Comparison of the atmospheric stability and wind profiles at two wind farm sites over a long marine fetch in the North Sea

A comparison of the atmospheric stability and wind profiles using data from meteorological masts located near two wind farm sites in the North Sea, Egmond aan Zee (up to 116 m) in the Dutch North Sea and Horns Rev (HR; up to 45 m) in the Danish North Sea, is presented. Only the measurements that represent long marine fetch are considered. It was observed that within a long marine fetch, the conditions in the North Sea are dominated by unstable (41% at Egmond aan Zee Offshore Wind Farm (OWEZ) and 33% at HR) and near-neutral conditions (49% at OWEZ and 47% at HR), and stable conditions (10% at OWEZ and 20% at HR) occur for a limited period. The logarithmic wind profiles with the surface-layer stability correction terms and Charnock's roughness model agree with the measurements at both sites in all unstable and near-neutral conditions. An extended wind profile valid for the entire boundary layer is compared with the measurements. For the tall mast at Egmond aan Zee, it was found that for stable conditions, the scaling of the wind profiles with respect to boundary-layer height is necessary, and the addition of another length scale parameter is preferred. At the lower mast at HR, the effect was not noticeable. Copyright © 2011 John Wiley & Sons, Ltd.

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