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WISLINE

Wind, Ice and Snow Load Impacts on Infrastructure and the Natural Environment

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Partners

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- The Norwegian Meteorological Institute (MET Norway)
- Department of Geosciences, University of Oslo (UiO)
- National Center for Atmospheric Research, Colorado (NCAR)
- Kjeller Vindteknikk (KVT)
- Norwegian Institute of Bioeconomy Research (NIBIO)

Contributors and user group

- Swedish Meteorological and Hydrological Institute
- Swedish University of Agricultural Sciences
- Statnett (System operator on the Norwegian energy system)
- Skogbrand (Insurance company founded by Norwegian forest owners)

Background

In cloude icing on 420 kV line in Hardanger (1100 mas), December 2013.
Ice load: 50 – 70 kg/m
Photo Ole Gustav Berg, Statnett

In cloude icing on 420 kV line near Vemork at 1200 mas, March 2014. Photo Statnett.

In cloude icing:

- High elevation power lines most exposed (line above cloud base)
- Supercooled cloud droplets hit line and freeze immediately
- Highest observed load is appproximately 300 kg/m in Voss (1961)

PhD study: Improve the AROME model's microphysics

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Background

Windfall during Dagmar, December 2011. Foto Jon Eivind Vollen

60 millions NOK insurance paid to forest owners (Skogbrand)

Heavy snow and 8 m/s wind November 2016 in Agder

10 000 homes left without electricity (photo Agder Energi)

Weather related forest damage - risks

Wind, snow, rain, soil moisture and temperature

Topography, forest data (tree height, species, age), soil depth

Create a risk modell and risk maps by combining these data with data for forest damage

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Financing

Mainly the The Norwegian Research Council

In-kind contribution from partners

Purchase and operation of a disdrometer by Statnett

Main Objective:

To quantify climate change impact on technical infrastructure and the natural environment caused by strong winds, icing and wet snow

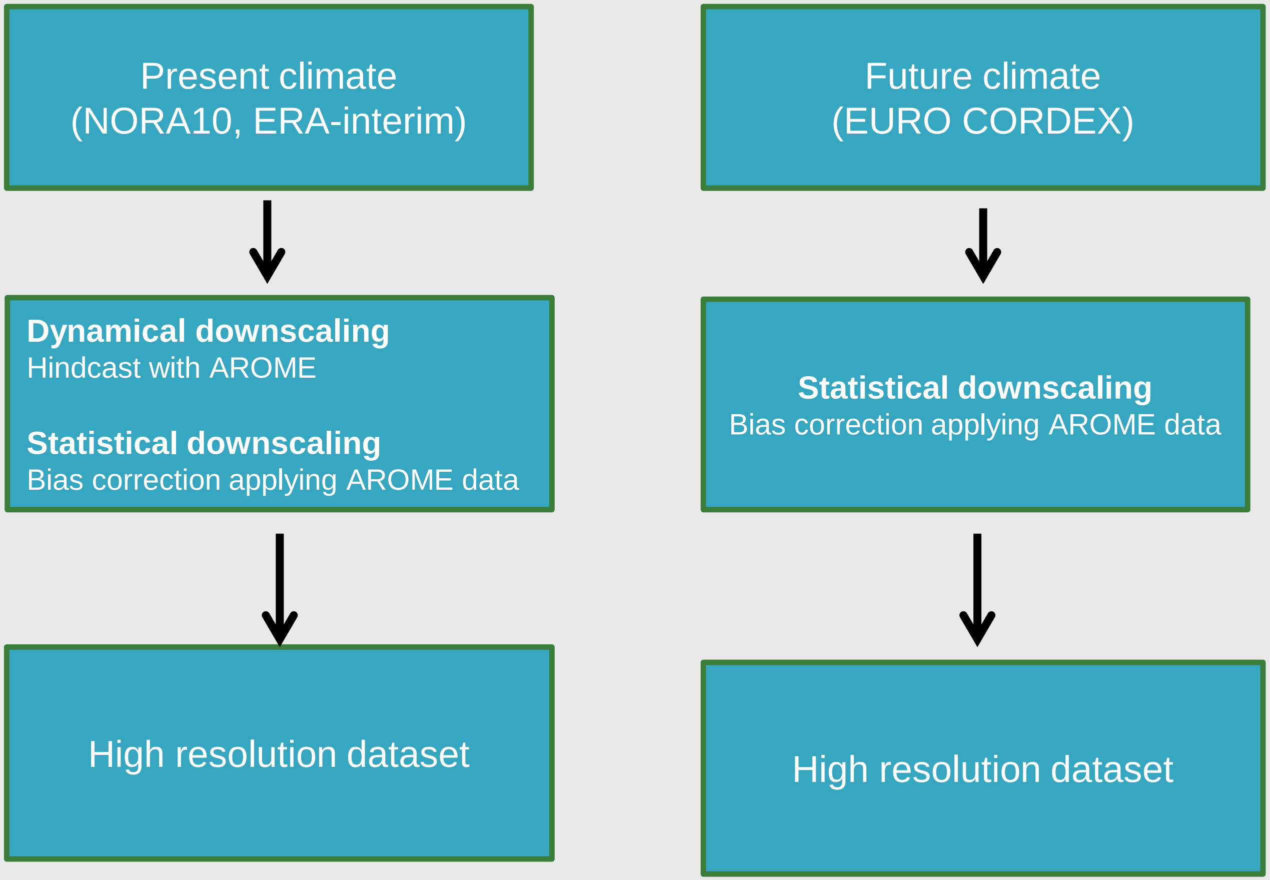
Sub Objectives:

