Experimental investigation of ice accretion on wind turbine blades

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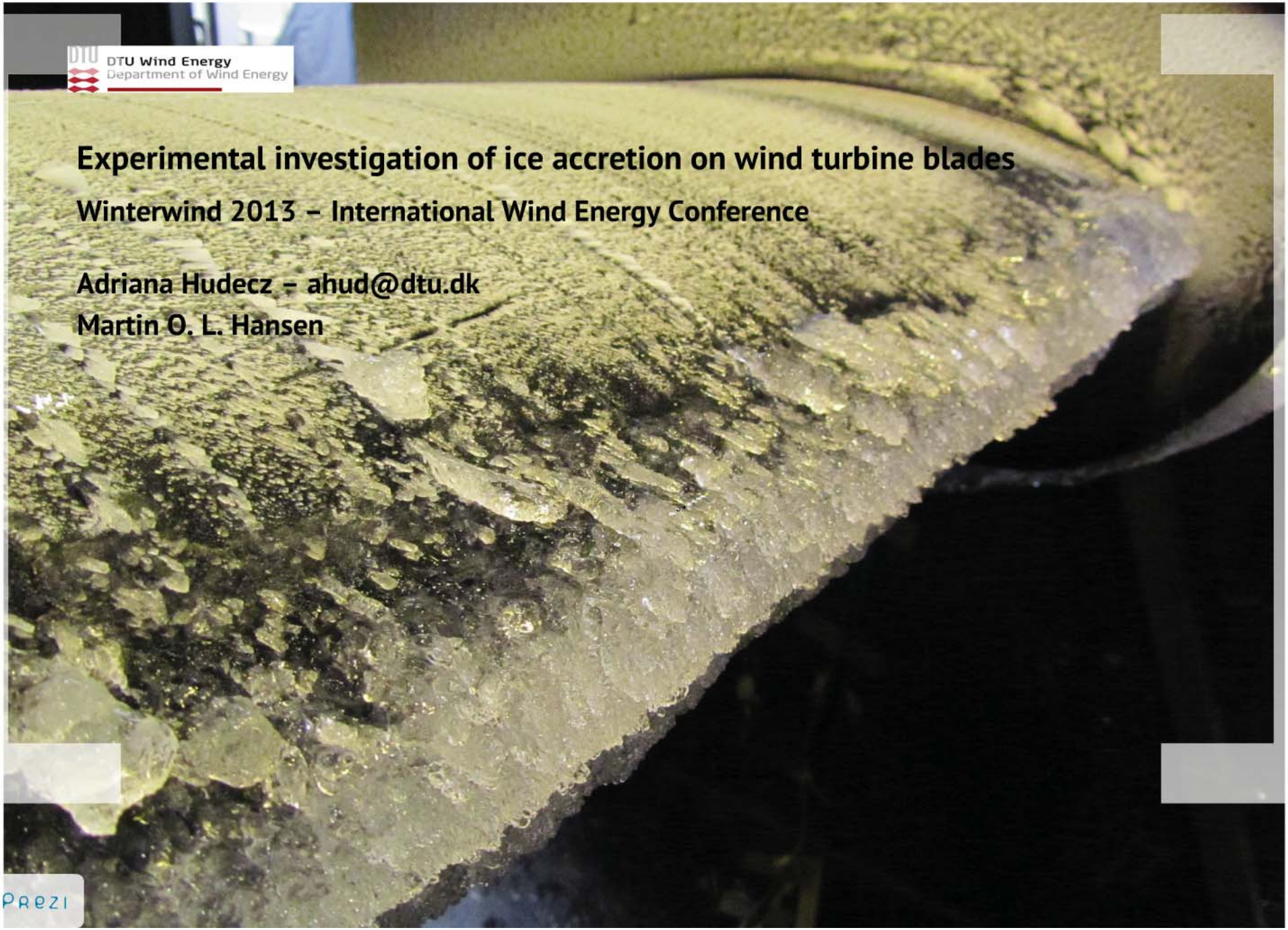
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Experimental investigation of ice accretion on wind turbine blades
Winterwind 2013 – International Wind Energy Conference
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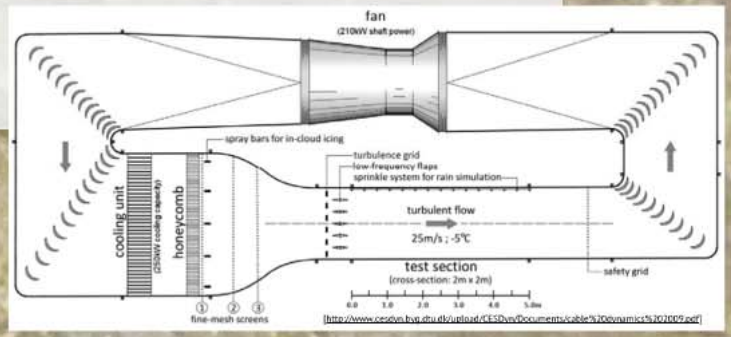
Wind tunnel tests

