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Influence of offshore wind farms on the latent heat flux in the marine boundary layer

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Unique airborne in-situ measurements were evaluated to investigate the influence of offshore wind farms on the latent heat flux in the marine boundary layer. 21 of the total 42 measurement flights carried out in the frame work of the WIPAFF project over the German Bight in the years 2016 and 2017 enabled such an evaluation under different atmospheric conditions. The measurements of 15 flights showed a significant increase of the vertical upward latent heat flux over the offshore wind farm clusters Amrumbank West, Nordsee Ost, Meerwind Süd/Ost or the wind farm Godewind. Under thermally stable conditions, all except one of the measurement flights showed an increase of latent heat flux over or in the wake of the wind farms, with an heat flux up to 17 times higher compared to the undisturbed flow. During flights under unstable thermal stratification, the phenomenon was observed in 8 out of 13 cases. The results also suggest that not only thermal stratification but also moisture stratification plays a decisive role in whether the influence of the wind farm becomes noticeable in the latent heat flux. Considering the absolute amount of the increase of the upward latent heat flux, a maximum increase of +400 W/m² was measured in unstable conditions.