

Abstract content

Title: CORRELATION ANALYSIS BETWEEN UK ONSHORE AND OFFSHORE WIND RESOURCES

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1. Introduction:

Using wind resources measured with an onshore radiosonde, an offshore tower and onshore surface stations; the work presented studied vertical and horizontal correlations between onshore and offshore sites on a region of the East coast of the UK. Different onshore – offshore configurations are statistically analysed to presents the correlations and discuss the predictions of the offshore wind from the onshore wind data.

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2. Approach:

In this research; the directional, diurnal and seasonal wind resources were studied at several onshore surface stations and at two different heights on an offshore mast. Also; the vertical onshore wind profile was studied using data from a high resolution radiosonde and the atmospheric stability was computed for both onshore and offshore sites.

Then, the total study period was divided in two to use the first sub-period to correlate and predict the data of the second sub-period and vice-versa. Finally, R-squared and the RMSE were computed in order to evaluate all the correlations and predictions.

3. Main body of abstract:

The analysis of how to improve the offshore wind estimation is an important part of the strategies to reduce the overall cost of the offshore wind farms. Particularly in the UK where the offshore wind development are moving ever further from the coast in deeper water with greater costs as the foundations become deeper and the hub reach higher heights.

Relative few data, for several of the potential UK offshore wind farm sites, is generally available to infer the expected overall wind resource and its spatial behaviour over different timescales. As large hub heights for wind turbines are approaching the top of the surface layer, there is also other research areas which are barely understood including, for example, sudden changes in wind direction and the presence of non-traditional vertical profiles.

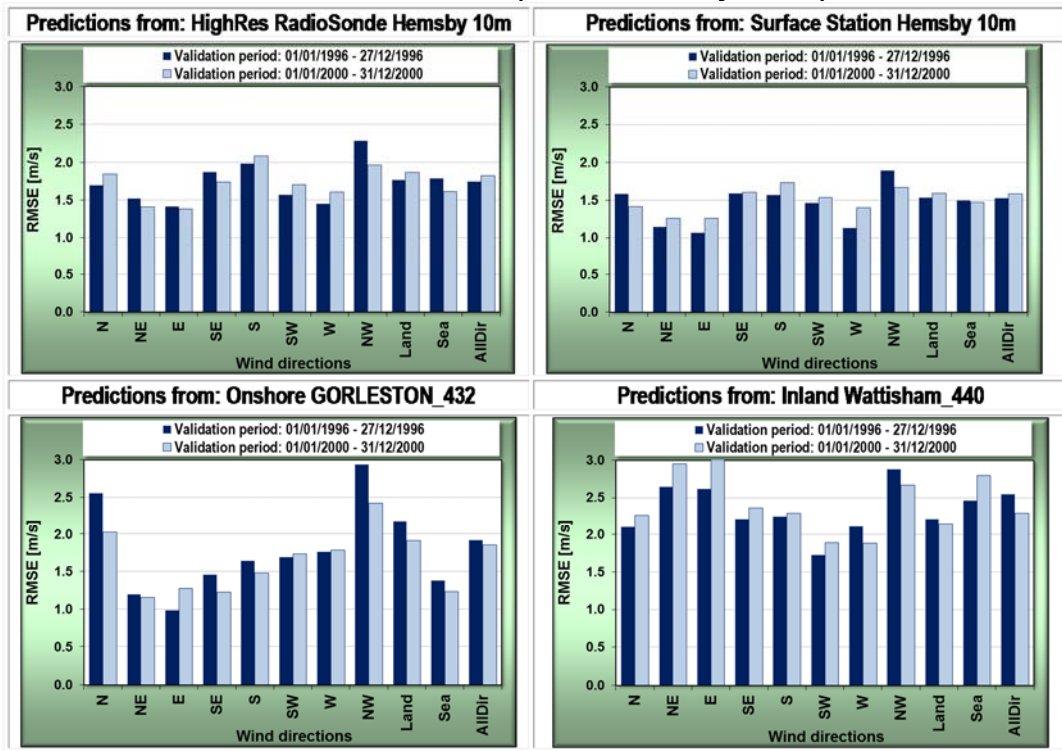
The work presented in this research analyse the directional, diurnal and seasonal cycles of the offshore and onshore synchronized data in order to predict the offshore patterns of wind speed from different kind of onshore wind datasets.

Locations of the study sites:

