Study Committee B2

Overhead Lines

10974_2022

Design of overhead lines in a changing climate

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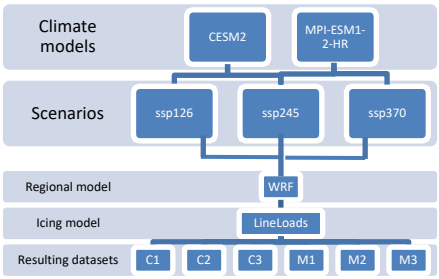
Motivation

- OHLs are typically designed according to the current or historic climate.
- With global warming, the frequency and severity of extreme weather events as well as the mean state of the climate will change.
- Climate change impacts on the design parameters should be considered.
- Future changes in extreme ice loads in Norway is the focus of this work.

Experimental setup



Method/Approach

- Dynamical downscaling of future CMIP6 climate projections to 12 km horizontal resolution.
- Icing models are applied to obtain time series (1990 – 2100) of ice loads for all of Norway.
- Extreme values are calculated (10-yr return period).
- Future changes are assessed.

Discussion

- The choice of climate model exerts a significant impact on estimated changes in future ice loads.
- This is due to both differences in regional climate change features and model biases.
- Natural variability is present in the data. Should ideally use a larger ensemble.

Objects of investigation

- The regional model used for downscaling is the Weather Research and Forecast (WRF) model.
- The icing models are based on the ISO standard:

$$\frac{dM}{dt} = \alpha_1 \alpha_2 \alpha_3 w v A$$

- The icing models contain modifications and add-ons based on research by the authors and project partners, and are called 'LineLoads'.

Conclusions

- Wet snow loads are generally decreasing in the lowlands and increasing at higher elevations.
- Future rime ice loads vary substantially between the two applied climate models, with different signs of change.
- This is linked to the models' different regional climate projections, and specifically the 'North Atlantic Warming Hole'.
- More research, possibly involving downscaling of more climate models, is needed to constrain the signal.
- However, large uncertainties in projections as well as model biases challenge the constrain.

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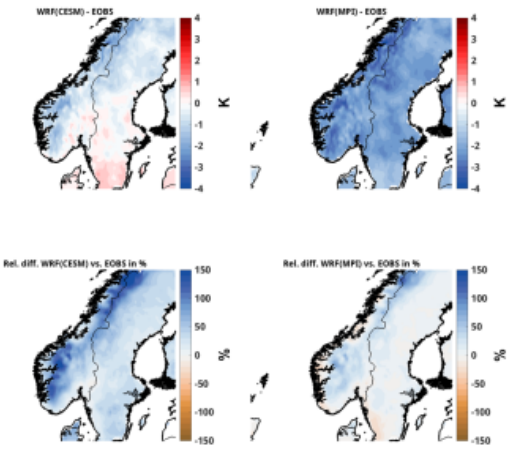
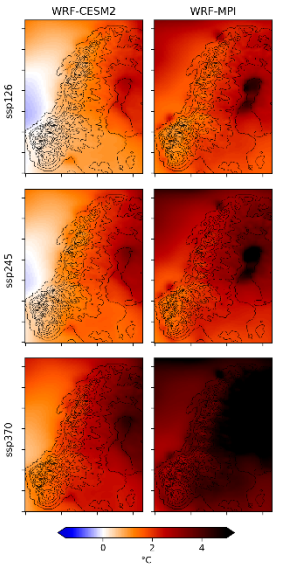
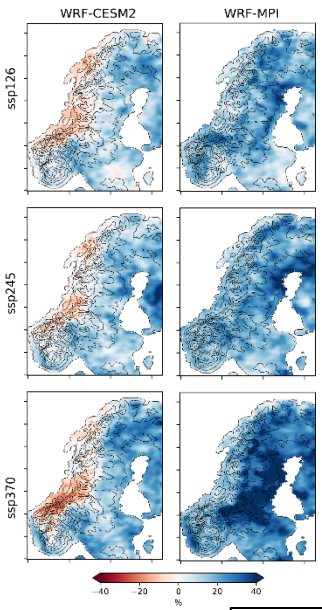
Model validations



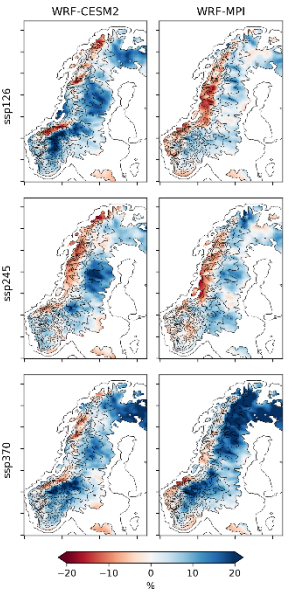
Temperature changes



Precipitation changes (99p 1day)



Cloud water changes (99p)



Change is between 1990-2014 and 2075-2099.

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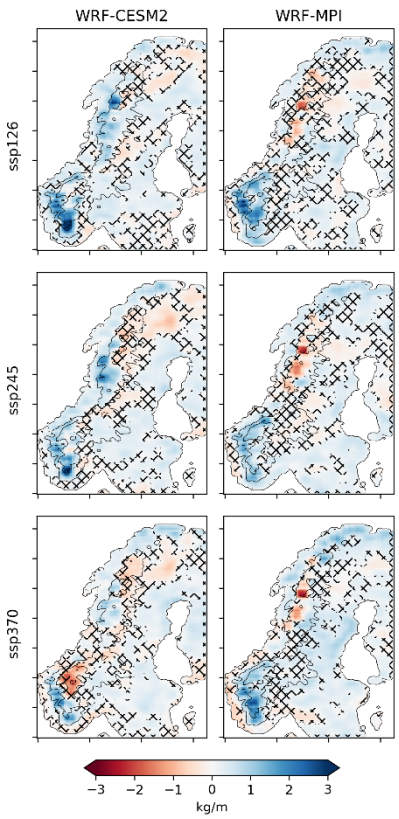
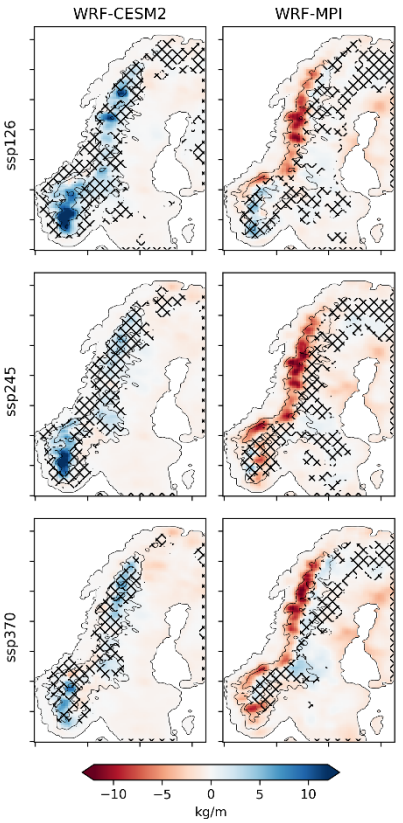
10-yr wet snow load changes



10-yr rime ice load changes



Change is between 1990-2014 and 2075-2099. Hatched areas indicate non-significant changes, as tested using a two-sample Kolmogorov–Smirnov test.

Conclusions

- Wet snow loads are generally decreasing in the lowlands and increasing at higher elevations.
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