

# The history of mapping wind resources at DTU

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## Abstract

This talk is about the history of the development of methods by DTU for mapping and assessment of wind-resources; from its infancy 40 years ago when the mapping covered Denmark only, then how it was further developed to cover Europe and finally resulted in the creation of a Wind Atlas that covers the globe.

In the infancy of the modern development of wind energy, well-proven methods of determining the wind resource for single turbine locations or for a wider region were lacking, necessitating recourse to using local measurements, provided they existed. It soon became clear that the straightforward extrapolation and interpolation of standard meteorological measurements were not satisfactory and often came up with quite erroneous results. Therefore, national and international projects were initiated to develop methodologies based on basic meteorological principles for calculating site-specific and regional wind resources by means of climatological measurements. One such project was the European Wind Atlas (EWA), the aim of which was to establish a meteorological basis for assessing the wind resources of the European Union (1981 -1989). A methodology, called the wind atlas method, was developed, resulting in a comprehensive set of models for the horizontal and vertical extrapolation of meteorological data and estimates of wind resources. The models are based on the physical principles for flow in the atmospheric boundary layer, and they take into account the effect of different surface conditions, sheltering effects due to buildings and other obstacles, and the modification of the wind imposed by the specific variations of the height of the ground around the meteorological station concerned. In fact, the wind atlas methodology was borne out of an earlier project, the Danish Wind Atlas, which actually builds on the application of a fundamental meteorological concept: geostrophic wind (the wind aloft) and its climatology, which was determined using long-term pressure measurements at about 55 synoptic stations in and around Denmark. Hence the development of 'the wind atlas method' was initiated during the construction of the Danish Wind Atlas. The European Wind Atlas covers a land area of about 2.25 million km<sup>2</sup>. It employs surface observations of wind speed and direction, measured over a ten-year period, to determine the wind climate.

After the publication of the European Wind Atlas in 1989, it became clear that it was necessary to develop the methodology further in order to decrease uncertainty surrounding the calculations in complicated topography and climatology. The first major step was an attempt to combine mesoscale and microscale models. Up to that date, insufficient computer power and storage, as well as the lack of sufficiently detailed climatological data and high-resolution topographical information, had made such an approach impossible. However, the ever-increasing computer power and the advent of publicly available large databases on long-term global wind climatology and high-resolution topography (orography and land use) showed the potential to develop the wind atlas methodology further, that finally resulted in a wind atlas that now covers the whole globe (normal, TNR 11, this is the abstract text and the maximum length is to the bottom of this page)