To improve the description of cloud microphysical processes of importance for simulating atmospheric icing.

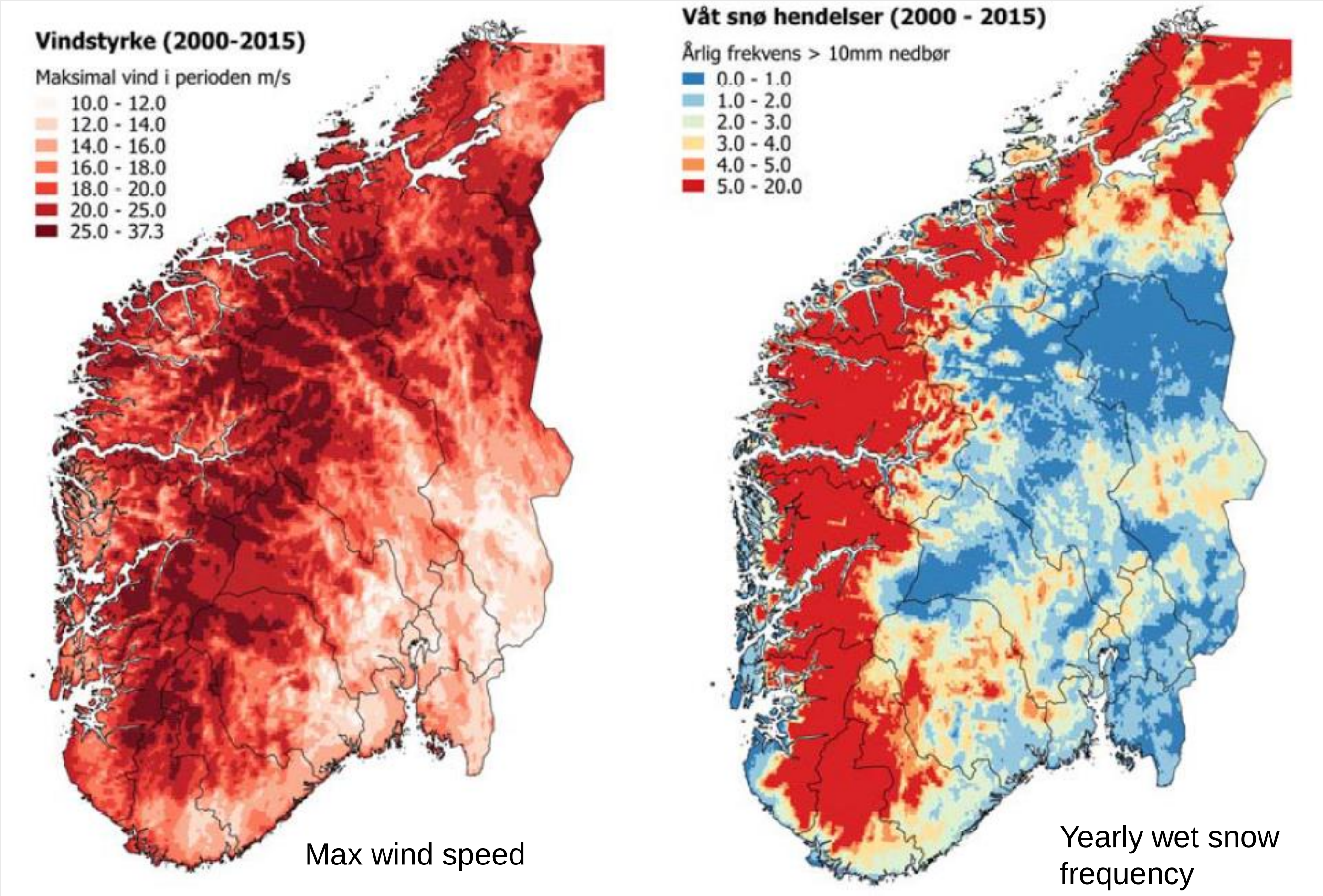
To quantitatively assess future wind and ice design loads on electric transmission lines in different geographical regions in Norway.

