Offshore wind resource assessment with a mesoscale model

L. Claveri (1), J. Beran (1), F. Durante (2), B. Lange (1), M. Strack (2)

1. ForWind Center for Wind Energy Research, University of Oldenburg, Germany (lorenzo.claveri@forwind.de / Fax: +49 441-36116739 / Phone: +49 441-36116731)
2. Dewi – German Wind Energy Institute, Germany

Limited-area models (LAMs) are often used to calculate the wind resources for wind energy utilisation over land. For this application, a very high accuracy of the wind speed modelling is required. Additionally, there are new challenges arising from technology installation off-shore, where measurements are scarce. Thus, the wind resource often has to be assessed by means of numerical modelling. In contrary to the application over land, orographic effects are of minor importance offshore. A coarser spatial resolution is therefore sufficient, which significantly reduces the computational cost. This allows the use of LAM for the modelling of long time series to establish the wind climatology instead of using a combination of cluster analysis and short runs.

This work studies the application of LAM to the offshore wind resource assessment. The mesoscale numerical model MM5 developed by PSU/NCAR is used. Measurements from the 100 m high meteorological mast FINO 1 in the North Sea have been used for validation of the model results.

Focus of the investigations is the optimisation of the model configuration suitable for offshore wind resource assessment. The number and position of model domains, the required horizontal and vertical grid resolution and nesting techniques have been studied. The influence of atmospheric stratification, distance to the coastline and synoptic situation on the model results for different configurations have been investigated. Also, the effect of the choice of the model setup on computational cost is discussed. It has been found that the grid resolution can be reduced significantly compared to commonly used configurations without loss in performance over the sea. The model performance deteriorates close to the cost-line depending on grid resolution.

As an example application, a long-term simulation of the wind speed of the German Bight has been performed and compared to the measurement at FINO 1.Generally a good agreement has been found, while for some situations large deviations occur.