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Calibrated COSMO-DE-EPS wind forecasts for energy application

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The improvement of wind power forecasts is one objective within the research project EWeLiNE, a cooperation between the German Weather Service (DWD), the Fraunhofer Institute for Wind Energy and Energy System Technology (IWES) and three German transmission system operators. Scenarios from reliable ensemble wind speed forecasts that are driving power predictions should contribute to ensure the power grid stability.

The focus is on hourly wind forecasts at 100 m height (approximate hub height of wind power plants) with horizon of 45 h delivered by the convection permitting high-resolution ensemble system COSMO-DE-EPS. Operational since 2012 at the DWD, the ensemble consists of 20 ensemble members driven by four different global models. The model area includes Germany and parts of Central Europe with a horizontal resolution of 2.8 km and a vertical resolution of 50 model levels.

Since the operational ensemble wind forecasts suffer from underdispersion and a seasonal and daytime dependent forecast bias, statistical postprocessing methods are applied to correct those deficiencies. Here, we use an L1-norm penalized quantile regression. Geographic information and suitable ensemble forecast variables from the model output serve as predictors. Based on wind speed training data from only a few available observation towers, the parametric calibration is aimed to be valid at any model grid point. The ensemble forecast quality before and after calibration is assessed using standard verification scores against tower observations which are independent from the training data used for calibration. The spatio-temporal emulation of the forecast error correlations is a challenging aspect of ensemble calibration. A new approach, called dynamic ensemble copula coupling, is applied to the calibrated quantiles in order to transfer the underlying error correlation to calibrated scenarios. The resulting scenarios are evaluated by product-oriented verification, e.g. diagnostics of wind ramps.