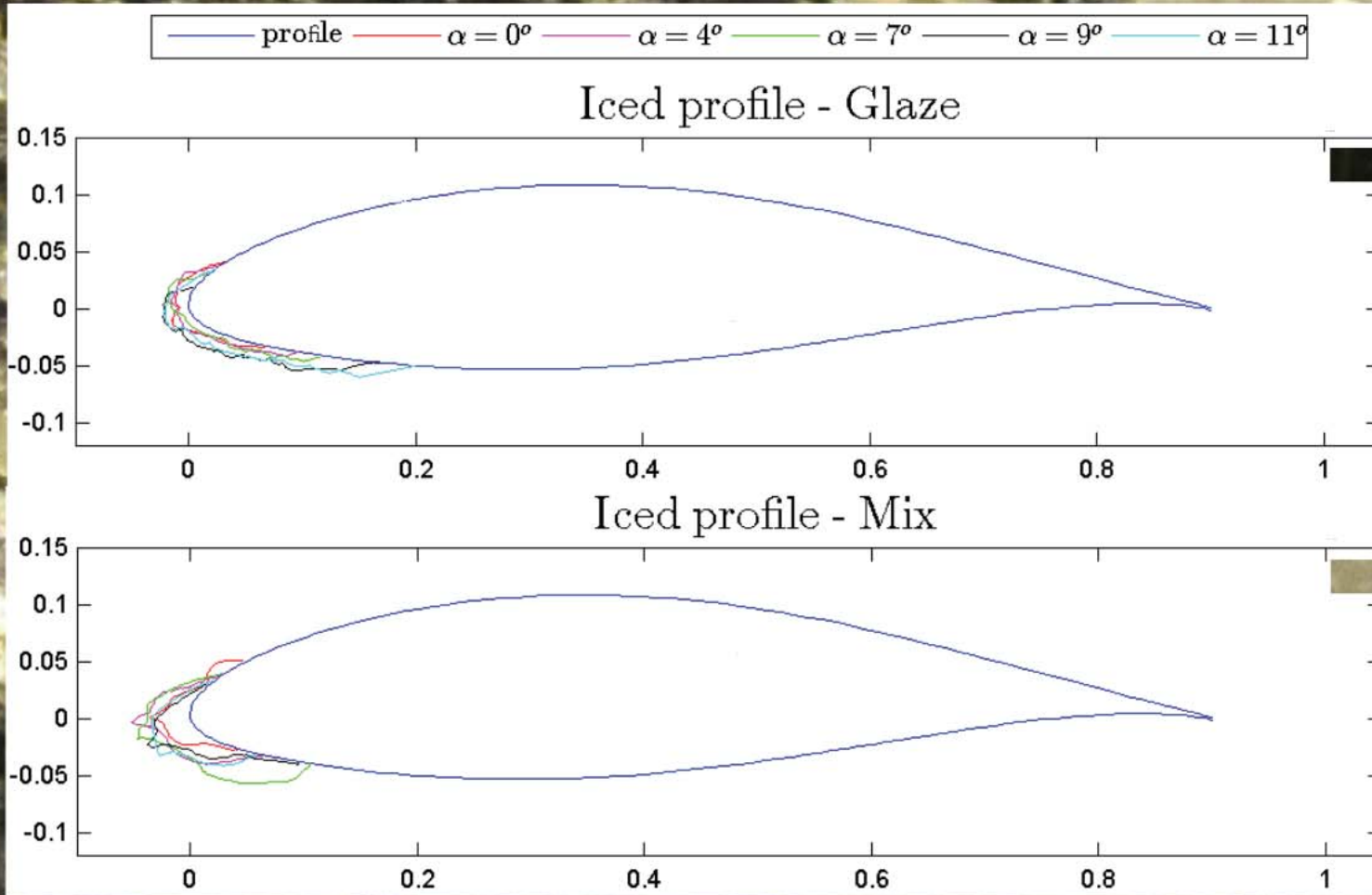


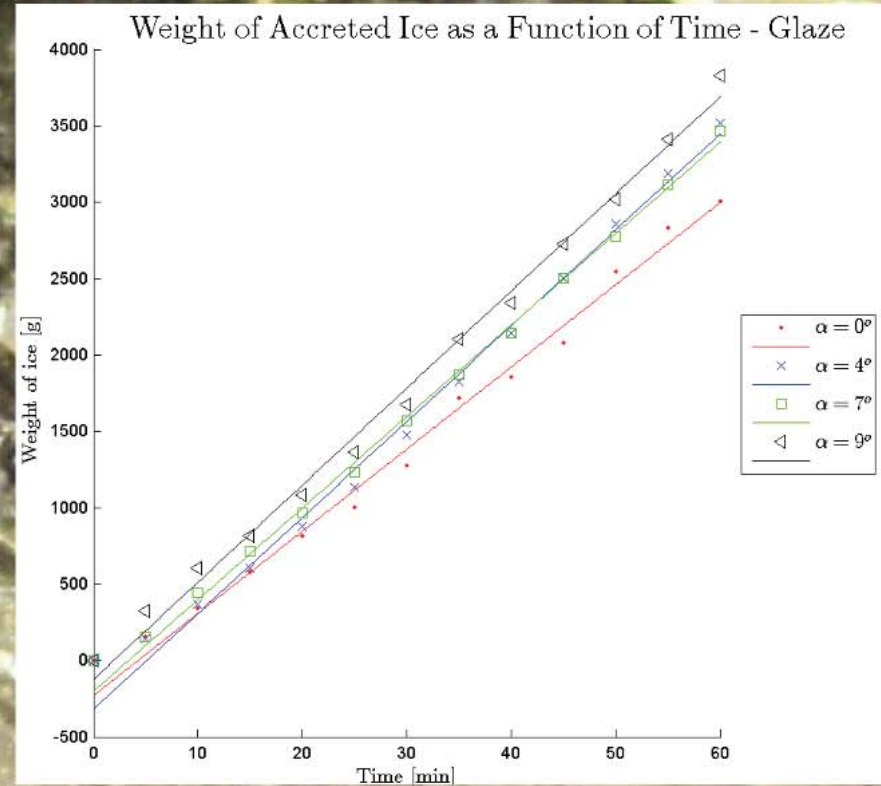
