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Influence of humidity fluxes on stability calculations offshore

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Atmospheric stability is an important consideration in offshore wind climates because accurate prediction of wind speed and turbulence profiles is necessary to develop resource estimates for offshore wind farms. In addition, wind turbine wakes are strongly influenced by stability. Power loss due to wakes is greatest in stable conditions and least in unstable conditions although wakes are also lower at high wind speeds which are typically associated with near-neutral conditions.

The most recognised way to estimate stability conditions is the similarity theory derived stability parameter called Monin-Obukhov length L. L is proportional to the ratio between the friction velocity u* and the turbulent virtual heat flux $<w'Tv'>$, than includes both sensible and latent heat fluxes. Both u* and $<w'Tv'>$ can be estimated using the fast response sonic anemometer. Alternatively, L could be estimated using a wind speed measurement at one height and a highly accurate temperature gradient measurement or the wind speed gradient can be used. However, the latter methods ignore the variability of humidity turbulent fluxes, which contribute to total turbulent heat fluxes. Here, we examine whether the moisture flux has an impact of the stability climate at a site in Denmark and whether the impact of the effect on the predicted hub-height wind speed is significant.