Geophysical Research Abstracts
Vol. 19, EGU2017-13441, 2017
EGU General Assembly 2017

ICE CONTROL – Towards optimizing wind energy production during icing events

Manfred Dorninger (1), Lukas Strauss (1), Stefano Serafin (1), Alexander Beck (2), Christoph Wittmann (2), Florian Weidle (2), Florian Meier (2), Saskia Bourgeois (3), René Cattin (3), Thomas Burchhart (4), and Martin Fink (4)

(1) University of Vienna, Department of Meteorology and Geophysics, Vienna, Austria (stefano.serafin@univie.ac.at), (2) Zentralanstalt für Meteorologie und Geodynamik (ZAMG), Austria, (3) Meteotest, Switzerland, (4) Verbund Hydro Power, Austria

Forecasts of wind power production loss caused by icing weather conditions are produced by a chain of physical models. The model chain consists of a numerical weather prediction model, an icing model and a production loss model. Each element of the model chain is affected by significant uncertainty, which can be quantified using targeted observations and a probabilistic forecasting approach.

In this contribution, we present preliminary results from the recently launched project ICE CONTROL, an Austrian research initiative on measurements, probabilistic forecasting, and verification of icing on wind turbine blades.

ICE CONTROL includes an experimental field phase, consisting of measurement campaigns in a wind park in Rhineland-Palatinate, Germany, in the winters 2016/17 and 2017/18. Instruments deployed during the campaigns consist of a conventional icing detector on the turbine hub and newly devised ice sensors (eologix Sensor System) on the turbine blades, as well as meteorological sensors for wind, temperature, humidity, visibility, and precipitation type and spectra. Liquid water content and spectral characteristics of super-cooled water droplets are measured using a Fog Monitor FM-120. Three cameras document the icing conditions on the instruments and on the blades.

Different modelling approaches are used to quantify the components of the model-chain uncertainties. The uncertainty related to the initial conditions of the weather prediction is evaluated using the existing global ensemble prediction system (EPS) of the European Centre for Medium-Range Weather Forecasts (ECMWF). Furthermore, observation system experiments are conducted with the AROME model and its 3D-Var data assimilation to investigate the impact of additional observations (such as Mode-S aircraft data, SCADA data and MSG cloud mask initialization) on the numerical icing forecast. The uncertainty related to model formulation is estimated from multi-physics ensembles based on the Weather Research and Forecasting model (WRF) by perturbing parameters in the physical parameterization schemes. In addition, uncertainties of the icing model and of its adaptations to the rotating turbine blade are addressed.

The model forecasts combined with the suite of instruments and their measurements make it possible to conduct a step-wise verification of all the components of the model chain – a novel aspect compared to similar ongoing and completed forecasting projects.