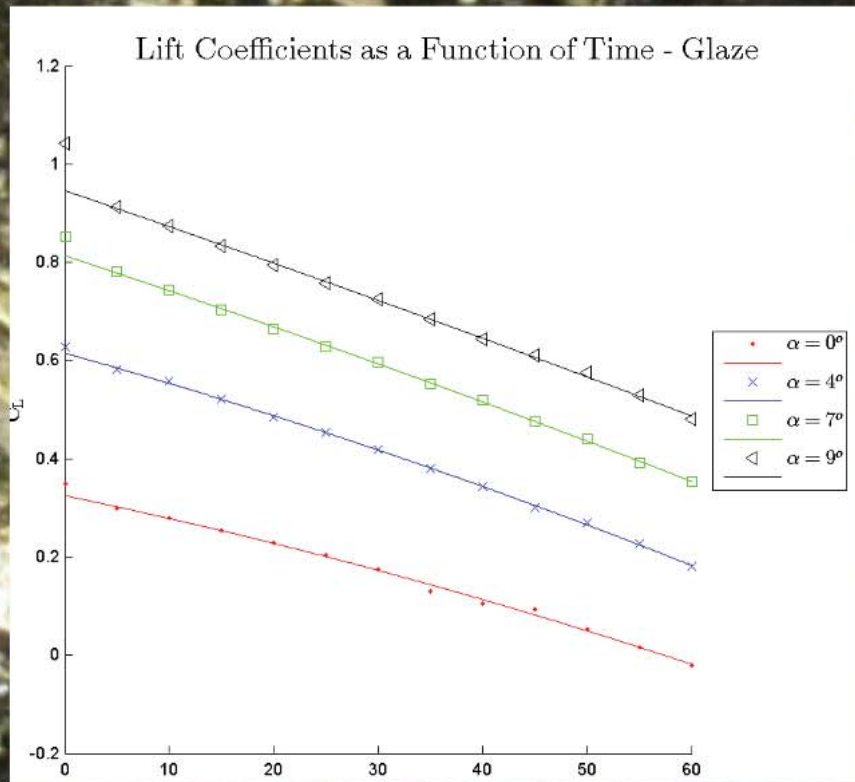
Spray system

