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1 Wind Speed Forecasts for the North and Baltic Sea - Verification against 10m to 100m Observations

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The quality of offshore wind speed forecasts up to 48 hours plays a crucial role not only for predicting wave heights and for navigation, but also for scheduling the power output of large offshore wind farms [1]. These marine power plants are planned to reach a total capacity of 25 Giga Watt in the German Bight. The aim of this investigation is to assess the uncertainty of marine wind speed forecasts from a numerical weather prediction (NWP) in order to identify necessary modifications and corrections for offshore forecasts.

We compared the wind speed predictions of the year 2002 provided by the German Weather Service (DWD) with synoptic observations at 10m height from several coastal sites at the North Sea and the Baltic Sea and from two lightships in the German Bight. Moreover, we validated the forecasts with time series of vertical wind speed profiles observed at two meteorological masts in the North Sea: Horns Rev (62m) and the new 100m mast at FINO1.

The analysis of different contributions to the root mean square error (RMSE), i.e. bias, bias of standard deviations and dispersion error, discriminates random from systematic

components [1,2,3]. All error parameters are analysed as a function of the look-ahead time between 0 and 48 hours. The decomposition of the RMSE reveals shortcomings of the NWP model regarding the 10m forecasts for the coastal sites at the North Sea, most likely related to effects of modified thermal stratification. In contrast, the same analysis shows a clearly better forecast quality at the lightships, the offshore met masts and the Baltic Sea sites: There is virtually no difference in the mean speed values and the RMSE is dominated by phase errors. The RMSE ranges from 20% to 30% in the first 24 hours of the forecast, normalised to the annual mean wind speed of 8 m/s at 10m height. Common values for on-shore sites vary from 30 to 45 %, but the absolute offshore RMSE with a value of 3m/s for the 48h-horizon is rather large.

An interesting result from the met mast data is that the observed wind shears are considerably higher than those derived from the NWP. This effect occurs in different thermal conditions and asks for a more detailed description of the marine boundary layer [1]. Nevertheless, the phase errors of the NWP seem to be the most important point for further improvements.

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