



Probabilistic Wind Farm Group Forecasts using Bayesian Model Averaging

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For operational purposes forecasts of the lumped output of a group of wind farms spread over a larger geographic area will often be of interest. It is well documented that a better choice than to simply sum up all sites within an area is to use a model that also is able to take advantage of spatial smoothing effects. It is however likely to also believe that some sites tends to more accurately reflect the total output of the group, either in general, for certain wind directions etc. It will then be of interest to give these a greater influence over the group forecast.

Bayesian model averaging (BMA) is a statistical postprocessing method for producing probabilistic forecasts from ensembles, in this case is the single site forecasts. Raftery et al. [1] showed how BMA can be used for statistical postprocessing of forecast ensembles, producing PDFs of future weather quantities. The BMA predictive PDF of the future wind power production of a group of wind farms is a weighted average of single-farm PDFs, where the weights can be interpreted as posterior probabilities and reflect the single site forecasts' contribution to overall group forecasting skill over a training period.

In [2] the BMA method was found to produce accurate probabilistic forecasts for group mean wind speeds, but when attempting to forecast wind power production the shape of the wind to power transformation curve caused the PDFs to be either too wide or to give consistent under-predictions. Here we discuss the problems caused by the power curve, and try solutions to these by e.g. adapting the parameter estimation process of the standard BMA procedure so that it can run directly on the wind power forecasts, splitting the data into subsets depending on the gradient of the power curve and estimating the parameters independently for each subset etc.

[1] Raftery AE, et al. 2005. Using Bayesian Model Averaging to Calibrate Forecast Ensembles. *Monthly Weather Review*, 133, pp. 1155-1174.

[2] Revheim PP, Beyer HG. 2013. Using Bayesian Model Averaging for wind farm group forecasts. *EWEA Wind Power Forecasting Workshop 2013*.