Geophysical Research Abstracts
Vol. 13, EGU2011-1339, 2011
EGU General Assembly 2011

Wind atlas mapping in the South Baltic Sea: methods and results

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Wind resources offshore are difficult to map. Firstly, meteorological data collection is cumbersome and costly, thus data are sparsely available. Secondly, meteorological conditions over sea – in particular in enclosed seas and near coastlines – can be significantly influenced by the advected air mass from land. In the South Baltic Sea, the offshore wind resources are mapped in the regional EU project South Baltic OFF.E.R. (South Baltic Offshore Wind Energy Regions) as several wind farms are being planned in the area. In fact, more than 12 GW wind power capacity is being planned. The method for producing a new wind atlas for the South Baltic Sea, and some results, will be presented. The method is built on mesoscale modeling, satellite-based wind maps, and meteorological data. For the mesoscale modeling the Weather Research and Forecasting (WRF) model is used in forecasting mode. Nearly two years of forecasts are weighted by long-term index with statistical-dynamical downscaling. The long-term record from 1980 to 2009 from NCEP/NCAR re-analysis is used for assessing the wind variability. The area is large and several re-analysis grid points are available within the area. Therefore, testing of the correlation between these grid points is done, as it is important to downscale in representative ways. It is clear from these correlation results that the wind climate is variable in the South Baltic Sea and therefore different statistical-dynamical downscaling will be done dependent upon location. The WRF results are evaluated with the available meteorological data. However, as stated before these data are sparse. Therefore, in addition, high-resolution satellite-based radar data are retrieved, calibrated and processed into wind maps. The CMOD5 Geophysical Model Function is used in combination with wind direction from a global atmospheric model of the US Navy. At Risø DTU we operate the ANSWRS software from Johns Hopkins University Applied Physics Laboratory. More than 3000 satellite scenes from the European Space Agency (ESA) from Envisat ASAR wide swath mode are used. The mean wind speed and Weibull parameters are compared to the WRF results. Furthermore, QuikSCAT wind maps and wind statistics from 1999 to 2009 observed twice daily are also used for comparison. Both Envisat ASAR and QuikSCAT wind maps are representative for 10 m winds, thus only at this level the comparison is possible. At higher levels, only mesoscale model results and tall met-masts directly provide results. The final result are wind atlases (tab or lib files) from which local downscaling for siting using the Wind Atlas Analysis and Application (WAsP) developed at Risø DTU can be used.