- 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



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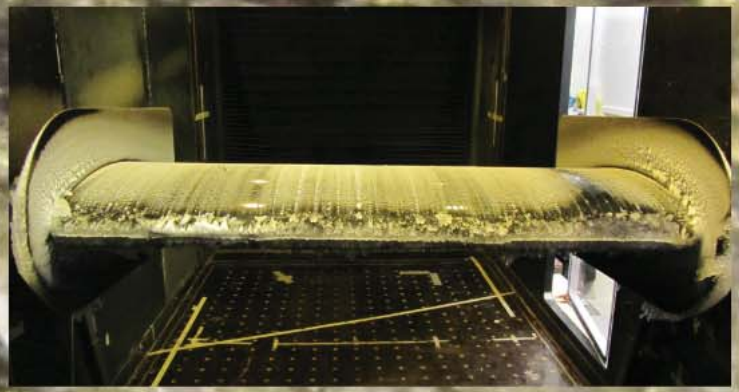
Wind tunnel tests

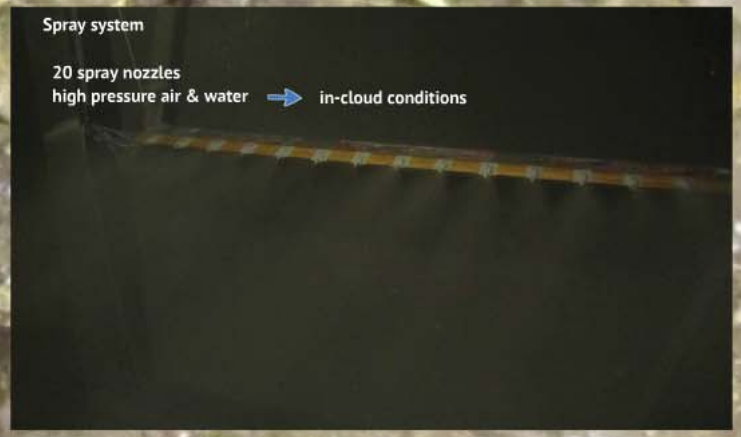