To establish risk assessment models for weather hazard induced damages on forests.

High resolution datasets for present and future climate are essential



Statistical downscaled NORA10 data

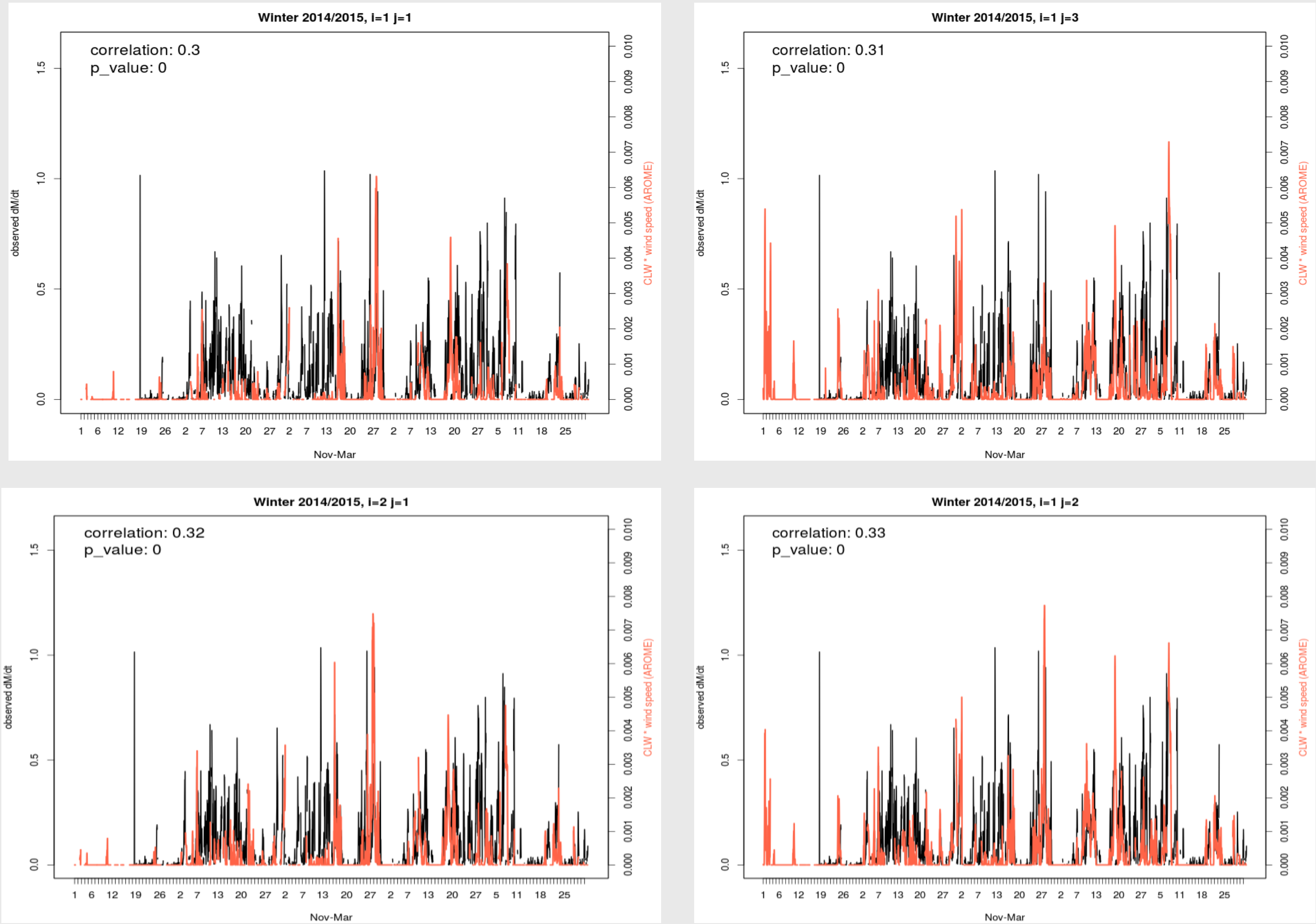


Wet snow:
0.5 °C < T < 2 °C
daily precipitation > 10 mm

Maximum wind speed and number of days per year with wet snow retrieved from statistically