# Analysis of wave climate forecast system performance off the north-western coast of Denmark

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## ABSTRACT

In response to the political energy policies on the global level [1], a race is ongoing for renewable energy sources to become primary, and in some case the only, source of energy within a few decades. To attain this goal, a drastic increase of renewable energy deployment and a diversification of the energy mix are compulsatory. Wave energy is considered as a candidate to enter the energy mix as it has complementary advantages with respect to both wind energy and photovoltaics [2]. In order to bring wave energy to the level needed for deployment, lower levelised cost of energy (LCoE) is required. As with wind energy, reduction of operation and maintenance (O&M) associated costs is believed to have a major effect on the LCoE. One strategy to reduce the O&M cost is to improve forecast models in order to better predict weather windows in terms of duration and wave height levels, to reduce costs for vessels and man power.

This strategy has been implemented at a smaller scale at the Danish wave energy center (DanWEC) [3] located at the north-western coast of mainland Denmark. In collaboration with the Department of Civil Engineering at Aalborg University and DHI, a forecast model for DanWEC test site area was developed based on the MIKE 21 spectral wave model [4]. The DHI forecast model developed for DanWEC updates a range of parameters related to the wave conditions, wind conditions and current speed, throughout the modelling area twice every 24 hours. This model provides a five days prognostic of the conditions at the test site and the model forcing comprises input from regional DHI models and wind fields.

To quantify the added value of this extended forecast system, a freely available wave climate forecast was analysed and compared with wave measurement for the area. The freely available forecast model is the HRES-SAW providing a ten days forecast updated 4 times per day. A list of the available parameters provided by this forecast system can be found at [5].

In this work, the performance of both forecast systems is analysed and presented, including detailed verification statistic with respect with actual measured data from the area for various forecast lead times.

## REFERENCES

[1] European Commission's Directorates-General for Research and Innovation, Energy and the Joint Research Centre, "*The Strategic Energy Technology (SET) Plan*", 2017, EU Publications.

[2] J. Fernandez Chozas, "*Technical and Non-Technical Issues Towards the Commercialisation of Wave Energy Converters"*, PhD thesis, Department of Civil Engineering, Aalborg University, 2013.

[3] H. J. Brodersen, K. Nielsen, J. P. Kofoed, "*Development of the Danish test site DanWEC"*. In proceedings of the 10th EWTEC 2013 European Wave and Tidal Energy Conference, Aalborg, Denmark.

[4] A. Tetu, J. P. Kofoed, F. Schlütter, and P. Hammer, "*Forecast Model for Current, Wave and Wind Climate at the Danish Test Site for Wave Energy, DanWEC"*, In proceedings of the International Conference on Time Series and Forecasting (ITISE 2018), Granada, Spain.

[5] ECMWF, Set II - Ocean Wave Model high resolution 10-day Forecast (HRES-WAM & HRES-SAW). Available online: https://www.ecmwf.int/en/forecasts/datasets/set-ii (Accessed on 11 January 2019).