A high resolution global wind atlas - improving estimation of world wind resources

Currently, policy makers and energy planners trying to tackle the challenges of climate change and seeking approaches for climate change mitigation, have no global wind resource dataset appropriate for their pressing needs. The current practice of global energy modellers is to use coarse resolution reanalysis datasets. This has the serious shortcoming that the wind energy resource is underestimated, as small scale variability of winds is missing. This missing variability is responsible for a large part of the wind resource not being captured in the analysis. Crucially it is the windiest sites that suffer the largest wind resource errors; in simple terrain the windiest sites may be underestimated by 25% for complex terrain the underestimate can be 100%. The framework for the methodology, laid out in this paper, is a global method, which is relative fast and economical to complete. The method employs large-scale global meteorological datasets (reanalysis), which are downscaled to high-resolution wind resource datasets via a so-called generalization step, and microscale modelling using WAsP developed at Risø DTU. A new feature of WAsP allows calculation of high resolution resource maps covering extensive areas. For the purpose of downscaling high resolution datasets surface elevation and roughness lengths need to be derived from global topography and land cover datasets. New and improved meteorological datasets and topographical datasets, in the public domain, are becoming available. All data and the tools necessary are present, so the time is right to link the parts together to create a much needed dataset. Geospatial information systems (GIS) will be one of the significant applications of the Global Wind Atlas datasets. As location of wind resource, and its relationships to population centres, electrical transmission grids, terrain types, and protected land areas are important parts of the resource assessment downstream of the generation of wind climate statistics. Related to these issues of integration are the temporal characteristics and spatial correlation of the wind resources. These aspects will also be addressed by the Global Wind Atlas. The Global Wind Atlas, through a transparent methodology, will provide a unified, high resolution, and public domain dataset of wind energy resources for the whole world. The wind atlas data will be the most appropriate wind resource dataset available for the needs of policy makers, energy planners and the Integrated Assessment Modelling (IAM) community.