VERIFICATION OF AN OFFSHORE WIND-ENERGY MAPPING TOOL USING SATELLITE SAR IMAGES
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ABSTRACT

Offshore wind resource estimation by one of satellite-based wind speed and wind direction images is investigated by the RWT project at the Horns Rev site, Denmark. The satellite images are ERS-2 SAR. The satellite wind maps are input to offshore wind resource calculation programme called WEMSARITOOL. This software is based on the RWT method, however, with some modifications due to the different type of wind observation data compared to classical wind observations. The wind speed information in ERS-2 SAR wind maps is based on a signal resolution of 400 m by 400 m. Dependent upon the actual wind direction, it is therefore necessary to average wind speeds in the upwind area of the site or to use a 2-dimensional Fast Fourier Transform (FFT) wind streak vectors. Furthermore the wind parameter is often more than 108 m as obtained. The accuracy of the offshore satellite-based wind resource image map over (20 km) 400 m, however, it is thought to be useful in remote areas e.g. at feasibility studies. The satellite SAR observations are available for many sites worldwide, hence any office work will be fatued to obtain offshore wind resource maps from satellite SAR.

WEMSARITOOL is developed by NERSC and Risø within the WEMSAR (Wind Energy Mapping from SAR) project.

METHOD

The RWT offshore satellite-based wind resource mapping SAR system uses map wind speed over the area is used for estimating offshore wind resources. The satellite images from ERS-2 SAR are obtained and come around 10 years of observations from daily to be monthly intervals at most sites on the globe. A series of scenes e.g. 40-70 are necessarily for obtaining reliable statistics (please refer to Pryor et al. (OWEMES, 2003)).

The nominal accuracy on wind speed is +/- 2 m/s and +/- 20 degrees, but may in fact be better according to some investigations (e.g. Hasager et al. (2002)).

The method of area-averaging spatial wind data from satellite for assessing wind resources and for calibration analysis in these remote meteorological observations from marine, is done through footprint analysis. The wind is in the local area of ellipse shaped footprint site in the period of interest is averaged linearly or non-linearly depending on the chosen method.

CONCLUSIONS

Offshore wind resource estimation by one of satellite-based wind speed and wind direction images is now possible by one of the WEMSARITOOL software. The accuracy of an offshore satellite-based wind resource image map is not yet fully known, however it is thought to be useful in remote areas e.g. in feasibility studies. The satellite SAR observations are available for many sites worldwide, hence any office work will be fatued to obtain offshore wind resource maps from satellite SAR.

Acknowledgements and references

T. Pryor et al. "Verification of an offshore wind-energy mapping tool using satellite SAR images" in EGS-AGU-EUG 2003 Joint Assembly, Nice, France, 7-11 April, 2003. For further information visit www.nerc.ac.uk/remote/wemsar.htm or email charlotte.hasager@risoe.dk

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