EMS Annual Meeting Abstracts
Vol. 11, EMS2014-342-1, 2014
14th EMS / 10th ECAC

Optimized significant wave height forecasts and their benefit on the workability at Offshore Wind Farms

Thomas Kanefendt, Arne Wessel, and Britta Mey

Fraunhofer Institute for Wind Energy and Energy System Technology IWES, Division Energy Economy and Grid Operation, Germany (thomas.kanefendt@iwes.fraunhofer.de)

There is an ongoing debate on the huge investments necessary to expand the renewable energies and especially the comparatively expensive offshore wind sector. To lead the energy transition to success, reducing their costs is one of the key factors. Optimized significant wave height forecasts can help achieving this goal by a better prediction of possible working times for wave height restricted processes when constructing or maintaining an offshore wind farm.

However, post-processing of wave height forecasts to improve the direct model output is not commonly used. Therefore, this study introduces approaches successfully applied in other meteorological fields to post-process the wave height predictions. Different time-lagged ensemble methods are compared and their benefit on planning the work at offshore construction sites is shown.

The research is based on analysis and forecasts of the wave model operationally run at the German Weather Service (DWD) with a forecast horizon up to 174 hours and buoy measurements from the sites FINO1 and $FINO_3$ located in the German Bight. On the one hand the weighting of the different forecast lead times is calculated by a multi-linear regression. On the other hand artificial neural networks (ANNs) are used. These are constructed in a way that allows the investigation on the impact of the linear and the non-linear dependencies between the inputs (predictions with different lead times) and the target (measurement / model analysis).

The applied algorithms lead to significant improvements in the wave height forecasts for the investigated locations in terms of the mean absolute error (MAE) and the root mean square error (RMSE). Furthermore weather windows representing common restricted processes at offshore wind farms are more often correctly predicted when looking at the post-processed forecasts in comparison to the direct model output.