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Icing probability estimation based on WRF model hindcast

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Windfarm projects in cold climates are becoming more frequent with new markets developments (Russia, China) and new/limited availability of sites in traditional markets (Scandinavia, North America).

Characterization of the impact of extreme environmental operation conditions are relevant in the technical and financial feasibility of these projects . Crossed probabilities of wind energy density with extreme low temperatures and icing events are needed to estimate the number of hours/year that windfarms are expected to be under 'critical' conditions of operation and 'potential' production losses due to low temperature and icing on the wind-turbine structure.

The lack of reliable site long-term data that could be employed to characterize cold climate conditions justifies the use of atmospheric modelling techniques. The positive experience of using regional atmospheric models from operational forecast and the increase of computing power has made reliable downscaling large scale conditions to near local scale.

As part of an ongoing project to develop a fine-tuned high resolution cold-climate setup of WRF model, results from first hindcast experiments of extreme cold and icing conditions are presented in this work. Sensitivity analysis of different model configurations and resolution are also included in the work. Verification of model output has been done by using meteorological mast measurements and data acquired from operational windfarm. Preliminary results show promising accuracy of wind and low temperatures/icing joint statistics on annual basis. The derived coupled statistics can be employed to estimate site specific cold climate control on the wind power resource.