downscaled dataset (From NIBIO report Skogbehandling langs kraftlinjer by Solberg et al, 2017)

AROME hindcast 2004 – 2016

dynamical downscaling



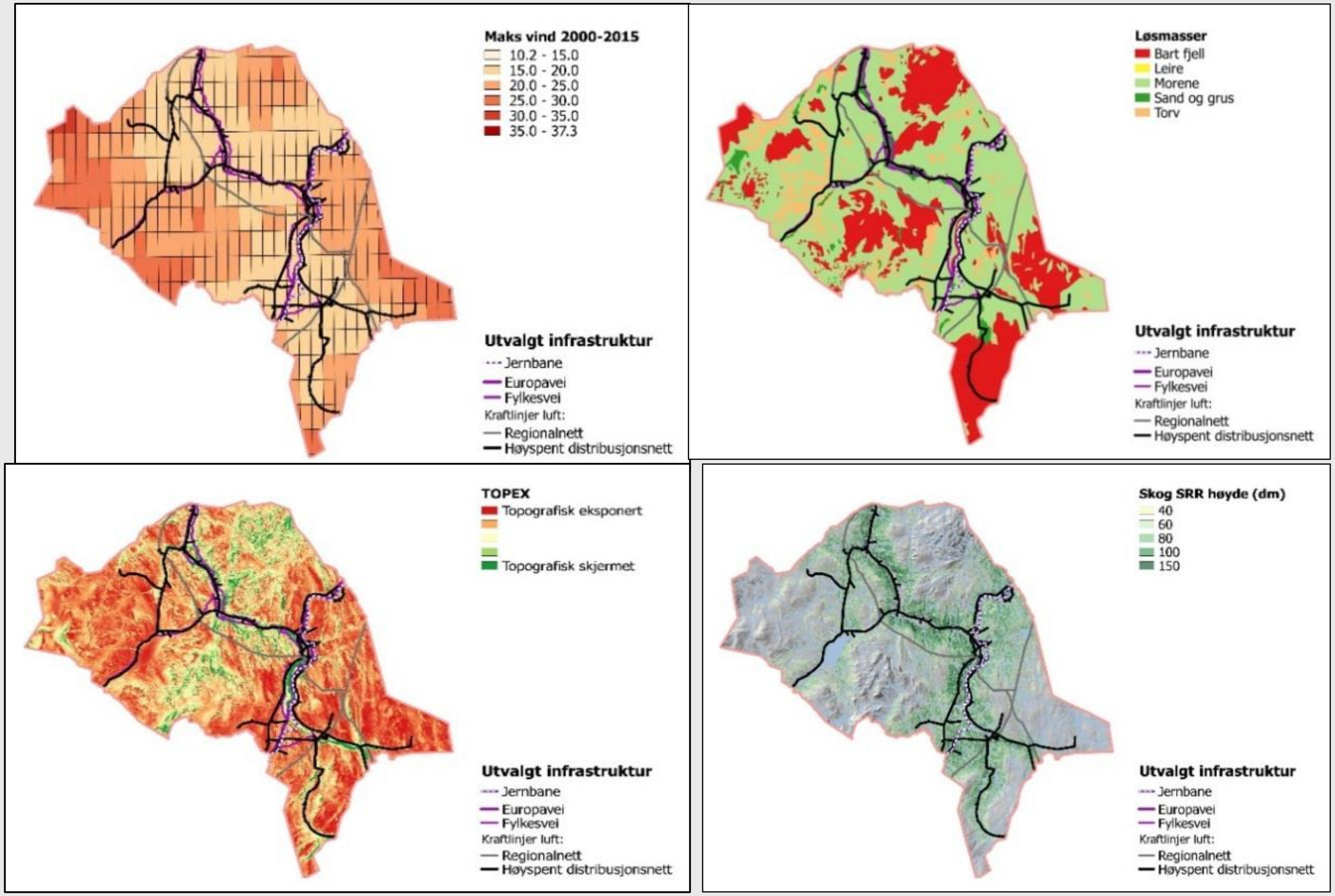
Observed

Modelled

Atmospheric icing estimated from modelled liquid cloud water (grid points near obsevations) and observed accretion (Ålvikfjellet in Hardanger winter 2014-2015)

