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Probabilistic Wind Power Forecasts using ECMWF's Ensemble Prediction System

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Renewable energies are considered the only energy source that will become less expensive in a future of continously increasing energy demand. Since many years wind power deployment is rapidly increasing and has become a very important market. The current perspectives for 2030 are that 300 GW of installed wind power capacity will will meet 22% of Europe's electricity demand.

Increasing wind power capacities require very good predictions of wind power production to enable save grid integration while keeping the commonly high level of reliability of the European power supply system. Continuous improvement is indispensable and is requested by all stakeholder of the electricity market (Transmission System Operators (TSOs), energy traders, wind farm operators). The day-ahead (24-48h) predictions of wind power are nowadays established products. The root mean square error of the best forecast for Germany is between 5 and 6 % (normalized with the rated capacity) using the deterministic ECMWF forecast.

In order to tackle the problem of situations with low predictability the development of probabilistic wind power forecasts becomes very important. In particular, the problem of seldom but large forecast error needs to be solved and requires probabilistic information for decision making.

In this paper we study the skill of ECMWF's Ensemble Prediction System (EPS) regarding wind power forecasts for Germany. A very effective wind power forecast model has been developed to cope with the 50 ensemble members. The wind power

prediction model is based on principle component regression techniques of the wind speed to reduce the degrees of freedom.

The evaluation includes a range of probabilistic skill scores like Brier Skill Score, ROC Area, Reliability Diagram, and Ignorance Score. Each of the scores is used to diagnose specific aspects of the quality of the wind power forecast system. For example, being a logarithmic score, the Ignorance Scores is very sensitive to extreme forecast errors, and thus can give valuable information to be confident (or not) in extreme situations. TSOs are predominantly concerned about extreme situations (either in forecast error or strong winds) as they are very costly with respect to save grid operation management decisions.