

Review of “Ship-based lidar measurements for validating ASCAT-derived and ERA5 offshore wind profiles” by Hugo Rubio, Daniel Hatfield, Charlotte Bay Hasager, Martin Kühn, and Julia Gottschall

**General comments**

The authors conducted a comprehensive comparison of wind profiles derived from the Advanced Scatterometer (ASCAT) satellite observations and the ERA5 reanalysis dataset against ship-based lidar measurements in the Northern Baltic Sea. Their analysis revealed a consistent underestimation in ERA5 profiles and an overestimation in ASCAT profiles when compared to ship-based lidar measurements. Additionally, they reported that the accuracy of both datasets deteriorates with height, a trend that is particularly pronounced in ASCAT profiles due to the limitations of the extrapolating methodology. The study is well conducted, and the methods used are appropriate. In particular, the use of ship-based lidar measurements to validate satellite-based and reanalysis datasets is a valuable approach, as their accuracy can be dependent on the distance from the coast.

These findings will be of interest to researchers in wind energy meteorology, as well as to engineers assessing offshore wind energy resources. However, the manuscript still has room for improvement before publication, as it lacks a positive message highlighting the significance of their findings through the manuscript. I have following concerns regarding the manuscript:

- Page 5, Figure 2: Although a height of 100 m is used as the reference height in this study, the hub height of recent wind turbines often exceeds 100 m. It would be helpful to explain why you chose 100 m as the reference height.
- Page 20, Figure 20: Since the ERA5 profiles above the surface layer are calculated using the PBL scheme, they exhibited more natural profiles than ASCAT-based dataset profiles as shown in Figure 12. Rather than using surface parameters from ERA5 for the vertical extrapolation of ASCAT, a simpler and potentially better approach might be to combine the surface wind field from ASCAT with wind profiles from ERA5.
- Additionally, the abstract currently concludes by highlighting the issues with the extrapolation method for ASCAT surface wind speeds. However, it would be more effective to end on a positive description, emphasizing the advantages of ASCAT-based offshore wind resource assessment.
- Page 25, Line 528–533: It is stated that there is a negative impact up to 40 km from the coast, but this seems rather extensive given the ASCAT data resolution of 12.5 km. This could lead to the impression that this dataset is unusable in near-shore areas. Considering the potential application of ASCAT data, it might be beneficial to examine this issue more carefully.
- Page 25, Line 524–540: It would be beneficial to describe the relationship between the

validation results of ASCAT and ERA5 in this study and previous research. Additionally, instead of listing numerical values in the main text, presenting them in tables would make the information clearer and easier to understand.

#### **Minor comments**

- Page 5, Line 103–104: In Section 2.1, it would be beneficial to include information on the accuracy of the ship-based LiDAR, particularly regarding whether there is any difference in accuracy compared to fixed LiDAR systems.
- Page 5, Figure 2: It would be more informative if Figure 2 were improved by using a geo-bubble chart or other visualization methods to plot the data on the map.
- Page 6, Line 138–149: It would be helpful to include a comparison table of ASCAT and ERA5 specifications in the Data and Methods section (Section 2).
- Page 15, Figures 7 and 9: In Figure 7, points A–F are indicated, but longitude is used in the figure's labeling. It would be better to ensure consistency in notation.