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Evaluation of the assumptions used in the assessment of future wind resources - A case for CMIP6 in Northern Europe

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In 2020, the North Sea already had 19.8 GW or 79% of the European offshore wind installations. The size and number of wind farms in this region are expected to increase substantially to reach climate mitigation targets, with forecasts of offshore wind commitments across Europe adding up to 111 GW of offshore wind by 2030. However, governments base their climate mitigation plans on past historical wind resources data. Still, there is a probable threat that these will change in the future due to climate change during the lifetime of a wind farm.

The study of future changes in wind resources is not a new subject. A systematic literature search with the keywords "Wind Resources" and "Climate Change" returned over 80 peer-reviewed articles that assessed future wind resources at the global, regional and local scale. Most of these studies used the 10-m wind speed output from the climate or regional model to directly estimate a wind turbine's power production, using the power law and sometimes an idealised power curve. As far as we know, only two studies explored the possible implications of changes in wind direction.

In this presentation, we explore the implications of the various assumptions. We use the example of the North Sea and Northern Europe and the CMIP6 climate model archive to demonstrate that some assumptions can exaggerate future wind resource changes. We also consider the consequences of the changes in boundary layer stability, wind direction and vegetation changes to the future wind resources in Northern Europe.