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Changes in Wind Speed and Vertical Fluxes of Moisture over a Wind Farm in the North Sea in a Regional Climate Model

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Offshore wind deployment is foreseen to expand dramatically in the coming years. The strong expansion of offshore wind parks is likely to affect the regional climatology of the coastal areas surrounding the Atlantic, North Sea and Baltic Sea. The main aim of this project is to assess the climate effect of a change in sea use, due to large-scale offshore wind deployment. This is done by using a non-hydrostatic regional climate model, namely COSMO-CLM. Two parameterisations are implemented based on results from wind farm large eddy simulations. In the first one, wind farms are parameterised as elevated sinks of momentum and sources of turbulent kinetic energy. This is compared to a second parameterisation where wind farms are parameterized as increased roughness lengths. Results show an induced vertical mesoscale circulation pattern over the wind farm and an increase in evaporation over the sea surface. This may result in an increase in low level cloud cover. In a second step, the effect of different wind farm parameters on geostrophic winds will be investigated for a layer above wind farms. These results can improve the boundary conditions for the top layers of wind farm large eddy simulations allowing further developments of the wind farm parameterisations.