Forest damage (risk modelling)

Rennebu in Trøndelag



Max wind from model

Soil/Surface type

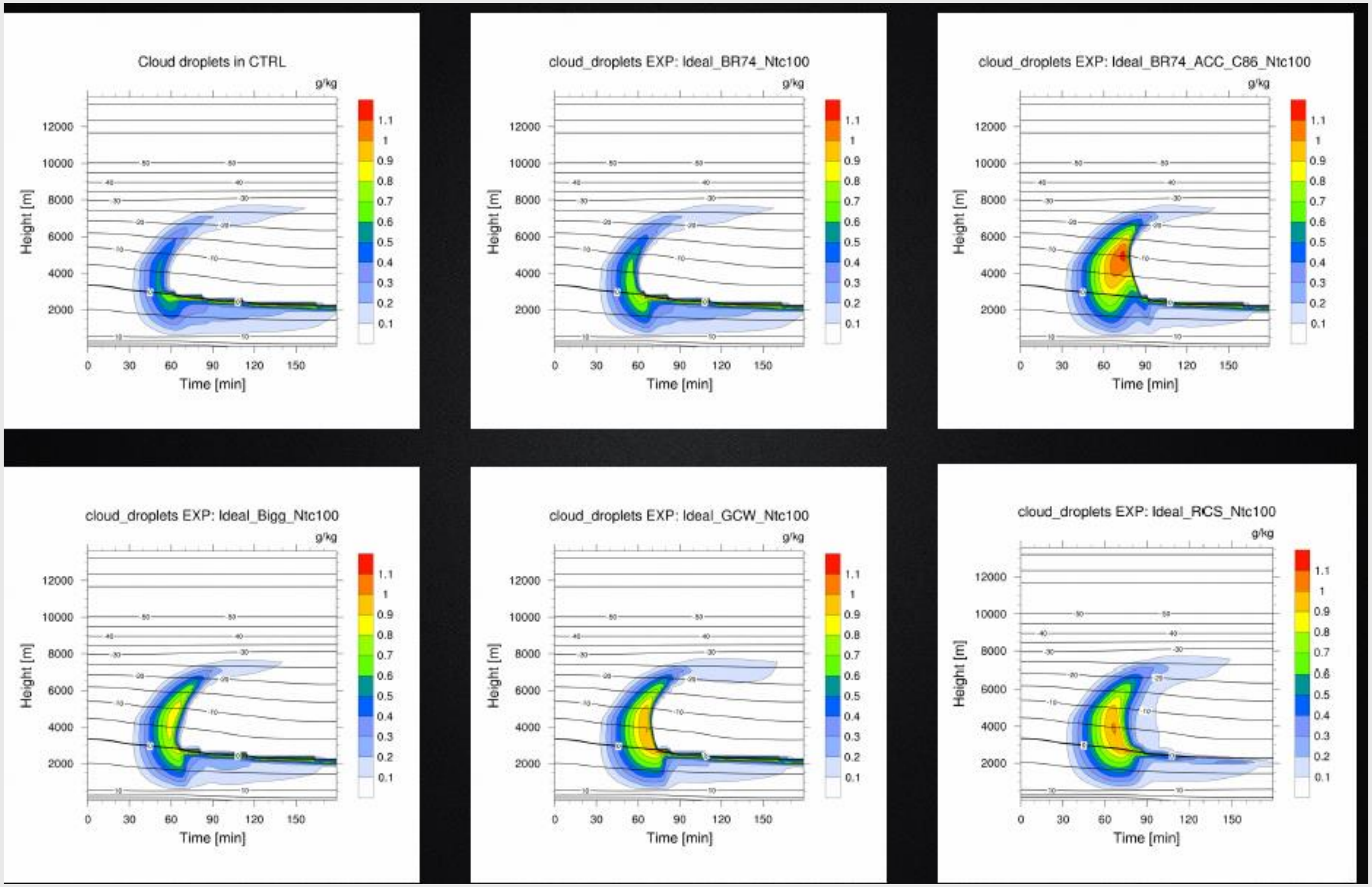
Topographic exposure

Measured tree heigth

From Solgberg et al (2017)

