

Wind Energ. Sci. Discuss., referee comment RC2
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Comment on wes-2022-40

Anonymous Referee #2

Referee comment on "Evaluation of low-level jets in the southern Baltic Sea: a comparison between ship-based lidar observational data and numerical models" by Hugo Rubio et al., Wind Energ. Sci. Discuss., <https://doi.org/10.5194/wes-2022-40-RC2>, 2022

The manuscript presents three months of lidar measurements made from a commercial ship ferry at a regular route. All types of offshore surface-based measurements are potentially interesting due to the scarcity. Especially wind field measurements in the Baltic Sea are of importance due to the upcoming expansion of offshore wind energy in the region. The presentation of the manuscript is overall quite good with clear figures. I noticed some language issues and some places where the references are presented in an unusual way.

This data set is tricky to analyze. It is too short to do climatological studies or analyze seasonal variation. Additionally, the variation in space is also a challenge. Although the authors make a good effort to address the latter, the data-set is biased in the way the measurements always seem to be from the same location at the approximately at the same time of day. This makes analyzes of temporal variation from one point not possible.

However, my main concern is that the main results of the study is the comparison with the reanalyses products. It is not clear what is really novel here that hasn't already been published in similar studies from the same region using the same reanalyses products, which you also cite in the manuscript e.g. Witha et al. 2019 and Hallgren et al. 2020. To be able to accept this manuscript I would like to see some more, other type of analysis trying to get a deeper understanding of the results from the comparison such as: During what conditions do the models perform better/worse? Also adding more evaluation metrics could be useful in this sense. How can one use these results to improve the models? Discussion of the benefits of using ferry based Lidar would be useful and give examples of these. Illustrative case studies could also be useful e.g. perhaps for some specific synoptic situation where the analysis would benefit from a moving platform. Is it possible to use this type of platform to evaluate models for internal boundary layer? These are just some examples, but this study would require some more along these lines.

Specific comments:

Line 3: it is stated that the objective is to evaluate performance of the ship-mounted lidar to investigate LLJ properties along the ship track. However, I can't see that this is presented in the manuscript. The LLJ properties from Lidar measurement are presented, but the performance is not evaluated in any formal sense.

39: "results **are** insufficient"

51: LLJs in the Baltic Sea have been studied also before the mentioned references. 1984 Högström and Smedman present a first paper where the LLJs formation mechanism is described as an "analogy in space to the classical Blackadar nocturnal jet frequently observed in continental areas". This mechanism is missing in this section. Other studies also followed from the group e.g. Smedman et al. 1995: Spectra, variances and length scales in a marine stable boundary layer dominated by a low level jet, BLM, 76(3):211-232.

61: "sloping topography" (not sloppy)

63: Concerning the Stensrud 1996 reference: I think this was first presented in Holton 1967: The diurnal boundary layer wind oscillation above sloping terrain. Tellus

69-70 a detail but is there support to say that NEWA is one of the most frequently used re-analyzes products? ERA-5 is for sure one them though.

116: "likewise in any" replace with something like "and like any"

118: why was -23 DB limit chosen?

121 I suggest replacing "filtered" with "rejected"

122 how is this 70% limit different from the 80% limit mentioned on line 121?

125 replace "capture" with e.g. "simulate"

134 and 139 : correct reference for ERA-5 Hersbach et al. 2020
<https://doi.org/10.1002/qj.3803>

146-147 how did you deal with this (mismatch between cycles)

155 "spin-off" replace with "spin-up"

179 "concentrates" do you mean "conserves"?

201 Reference Kalverla: The handling of references should be to place the parenthesis around the year only. This needs to be checked at several places in the manuscript

202 "extended" replace with "extending"

217 comparison with Witha et al: you are using essentially the same data set as Witha et al., please comment on why the results are different.

247 "misestimation" replace with "underestimation"

249 Cheinet at al. year missing

263-264 the onshore daily cycle is well studied as mentioned previously in the manuscript.

267 Can you motivate the choice of these four locations?

Figure 8: does this figure show comparison of co-located model-observations pair in time also, or just the location co-location?

281 "appearance" replace with "occurrence"

Section 3.2.2. you use the term "inshore", "near shore" and "onshore" to describe the same locations, please be consistent.

282-283 not following here, in the previous sentence it is stated that the frequency is overestimated in ERA 5 140% and then it is stated that it is underestimating in this sentence (?). Please clarify.

294-295 "The increase in the wind profile" do you mean the extension of the analyzed wind profile height in the models?

Figure 9 Here you could add the lidar measurements in the shadowed areas. Additionally, this type of analysis would benefit from some more statistics: do the means differ from each other significantly? What is the spread around each averaged point?

Table 3: Why not add the Lidar measurements in the comparison and present a similar analysis as in Figure 9?

Figure 10: Is there any correlation between frequency bias and the forecast length? Are the means statistically significantly different?

359 "alarm" the correct term is "false alarm", you need to correct this at several instances in the manuscript.

Table 4: spelling "mises" --> "misses"

382 Last sentence: please clarify, it's hard to follow the reasoning here.

Figure 11: Why not include ERA and NEWA in the same plot? This would make the comparison easier.

Figure 12: Other options are also available and should be commented: e.g. interpolate the nearby model data to the measurement location or combining a spatial and time window.

491 One way to investigate how successful the motion correction is would be to study the

spectrum of the velocity measurements. If the motion correction algorithm is successfully implemented the peak around the mean wave period should be removed. Although this requires access to the raw turbulence data from the lidar which might not be the case here (?)