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The effect of stability on the coastal gradients at the Anholt wind farm

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We use Synthetic Aperture Radar (SAR) and SCADA measurements and mesoscale model simulations from the Weather Research and Forecast (WRF) model[3] to analyse the flow conditions at the Danish offshore wind farm at Anholt.

The first Danish offshore wind farms have been installed in the North Sea off Denmark's West coast. In this location, the wind conditions have been extensively analysed [2]. Then, around 10 years later the large Anholt wind farm (nominal power of 400 GW) – situated in the Kattegat Strait to the East coast of the Jutland peninsula – has been commissioned. The Anholt wind farm stretches around 20 km in the South-North direction and the fetch increases from 15 km in the southern part to 50 km in the northern part of the wind farm. The relatively complex westerly flow conditions at this location are still not completely understood.

We use the 10-year SAR satellite measurements and WRF numerical simulations to identify general differences in wind conditions between Jutland's West- and East-coast. The 10 m neutral wind speeds retrieved from satellite images are obtained between 2002 and 2012. The WRF wind speeds are for the same period and at the same height from simulations that cover in total 1025×530 km (fig.1) with a horizontal grid-spacing of 5 km [1]. Furthermore, we investigate how the strength of the wind speed gradient in the South-North direction of the wind farm depends on the atmospheric stability and on the wind speed. Here, we use, additionally to the SAR measurements and WRF simulations, also Supervisory control and data acquisition (SCADA) measurements from the westerly most wind turbines. The SCADA measurements have been kindly provided by DONG Energy and partners.

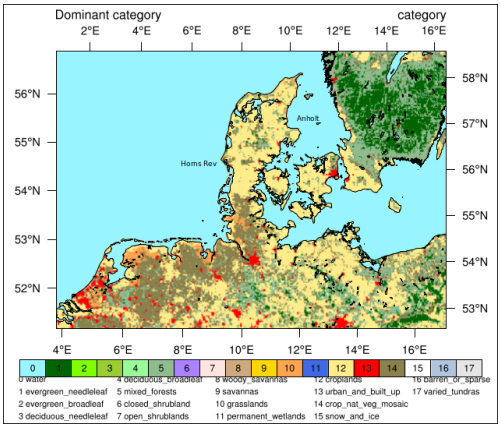

Figure 1: WRF domain that includes the Danish West and East coast

[1] Hahmann et al.: Wind climate estimation using WRF model output: Method and model sensitivities over the sea, *Int. J. Clim.*, 2015

[2] Peña and Hahmann: Atmospheric stability and turbulence fluxes at Horns Rev – an intercomparison of sonic, bulk and WRF model data, *Wind Energy*, 15:5 717–731, 2012

[3] Skamarock et al.: A Description of the Advanced Research WRF Version 3. *NCAR Technical note*, 2008.