Some risk factors that are considered when fitting a model for forest damage

PhD work on AROME



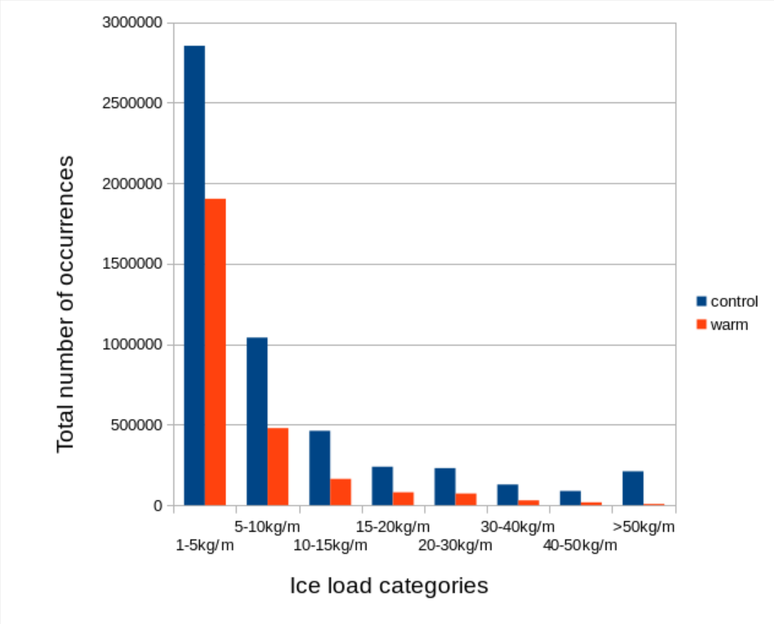
Experiments with different versions of AROME microphysics – liquid cloud water (key parameter for atmospheric icing)

Master thesis – Atmospheric icing in a warmer climate

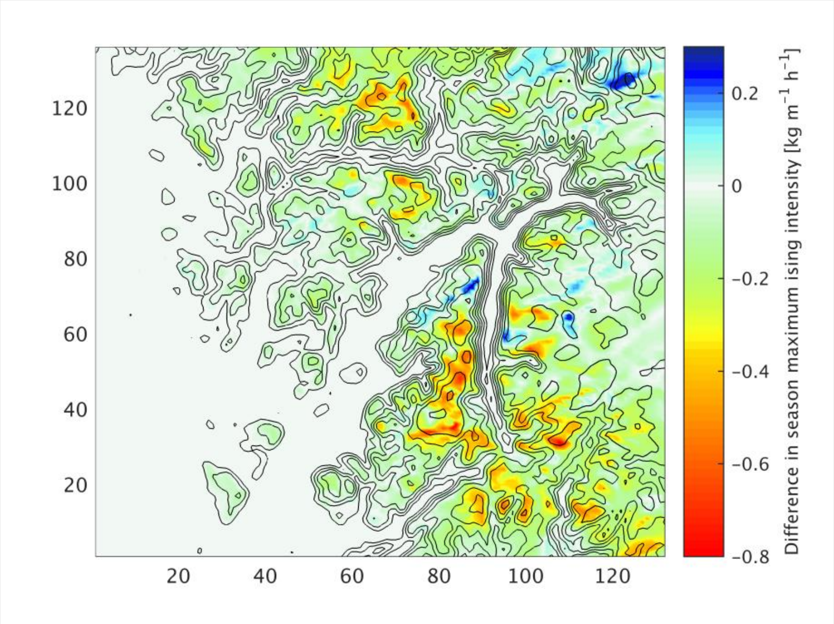
Simulating ice accretion winter 2015/2016 with WRF (CONTROL)

Simulating same period but temperature in initial field and boundaries increased by 2° C (WARM)

How is ice accreation impacted by the increased tempereature ?



Total number of occurences of iceloads for each time step and each grid point



Difference bewteen WARM and CONTROL in max icing intensity

In general a decrease of icing intensity and occurence of ice loads in different classes, also where LCW increases

Temperature increase is the main driver

Further work

- Future climate data for wind and atmospheric icing are currently being prepared by statistical downscaling of data from regional climate models (EURO-CORDEX)
- All data will be made available at http://thredds.met.no (downscaled data for present climate are currently available)
- Project will be completed by the end of 2018
- PhD is planned to be finished by July 2019

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