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Highlight results

- **Variety of approaches and product for probabilistic forecast**

Background :

Probabilistic forecasts of renewable energy generation (especially wind power, since having a leading role in a number of European countries) are becoming increasingly accepted as an optimal input to a number of decision-making problems related to market participation and power systems operations. While from a practical point of view they give a very visual information about forecast uncertainty, they also give a mathematically sound description of the range of possibilities for the coming future in terms of wind power generation. A large number of methods based on already issued point forecasts, metrological ensemble forecasts, stochastic power curves, etc., were developed and refined through the lifetime of the EU project SafeWind.

Scenarios of short-term wind power generation:

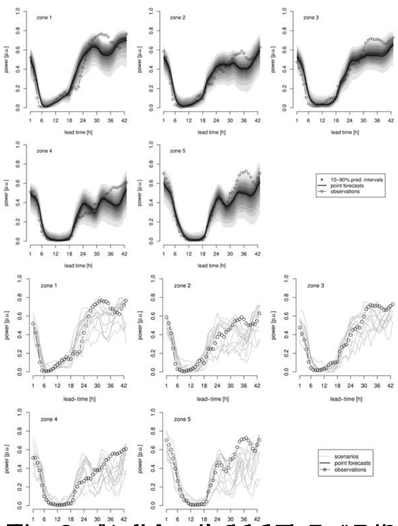
The various types of probabilistic forecasts that were issued and communicated operationally a few years ago were focusing on providing a probabiistic information for every lead time and location, independently. This is while a substantial share of decision makings problems additionally require an information about the spatial and/or temporal correlation structure of forecast uncertainty. Example problems include (i) the optimal operation of a wind-storage system in a market environment, (ii) stochastic unit commitment over a control zone, (iii) optimal maintenant planning offshore, etc. In such cases, scenarios of short-term wind power generation comprise an ideal product since providing the whole information about forecast uncertainty for every lead time and location, also accounting for spatio-temporal correlation.

Methods for generating scenarios of short-term wind power generation:

Varied approaches were proposed and investigated, based on time-series analysis methods, copula-based methods relying on already issued probabilistic forecasts, or alternatively based on meteorological ensemble forecasts. In all cases these methods focused on modeling and mimicing the observed spatio-temporal structure of forecast uncertainty. They were applied and evaluated for a number of test cases in the project, located in Spain, Denmark and France. In parallel, the framework for the assessment of the quality of such new forecast products was proposed and illustrated.

Example application for the control area of Energinet.dk in Denmark:

The control area of Western Denmark (also called DK-1) is operated by Energinet.dk the Transmission System Operator in Denmark and split into 15 control zones onshore. As an example application, point forecasts, probabilistic forecasts in the form of predictive densities, and spatio-temporal scenarios of wind power generation were produced for an aggregation into 5 control zones. There were generated over a period of almost 2 years based on a historical dataset of 2006-2007. This application was used for the evaluation of the forecast methodology, but also as input to other work on the importance of predictability and space-time effects at the ressource assessment stage. Example forecasts issued on the 3rd of April 2007 at 16:00 are shown in Figure 1, with predictive densities and corresponding space-time scenarios.



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Implementation and demonstration of scenarios:

Some of the proposed methodologies were implemented by ENFOR as a module integrated in the ANEMOS prediction platform. It was used for demonstratring the use of spatio-temporal scenarios as input to stochastic unit commitement for the whole Irish power system (operated by SONI and EirGrid) in the frame of the EU project Anemos.plus.

Further work:

It is expected that substantial emphasis will be placed on the further development of scenario generation methods based on statistical methods, but also on ensemble predictions. They should be extended to the the multivariate case in order to also represent the dependencies in the forecast uncertainty of all types of renewable energy forecasts, load and market prices. Not only the members of the SafeWind consortium have shown interest is these further developments as the meteorological community for instance is highly interested in this question of spatio-temporal scenarios of meteorological variables.

Bibliography:

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