EMS Annual Meeting Abstracts
Vol. 12, EMS2015-565, 2015
15th EMS / 12th ECAM

Statistical methods to develop skillful probabilistic wind power forecasts

Lüder von Bremen, Constantin Junk, Stephan Späth, and Detlev Heinemann
Universität Oldenburg, ForWind, Oldenburg, Germany (lueder.von.bremen@uni-oldenburg.de)

Recently, probabilistic wind power forecasts receive attention for the integration of wind power into the power supply system. Possible applications are the allocation of varying amounts of balancing reserves, power trading, grid security calculations for congestion management and grid operation.

Various statistical methods are applied to regional forecasts of wind power and single wind farms to obtain skillful probabilistic wind power forecasts.

Ensemble prediction systems (EPS) are designed to allow the quantification of flow-dependent forecast uncertainties. As ensemble forecasts from EPSs are often biased and unreliable, they require calibration. State-of-the-art calibration methods such as the adaptive wind vector calibration (AUV) approach, ensemble model output statistics (EMOS) and ensemble copula coupling (ECC) are applied to wind speed observations from measurement masts and to single wind farms and regional wind power. Alternatively, probabilistic wind power forecasts are generated with the Analog Ensemble (AnEn) method by means of deterministic forecasts that are related to historic forecasts (analogs) and their verifying observations [4]. The skill of calibrated ensemble forecasts and AnEn is compared for several measurement masts and wind farms.

The global ECMWF EPS is used for forecast ranges up to +120h. The regional, convection-permitting COSMO-DE-EPS of the German Meteorological Service is used for shortest-term forecasts.

It is shown that AUV calibration is superior to EMOS for ECMWF EPS at single wind farms and wind met masts [1]. However, it is found that the opposite is true for calibration of COSMO-DE EPS forecasts [2]. It is notable, that calibrated ECMWF EPS forecasts are far better than calibrated COSMO-DE-EPS. An investigation of the benefits of combining the calibrated COSMO-DE EPS and calibrated ECMWF EPS to a multi-model ensemble indicated the multi-model ensemble has a higher skill than the calibrated ECMWF EPS ensemble.

Concerning regional wind power forecasting in Germany with COSMO-DE-EPS we found that it is not beneficial to calibrate wind speed at grid point level with EMOS and ECC [3]. Resulting regional wind power forecasts are almost as unreliable as the raw ensemble. A skillful forecast is obtained when raw regional wind power ensemble members are calibrated with EMOS.

Literature

[1] Junk, C., von Bremen, L., Kühn, M., Späth, S., Heinemann, D., 2014: Comparison of Postprocessing Methods for the Calibration of 100-m Wind Ensemble Forecasts at Off- and Onshore Sites. J. Appl. Meteor. Climatol., 53, 950–969.

[2] Späth, S., von Bremen, L., Junk, C., Heinemann, D.: Time-consistent calibration of short-term regional wind power ensemble forecasts, Meteorol. Z., DOI: 10.1127/metz/2015/0664

[3] Späth, S., von Bremen, L., Junk, C., 2014: Ways to Obtain Reliable Wind Power Forecasts from Ensemble Weather Forecasts. In Proc. of 13th Wind Integration Workshop, Berlin.

[4] Junk, C., Delle Monache, L., Alessandrini, S., Cervone, G., von Bremen, L.: Predictor-weighting strategies for probabilistic wind power forecasting with an analog ensemble. Meteorol. Z., DOI: 10.1127/metz/2015/0659