Before

After



Spray system

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



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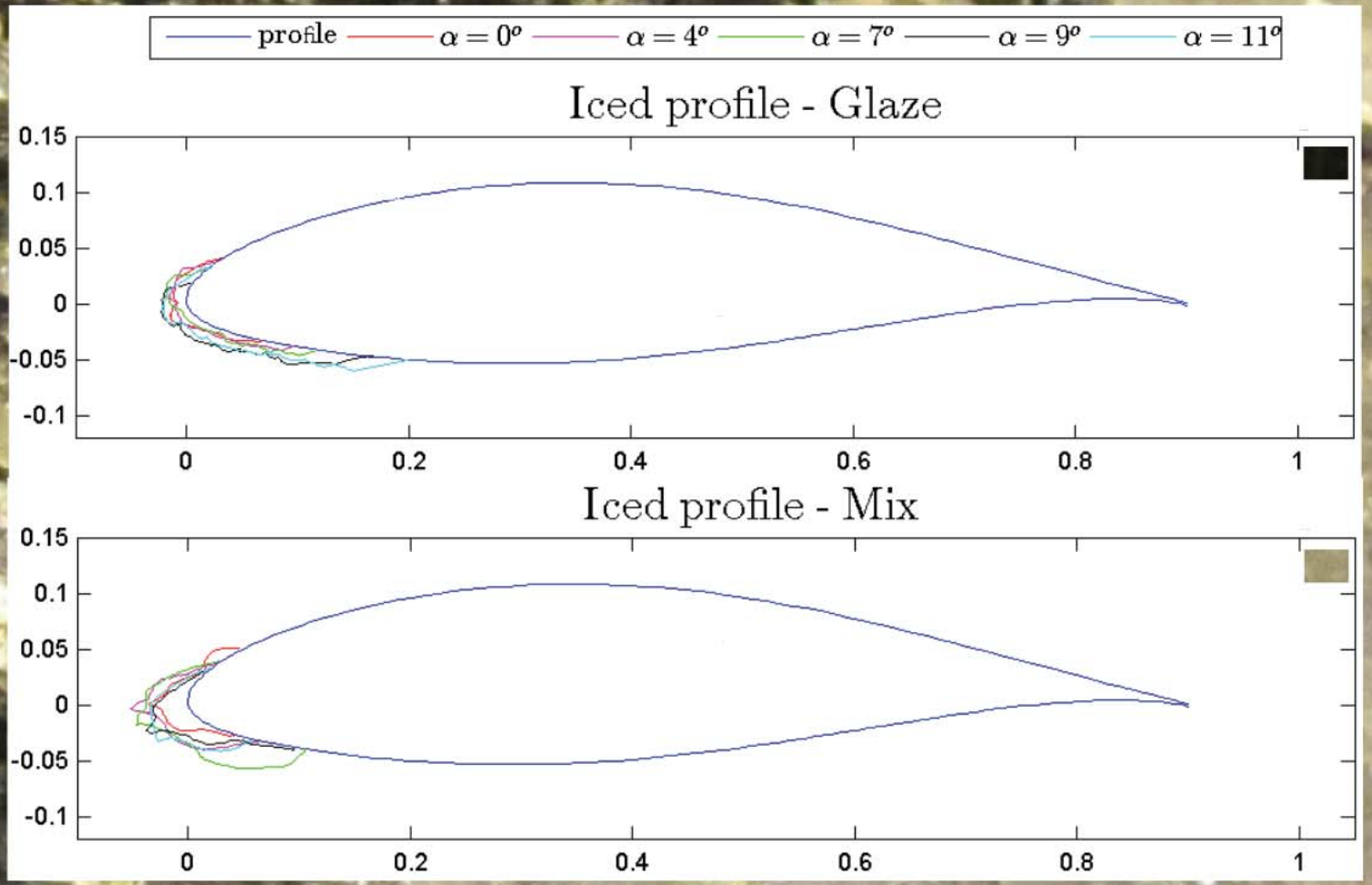
Results - profiles



