

Interactive comment on “US East Coast synthetic aperture radar wind atlas for offshore wind energy” by Tobias Ahsbahs et al.

Rémi Gandoin

rga@c2wind.com

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Dear authors, many thanks for this paper, which I read with great interest. The detailed explanation of the SAR data processing is very useful, and I learned many interesting things. I have made some comments as I read the paper, you will find them below. I hope that at least some of them will be relevant for your work.

All the best, Rémi Gandoin. C2Wind.

—Section 1—

Page 1 Line 25: "on the continental shelf of Northern Europe since 2001". The first offshore wind farm was commissioned in the Baltic Sea Denmark in 1991, do you mean the "North Sea Continental Shelf" ?

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Page 2 Line 2: "long-term wind statistics". Consider adding "at hub height".

Page 2 Line 16: "at scales around several hundred kilometers". You mean the swath width is o(100km) ? Or the length scales of the wind patterns ?

Page 2 Line 17: "SAR is better suited for resolving wind resources in coastal zones because of its higher resolution". Here, I would like to ask: 1) is the SAR resolution mentioned here the "raw" resolution, or the 10m neutral wind speed spatial resolution, after the GMF has been applied ? 2) How does this resolution compare with the WRF resolution (i guess you mean the actual physical resolution of the scales that WRF can resolve, that is up down to but not smaller than what is left to the PBL schemes, and not the grid size))? 3) From 1) and 2), why is that increased resolution a benefit ?

Page 2 Lines 18 and 19 : "accurately" and "similar". Can you quantify ?

Page 2 Line 20. Can you here mention as well the limitations of SAR in shallow waters ?

—Section 2.1—

Page 3 Line 11: "The positions of buoys". I may be wrong, but at this stage I have not seen a reference to the NDBC database (where the data originate I guess). Can you refer to it ?

Figure 1 : Can you add water depths contour lines, as well as wind farms lease areas ? Aren't you missing 44008, the Nantucket Shoals buoy ?

—Section 2.20—

Table 1: please add units to the table headers.

—Section 2.3—

Page 4 Line 11: "High-quality wind and temperature measurements". How do you define "high quality" and argue for it ?

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Page 4 Line 17: "from specific buoys". Which ones ?

—Section 3.1.—

Page 5 Line 15: "equivalent". What does "equivalent" means in this context ?

Page 5 Line 18: "needs to be known a priori". With what accuracy and precision ?
What is the wind direction is wrong by 5,10, 30° ?

Page 5 Line 19: "to match the SAR images". What does this mean ?

Page 5 Lines 20 and 21: Please check the wording.

—Section 3.2—

Page 5 Line 28: "should". Please explain. As I understand from the information presented until now, these could only be compared reasonably with spatially averaged (to some, yet unspecified, spatial resolution) measured wind speed values at 10m in neutral conditions (can these be found ? I remember the buoys are about 4 m tall, and the atmosphere rarely neutral).

General remark: (Badger et al, 2019) is quite a central piece here, yet the paper is not yet available (and not yet submitted as I understand). This is limiting the interpretation of the results, as I am curious to understand what are these biases, how they have been quantified and how they can be corrected. Could you maybe disclose at least some of the main results and bias correction figures ?

—Section 3.2.1—

Page 6 Line 19: "are expected to perform poorly in these conditions." Reference missing, possibly <https://ieeexplore.ieee.org/document/8016397> ?

Page 6 Lines 21-22: "SAR winds are instantaneous". I remember reading that SAR images were approximately 1-minute averages, what do you mean by "instantaneous" ?

Page 6 Line 12: "matched with the closest buoy time stamp": does the validation

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improve by interpolating between the 8-minute hourly measurements ?

Page 6 Lines 22-23. "better match the temporal average of buoy measurements". Can you explain how 3 km was chosen ?

Figure 2: Can you show density scatter plots instead of regular scatter plots ? Can you compute for every buoy the mean bias and the RMSE, and display these values on a histogram ? It could be interesting to show these in a Table and on a map as well. Depending on the amount of samples in each stability class (stable/unstable), the same information information could be presented for both of these subsets (for each buoy).

—Section 4.1—

Figure 4: Could these maps be shown for the periods Oct-Mar and Apr-Sep ? As explained in <https://findit.dtu.dk/en/catalog/2443553221>, stability conditions greatly vary along the East Coast, due to the Gulf Stream, the Labrador current, the polar vortex and the Azores high. In Southern New England for instance, cold water in shallow waters (like Georges Bank) lead to stable conditions during summer, and thereby small wind speeds at the surface. I note that the large wind speed area in (a) correlate well with the outer continental shelf bathymetry contour line (see https://www.researchgate.net/profile/Jason_Link/publication/228680188/figure/fig3/AS:667854709993487@15362403797-of-the-Northeast-US-continental-shelf-ecosystem-which-is-inhabited-by-pollock-Depth_W640.jpg), and thereby it could be interesting to understand whether the map could be biased by differences in stability conditions. Could you show the 100mMSL wind speed from WTK ?

—Section 4.1.2—

Table 2: please add units to the table headers.

—Section 4.2.1—

Figure 11: Section no. 300 marks a clear difference between the SAR

and WTK data close to the coast. How can this be explained ? Maybe by colder water temperatures in reality than in the WTK model ? See cross sections of SSTs from MODIS for the year 2018 on this Figure: https://www.dropbox.com/s/0r26vzovcfw1eoj/SST_transects_large.png?dl=0.

—Section 4.2.3—

Page 23 s 8-9: "Note that a mesoscale numerical weather prediction model such as WRF is unable to pick up wind speed variations in the order of 0.5 m/s, and their RMSEs are typically more than 0.5 m/s.". Please provide specific references.

—Section 5—

Pages 24 Line 1: "tendency to overestimation for low wind speeds and underestimation for high wind speeds". Is this more than a tendency, maybe a consistent negative bias in unstable conditions and a positive bias in stable conditions ? Could you quantify "overestimation", "underestimation", "low" and "high" wind speeds ?

Page 25 Line 27-28: " Comparisons at 10 m are nonetheless valuable to assess differences relative to mesoscale models and to gain insight in the horizontal variation of wind resources.". I suggest to add "provided that the stability conditions are the same across the area of interest".

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