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On the influence of fetch on wind and stability conditions in the North and Baltic Sea

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Offshore wind energy capacity is expected to grow rapidly within the next decades, particularly in Europe with more than 120 GW of consented and planned offshore wind farms. To reduce grid connection, logistics and maintenance costs, most of the erected and also planned wind farms will be within a distance to the coastline of 50 km or less [1].

In the case of offshore winds, this coastal zone is dominated by the adaptation of the flow to the differing properties of the sea surface. During stable conditions, internal boundary layers within the height ranges of typical offshore wind turbine rotors form, having increased loads on these wind turbines as a result. In addition, inhomogeneities in the roughness distribution at the coastline can lead to strong horizontal gradients in the wind field particularly during stable atmospheric conditions [2].

Complementing the result from this study, wind data from offshore meteorological masts as well as high-resolution mesoscale meteorological modelling is employed to extensively study the interaction of fetch and different atmospheric parameters on the wind and stability conditions in the North and Baltic Sea. This investigation is focussing on heights relevant for offshore wind power conversion. The results presented in this study lead to an increased understanding of the wind resource in the coastal zone.

[1] EWEA (2015), The European Offshore Wind Industry - key trends and statistics 2014, *Technical Report, 25 pp.*, European Wind Energy Association.

[2] Dörenkämper, M., M. Optis, A. Monahan, and G. Steinfeld (2015): On the offshore advection of boundary-layer structures and the influence on offshore wind conditions, *Boundary-Layer Meteorol.*, pp. 1–24, doi:10.1007/s10546-015-0008-x.