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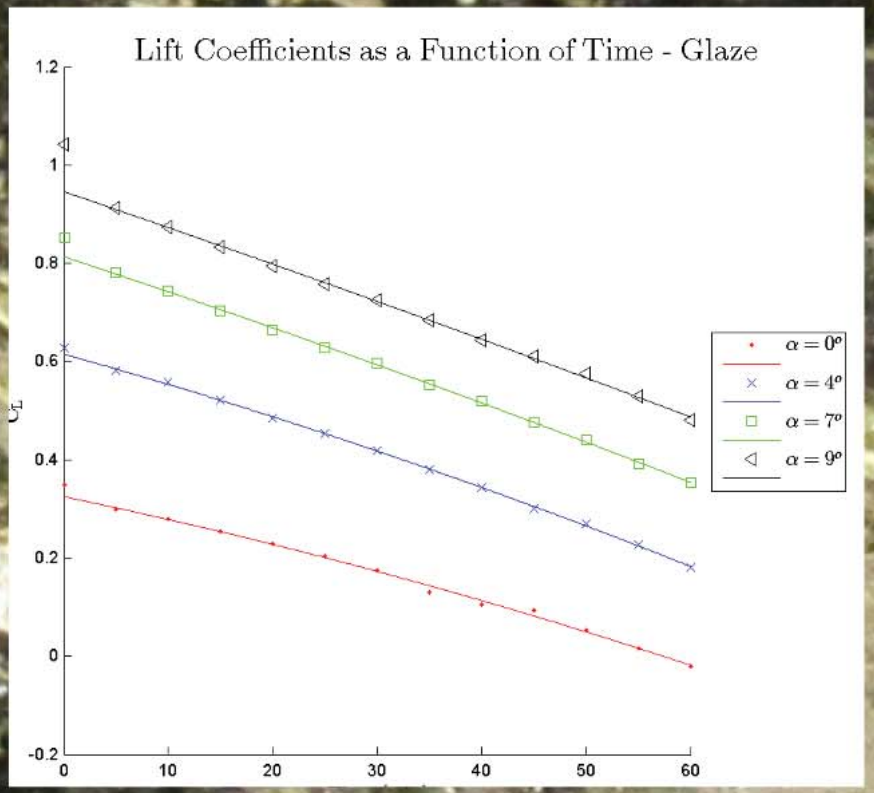
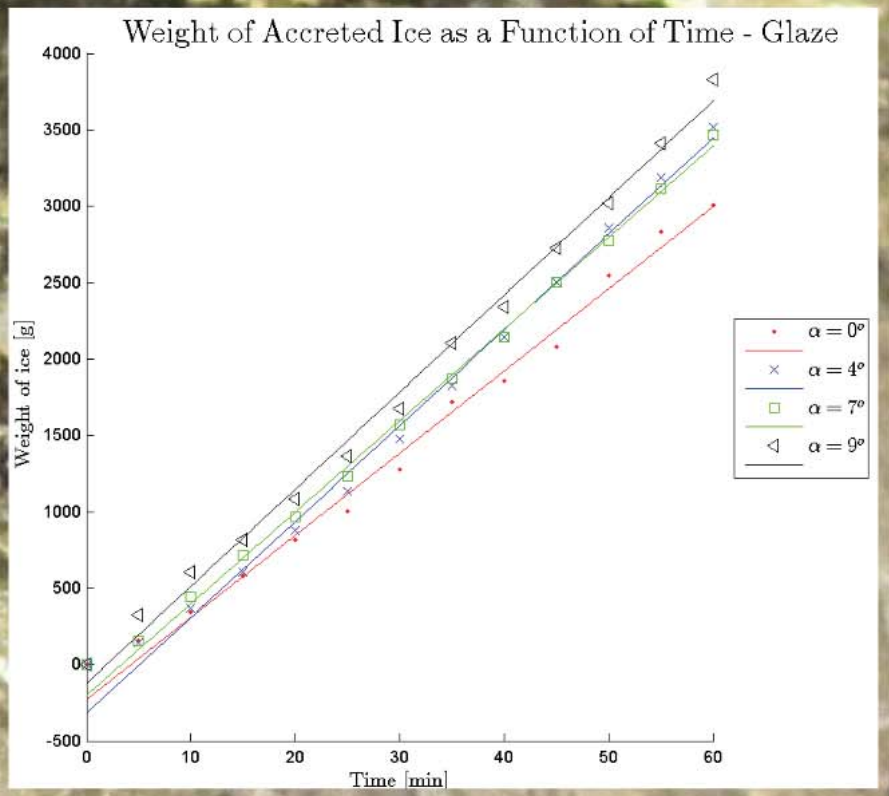
Results - ice and aerodynamics





