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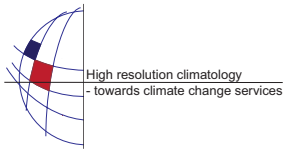

An application of ensemble/multi model approach for wind power production forecast.

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The wind power forecast of the 3 days ahead period are becoming always more useful and important in reducing the problem of grid integration and energy price trading due to the increasing wind power penetration. Therefore it's clear that the accuracy of this forecast is one of the most important requirements for a successful application. The wind power forecast is based on a mesoscale meteorological models that provides the 3 days ahead wind data. A Model Output Statistic correction is then performed to reduce systematic error caused, for instance, by a wrong representation of surface roughness or topography in the meteorological models. The corrected wind data are then used as input in the wind farm power curve to obtain the power forecast. These computations require historical time series of wind measured data (by an anemometer located in the wind farm or on the nacelle) and power data in order to be able to perform the statistical analysis on the past. For this purpose a Neural Network (NN) is trained on the past data and then applied in the forecast task. Considering that the anemometer measurements are not always available in a wind farm a different approach has also been adopted. A training of the NN to link directly the forecasted meteorological data and the power data has also been performed. The normalized RMSE forecast error seems to be lower in most cases by following the second approach.
We have examined two wind farms, one located in Denmark on flat terrain and one located in a mountain area in the south of Italy (Sicily). In both cases we compare the performances of a prediction based on meteorological data coming from a single model with those obtained by using two or more models (RAMS, ECMWF deterministic, LAMI, HIRLAM). It is shown that the multi models approach reduces the day-ahead normalized RMSE forecast error of at least 1% compared to the singles models approach. Moreover the use of a deterministic global model, (e.g. ECMWF deterministic model) seems to reach similar level of accuracy of those of the mesocale models (LAMI and RAMS). Finally we have focused on the possibility of using the ensemble model (ECMWF) to estimate the hourly, three days ahead, power forecast accuracy. Contingency diagram between RMSE of the deterministic power forecast and the ensemble members spread of wind forecast have been produced. From this first analysis it seems that ensemble spread could be used as an indicator of the forecast's accuracy at least for the first day ahead period. In fact low spreads often correspond to low forecast error. For longer forecast horizon the correlation between RMSE and ensemble spread decrease becoming too low to be used for this purpose.