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High resolution probabilistic forecasting for wind energy applications.

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This project aims to produce the best possible wind speed forecasts for the wind energy industry by using an optimal combination of well-established forecasting and post-processing methods. We start with the ECMWF 51 member ensemble prediction system (EPS) and produce a more accurate forecast than the ensemble mean. The 51 members are clustered to 8 weighted representative members (RMs) using a clustering technique. The 8 RMs are chosen to minimize the within-cluster spread, while maximizing the inter-cluster spread. The forecasts are then downscaled using two limited area models, WRF and COSMO, at two resolutions, 14km and 3km.

Numerical weather prediction is far from perfect and each of the ensemble member forecasts contains errors, both systematic and chaotic. Systematic errors can be minimized with statistical post-processing. We apply four adaptive post-processing methods to each forecast which require only a short training period. The weighted ensemble mean of the post-processed ensembles is used as the input to a Bayesian Model Averaging (BMA) system.

Each ensemble forecast probability density function (PDF) is weighted based on how well it has performed over a training period. The weighted PDFs are then summed to form the BMA PDF which represents the probability of all possible wind speeds and has been proven to outperform the ensemble mean. We present a detailed description of the above process and detail some preliminary results.