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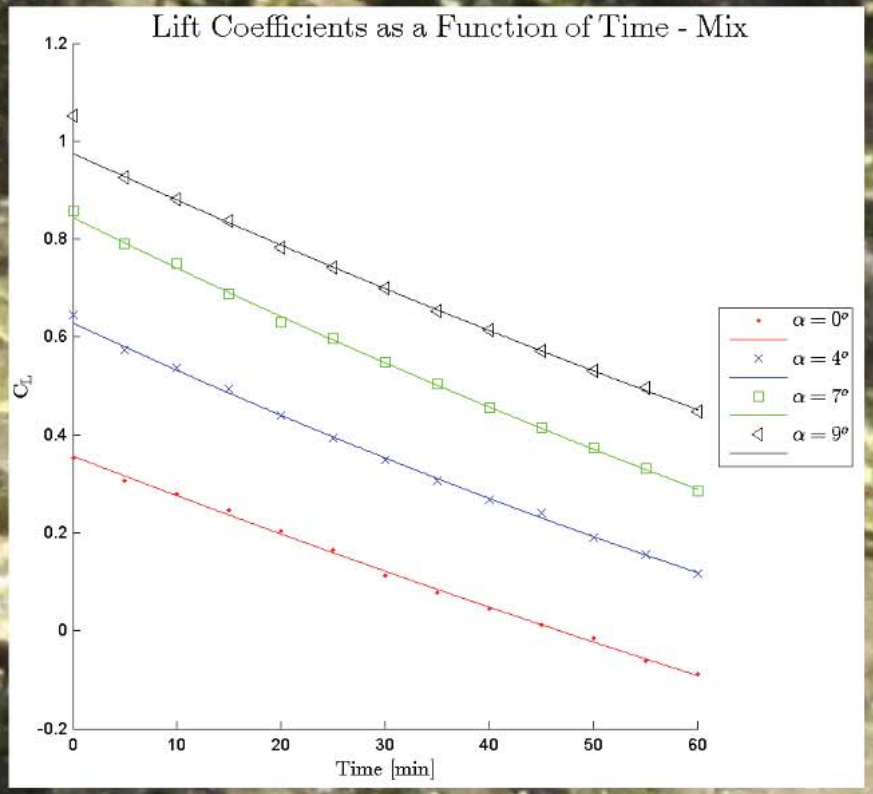
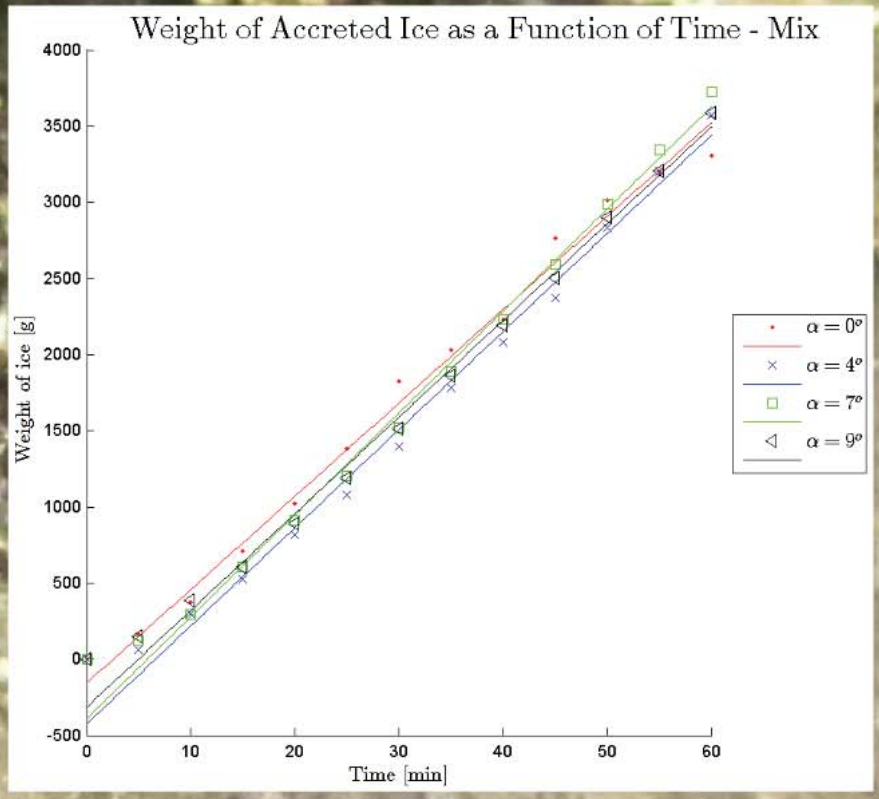
