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Persistent low wind events over the UK and their drivers

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In Europe, wind power contributes a significant and growing part of the electricity generation mix. Wind represents approximately 17% of Europe's total power generation capacity (and almost 30% of its renewable power capacity), making it the second largest source by capacity after gas. With higher penetrations of renewable energies and the increasing efforts to decarbonize the energy system, a strong motivation therefore exists to robustly characterize the wind resources and, in particular, extreme generation events. Among those, persistent low capacity factor events are of utmost relevance as, during these events, the energy system typically has to rely heavily on traditional sources of power generation such as gas, coal and nuclear power plants. Moreover, as low wind power events are often associated with blocking conditions, low wind resources can simultaneously affect widespread areas, limiting the wind generation across a wide region.

Despite their importance, previous assessments of low wind power events have typically only used historic datasets (reanalysis or station-observation). Assessments are therefore both limited in duration and unlikely to represent the full range of climate conditions that may occur in the coming decades. The ability to utilize climate model simulations – i.e. GCM output – is therefore important for robustly characterizing rare low wind power events and their projected changes over the next few decades.

This presentation assesses the representation of low wind power events in high resolution GCM simulations from the Horizon 2020 PRIMAVERA project, focusing initially on events over the United Kingdom. GCM simulated low wind power events are characterized (e.g., frequency and duration; spatial size and distribution) and contrasted to reanalyses (ERA-Interim). The importance of GCM resolution, the time-frequency of model output, and the sensitivity of the results to turbine properties are discussed. The large-scale atmospheric drivers influencing the probability of low wind events over the UK and Europe are discussed.