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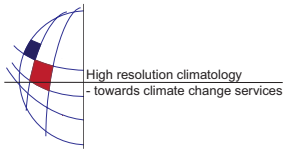

Dynamical downscaling of wind fields for wind power applications

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Investments in wind power require information on the long-term mean wind potential and its temporal variations on daily to annual and decadal time scales. This information is rarely available at specific wind farm sites. Short-term on-site measurements usually are only performed over a 12 months period. These data have to be set into the long-term perspective through correlation to long-term consistent wind data sets. Preliminary wind information is often asked for to select favourable wind sites over regional and country wide scales. Lack of high-quality wind measurements at weather stations was the motivation to start high resolution wind field simulations

The simulations are basically a refinement of global scale reanalysis data by means of high resolution simulations with an atmospheric mesoscale model using high-resolution terrain and land-use data. The 3-dimensional representation of the atmospheric state available every six hours at 2.5 degree resolution over the globe, known as NCAR/NCEP reanalysis data, forms the boundary conditions for continuous simulations with the non-hydrostatic atmospheric mesoscale model MM5. MM5 is nested in itself down to a horizontal resolution of 5 x 5 km^2. The simulation is performed for different European countries and covers the period 2000 to present and is continuously updated. Model variables are stored every 10 minutes for various heights. We have analysed the wind field primarily.

The wind data set is consistent in space and time and provides information on the regional distribution of the long-term mean wind potential, the temporal variability of the wind potential, the vertical variation of the wind potential, and the temperature, and pressure distribution (air density).

In the context of wind power these data are used

- as an initial estimate of wind and energy potential
- for the long-term correlation of wind measurements and turbine production data
- to provide wind potential maps on a regional to country wide scale
- to provide input data sets for simulation models
- to determine the spatial correlation of the wind field in portfolio calculations
- to calculate the wind turbine energy loss during prescribed downtimes
- to provide information on the temporal variations of the wind and wind turbine energy production

The time series of wind speed and wind direction are compared to measurements at offshore and onshore locations.