

Probabilistic Wind Power Prediction Based on Ensemble Weather Forecasting

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Despite the growing popularity of renewable (e.g., wind and solar) energy usage, the volatility of the corresponding sources, partially due to the natural variability of weather conditions, hinders their further commercialization and necessitates the development of cost-effective and easily implementable predictive models such as those simulating power generation. Despite the recent increase in the accuracy of numerical weather prediction models, most of them still face problems such as the poor predictability of wind ramp event intensity, location, and timing, which can be addressed through the use of probabilistic modeling. Herein, we present a probabilistic wind power prediction method based on a numerical weather prediction model, using a power curve empirically estimated from the relationship between area-averaged wind speed and area-integrated wind power generation to project wind power and accounting for the inherent uncertainty associated with the above curve. The established probabilistic prediction method exhibits high statistical consistency and reliably captures the confidence interval of wind power variability, thus being well suited for ramp event prediction.

Keywords: Probabilistic prediction, Wind power, Ramp events