From wind ensembles to probabilistic information about future wind power production - results from an actual application - DTU Orbit (21/10/2019)

Meteorological ensemble forecasts aim at quantifying the uncertainty of the future development of the weather by supplying several possible scenarios of this development. Here we address the use of such scenarios in probabilistic forecasting of wind power production. Specifically, for each forecast horizon we aim at supplying quantiles of the wind power production conditional on the information available at the time at which the forecast is generated. This involves: (i) transformation of meteorological ensemble forecasts into wind power ensemble forecasts and (ii) calculation of quantiles based on the wind power ensemble forecasts. Given measurements of power production, representing a region or a single wind farm, we have developed methods applicable for these two steps. While (ii) should in principle be a simple task we found that the probabilistic information contained in the wind power ensembles from (i) cannot be used directly and therefore both (i) and (ii) requires statistical modelling. Based on these findings an demo-application, supplying quantile forecasts for operational horizons of up to approximately 6 days, was developed for two utilities participating in a common project. The application use ECMWF-ensembles. One setup corresponds to an offshore wind farm (Nysted, Denmark) and one corresponds to regional forecasting (Western Denmark). In the paper we analyze the results obtained from 8 months of actual operation of this system. It is concluded that the demo-application produce reliable forecasts. The average difference between the 75% and 25% quantile forecasts exceeds 50% of the installed capacity for horizons longer than approximately 4 days for the wind farm setup. For the regional forecasts the corresponding horizon is not reached within 7 days, which is the maximum horizon available. The ability of the demo-application to differentiate between situations with low and high uncertainty is analysed. Also, the relation between the forecasted uncertainty and the actual skill of a point forecast is analysed. A satisfactory agreement is observed.