Offshore wind resources: evaluation of satellite-based results in the North Sea

Charlotte Bay Hasager, Merete Badger, and Jake Badger

Risø National Laboratory for Sustainable Energy - DTU, Wind Energy, Roskilde, Denmark (cbha@risoe.dtu.dk, +45 4677 5970)

Offshore wind resources are evaluated from three meteorological masts and satellite Synthetic Aperture Radar (SAR) observations for a study area in the North Sea. The analysis included evaluation of wind profiles from the meteorological mast near the Horns Rev offshore wind farm, the FINO-1 meteorological mast and the Høvsøre meteorological mast. The latter is located 1.4 km inland from the North Sea coast in Jutland, Denmark. Therefore the WAsP program has been used to estimate the wind resource over sea. The satellite SAR radar imagery has been processed using the Johns Hopkins University Applied Physics Laboratory software ANSWRS. The wind maps have been used in different configurations before comparing to the meteorological wind resource statistics: 1) all wind maps are averaged and fitted by the Weibull distribution function; 2) a random selected sub-set of wind maps are used similarly; 3) a non-randomly selected sub-set of wind maps are used similarly. For the last selection it was chosen to use around 135 wind maps for which each represent prevailing conditions as found from long term large scale using NCAR re-analysis results in a nearby grid point. The SAR wind maps are selected such as to match well these conditions. Furthermore, prior to the Weibull fitting the selected wind conditions are weighted representatively. E.g. in case medium strong westerly winds with near neutral stability occur 3% of the time the weight given will be 3% for the wind map representing this condition. The results show that the mean wind speed and Weibull scale (A) is within 5% and the Weibull shape (k) and energy density is within 7% for the study of the meteorological observations. The study is part of the EU-Norsewind project.