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Selected track and topic: Technology and grids track: Research programmes and test facilities

Abstract title:

HRENSEMBLEHR - HIGH RESOLUTION ENSEMBLE FOR HORNS REV

Summary of your work:

One of the major benefits of Offshore Wind Power is a smoothing effect on the energy price, because it has it is own generation pattern, but also a more variable predictability for which ensemble predictions are designed. A Multi-Scheme Ensemble Prediction system (MSEPS) is used to quantify the forecast uncertainty, which is in fact a dynamic reserve forecast. The goal is also to improve single forecasts by running MSEPS and the ocean model GETM coupled for consistent surface flux computations over sea. The coupled MSEPS output is deployed with 4 different short term wind power prediction tools.

Full description:

The wind farm output of an offshore-farm such as Horns Rev changes between nearly constant output to highly variable power output. A balance responsible would benefit from knowing the variability of a wind farm in advance.

Some understanding of the observed variability and the corresponding forecast error on offshore wind farms has been gathered in the past few years. However, a large fraction (about 60%) of the error lacks understanding and requires further intense research.

In this project we are studying these interactions further by combining developments in ocean, weather and wind power prediction to create an optimised model system. This means that we want to combine an ocean model with an ensemble prediction system in coarse resolution to simulate the larger scales of the weather and ocean and add a high resolution ensemble to provide best possible data for training of different wind to power conversion approaches.

One of our focal points is the environmental value of wind power that can be increased by knowing the spinning reserve requirements needed for the steep ramp rates of single wind farms. The reserve requirements are a function of the accuracy of the wind power prediction, but also the variability of the weather, which is typically generated on the mesoscale. By not only predicting the most likely production of the wind farm, but also the expected ramping and variability, the reserve requirements can be adjusted up and down in advance.
A deterministic high resolution numerical weather prediction system gives one result and no information about the expected uncertainty at a given time. An ensemble of forecasts can be used to generate a probability density function of the most likely outcome.
The variability of the wind farm output within one hour is however not well understood nor predicted by todays ensemble prediction systems, because they predict a wind speed which is averaged over an area much larger than the physical extend of offshore wind farms such as the Hornsrev wind farm.
The spatial and time resolution of the ensemble output needs to be increased to achieve a good estimate of the reserve requirements and a better air sea interaction scheme is required to simulate the planetary boundary layer eddies and the atmospheric flow under non-neutral conditions.

The HREnsembleHR project and its objectives will be described and first results presented.