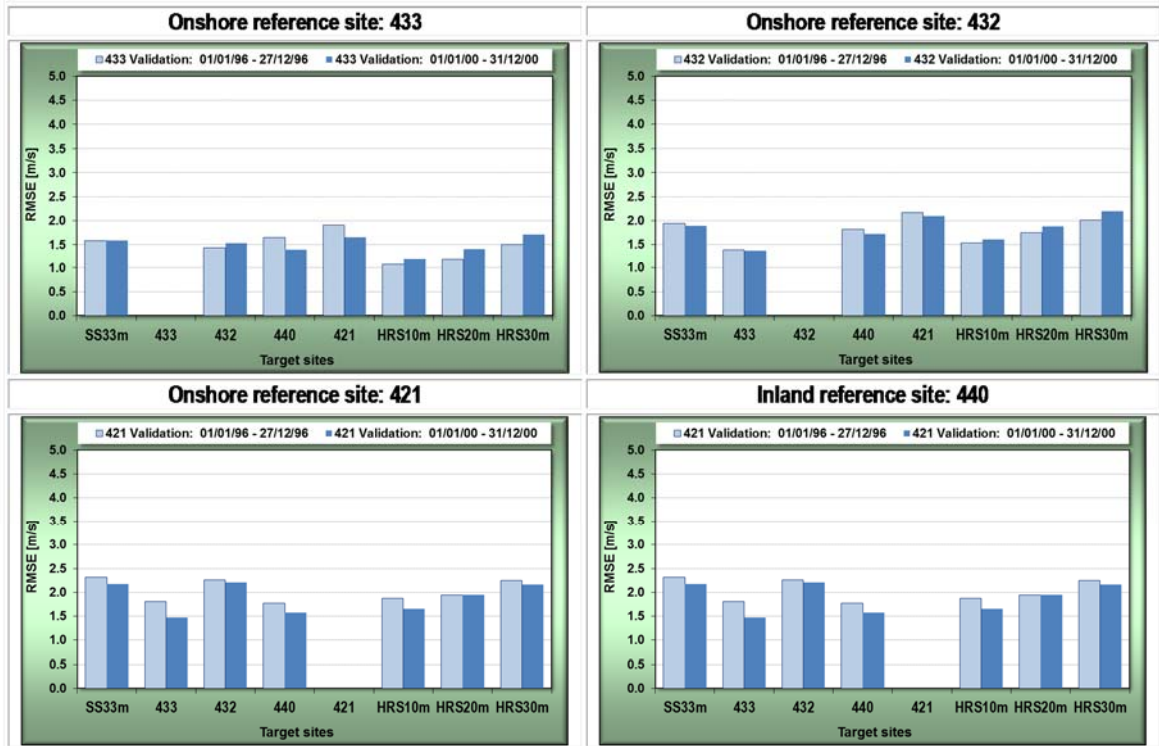


RMSE for predictions considering wind directions

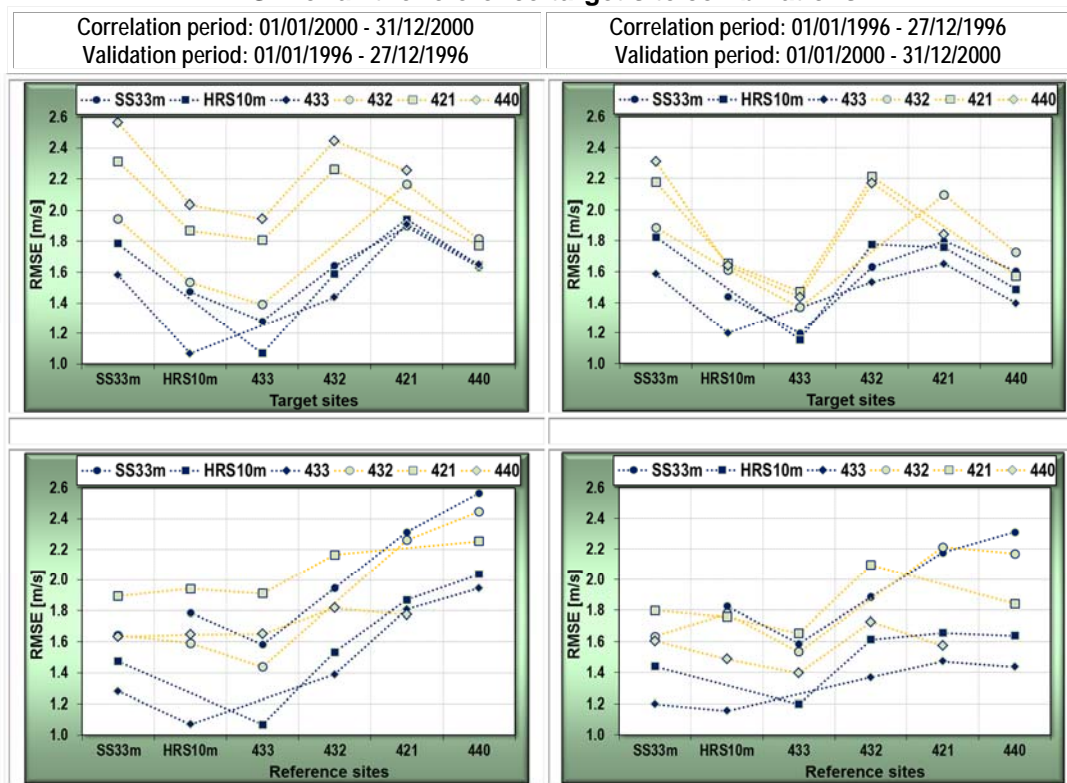
Measurements at 33m (Offshore Scroby Sands)



RMSE for predictions among the study sites:



RMSE for all the reference-target site combinations



4. Conclusion:

- MCP (Measure-Correlate-Predict) methods can produce a useful first approximation of the offshore wind from wind data measured at onshore surface stations.
- Data from onshore high resolution radiosondes can be used to study atmospheric stability patterns that help to predict offshore vertical wind profiles.
- There is a significant deviation from a logarithmic profile above around 80m.
- Predictions of the offshore wind using onshore data play an important role in the initial stages of the offshore site evaluation that can help to reduce the overall cost of a Wind Farm.

5. Learning objectives:

- An application of the MCP method using several spatial sites and different kind of measurement techniques.
- The correlation between several vertical onshore measurements and the offshore wind at a particular height.
- How the onshore wind data can be used to predict the offshore wind resources in the case of the East coast of the UK.