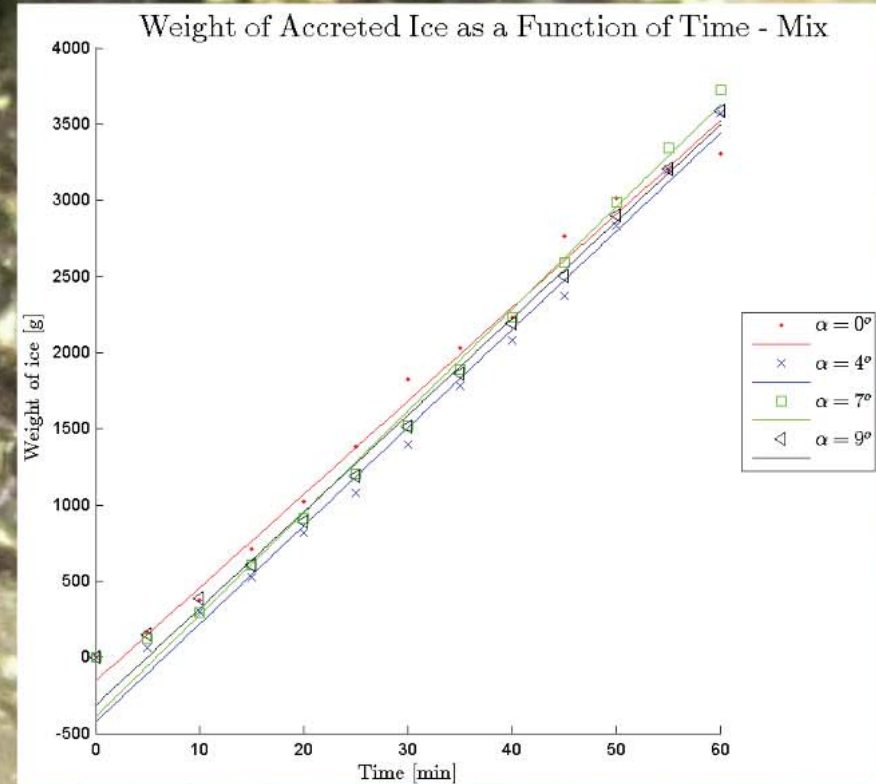
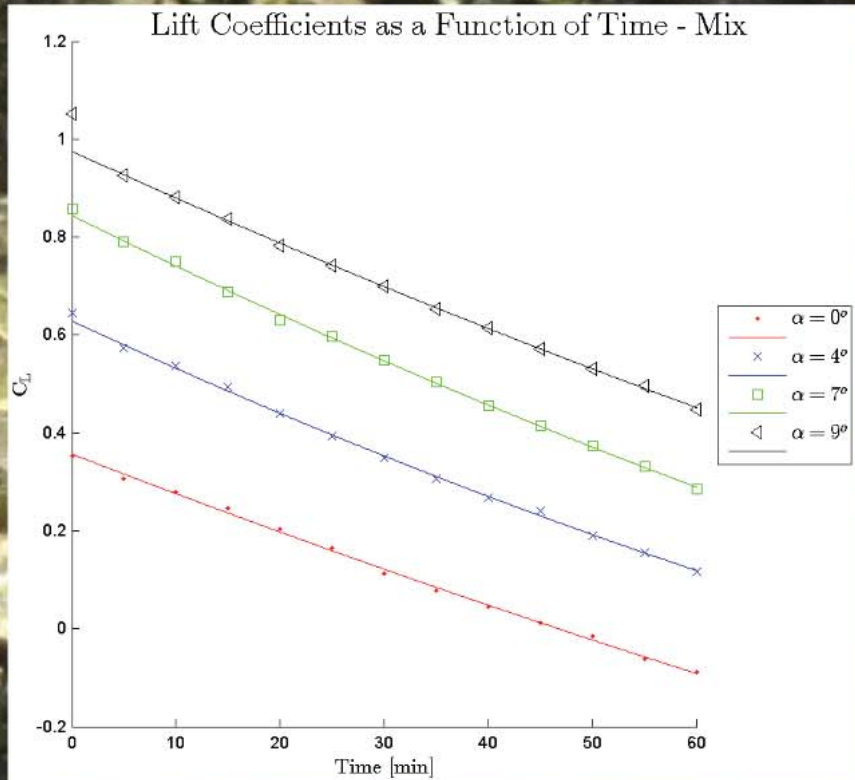
20 spray nozzles  
high pressure air & water → in-cloud conditions



# Results - profiles







## Main findings:

- Linear ice accretion
- Dramatic lift coefficient degradation
- Most amount of ice accretion and least decrease in Cl for 9 deg AOA - glaze tests
- Least amount of ice accretion and most decrease in Cl for 0 AOA

## Further plans:

- Include rime ice tests
- Comparison of the three different ice types
- Numerical analysis of the profiles



**Thank you for your attention!**  
**If you have any questions, contact:**  
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