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A global wind resource atlas including high-resolution terrain effects

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Currently no accurate global wind resource dataset is available to fill the needs of policy makers and strategic energy planners. Evaluating wind resources directly from coarse resolution reanalysis datasets underestimate the true wind energy resource, as the small-scale spatial variability of winds is missing. This missing variability can account for a large part of the local wind resource. Crucially, it is the windiest sites that suffer the largest wind resource errors: in simple terrain the windiest sites may be underestimated by 25%, in complex terrain the underestimate can be as large as 100%.

The small-scale spatial variability of winds can be modelled using novel statistical methods and by application of established microscale models within WAsP developed at DTU Wind Energy. We present the framework for a single global methodology, which is relative fast and economical to complete. The method employs reanalysis datasets, which are downscaled to high-resolution wind resource datasets via a so-called generalization step, and microscale modelling using WAsP. This method will create the first global wind atlas (GWA) that covers all land areas (except Antarctica) and 30 km coastal zone over water.

Verification of the GWA estimates will be done at carefully selected test regions, against verified estimates from mesoscale modelling and satellite synthetic aperture radar (SAR). This verification exercise will also help in the estimation of the uncertainty of the new wind climate dataset. Uncertainty will be assessed as a function of spatial aggregation. It is expected that the uncertainty at verification sites will be larger than that of dedicated assessments, but the uncertainty will be reduced at levels of aggregation appropriate for energy planning, and importantly much improved relative to what is used today.

In this presentation we discuss the methodology used, which includes the generalization of wind climatologies, and the differences in local and spatially aggregated wind resources that result from using different reanalyses in the various verification regions. A prototype web interface for the public access to the data will also be showcased.