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Exploring the added value of sub-6-hourly wind data from GCMs for energy applications

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A good understanding of climate variability and change is essential for management and planning in the energy sector, particularly for the integration of weather-sensitive renewable energy sources such as wind-, solar- and hydro-power. Long simulations from high-quality state-of-the-art general circulation models (GCMs) offer new opportunities to assess the impacts of climate on renewable energy resources (e.g., quantification of rare and extreme events, understanding climate trends) but the transformation from ‘climate’ to ‘energy’ is, however, often complex. This represents a challenge for estimating renewable resources using GCM data which is coarse in both time and space. For example, in most climate projections (e.g., CMIP5), the spatial and temporal resolutions of climate data are heavily constrained by the high costs of computing and storage. Typically, these models have horizontal resolutions of around 100 km and store outputs at frequencies not higher than 6-hourly, depending on the specific variables.

The ongoing release of high-resolution climate data from the Horizon-2020 PRIMAVERA project, provides an opportunity to explicitly assess the impact of having access to climate data for several decades of sub-6-hourly wind data for applications in the energy sector. Multi-model simulations are interrogated to identify the ‘effective’ spatial and temporal resolution of their output and its value for properties relevant to the energy sector (such as the wind power output, ramping rates and extremes).

Initial results indicate that even though the effect on speed properties of using 3- and 6-hourly data are small, the impact on capacity factors can be significant. A quantification of such impacts, though, depends on the location of the point (e.g., regarding the speed probability distribution and its seasonality) and on the turbine selected for the analysis.