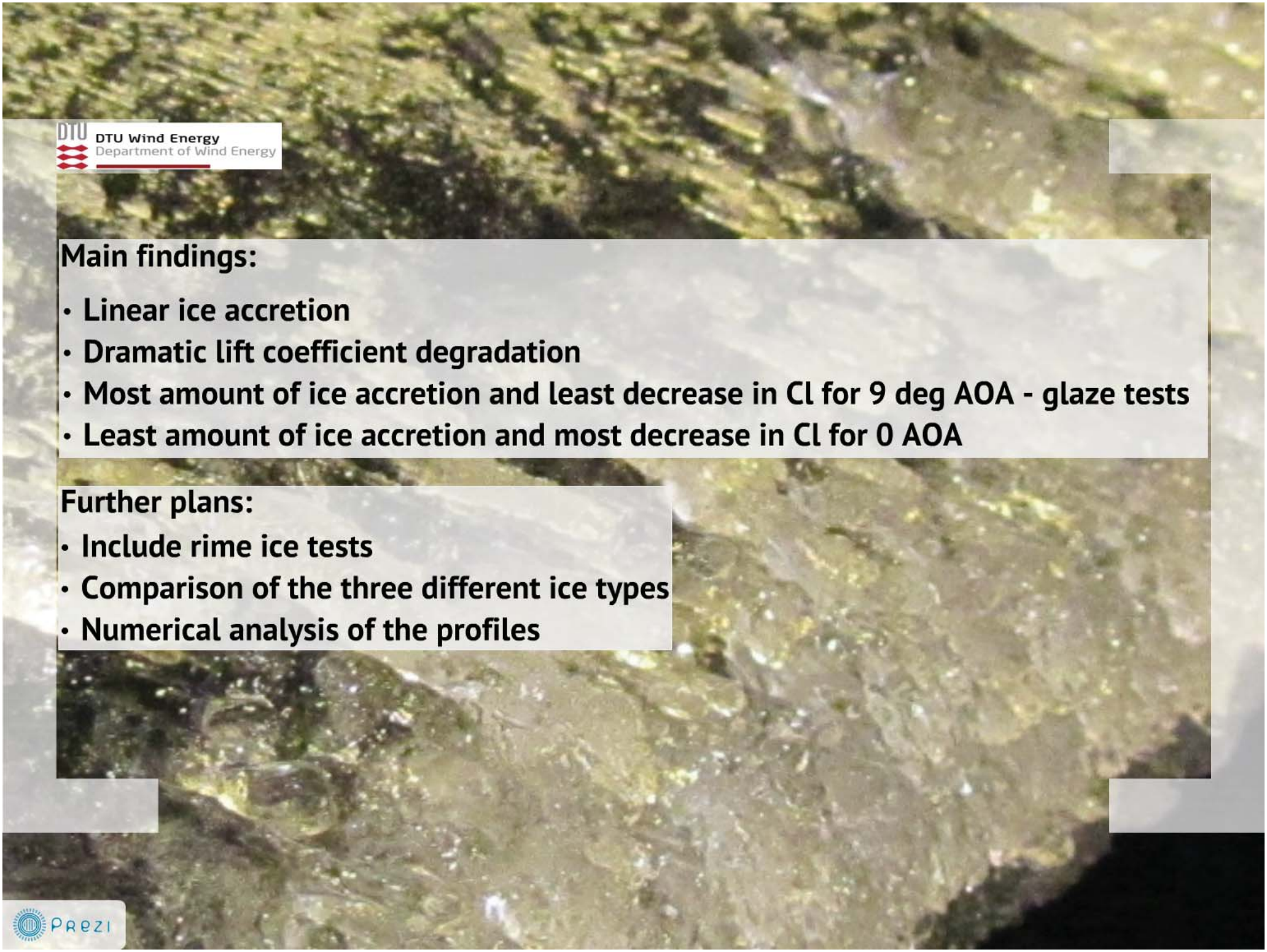
Results -ice and aerodynamics



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