

*In this document, the reviewer's comments are in black, the authors' responses are in red.*

The authors thank the reviewer for their thoughtful and productive comments.

The paper presents a study of how well the ERA-5 reanalysis dataset and a WRF-based dataset can represent the wind conditions at two locations in North America for one year and an assessment of whether ERA-5 is sufficiently good for estimating wind resources in simple terrain, or whether mesoscale modeling is required.

The paper is well written and introduces the problem and the state-of-the-art well too, but misses references to a few recent studies that are relevant (see one specific example in general comments below). The figures in the paper and the accompanying descriptions of the results are easy to read and understand. The scope of the study is quite narrow, representing just two specific locations. However, both sites are of high relevance for wind energy and represent two distinct and relevant wind climates. Although no clear-cut answer is given to the question in the title of the paper, important results and their implications are discussed.

Four metrics based on wind speed are used to judge the model's performances: bias, centered root-mean-square error (cRMSE), Pearson correlation coefficient, and Earth Movers Distance (EMD). I believe the paper could benefit from including additional wind-energy-relevant metrics, for example, wind direction metrics, such as directional RMSE or directional EMD, and/or wind power metrics (power density or power production estimate).

All in all, I found the paper interesting and valuable and would recommend accepting it with minor revisions.

### Specific comments

- P1L10 - I wonder if it actually is surprising that ERA-5 has a higher correlation, for hourly averages, than WTK-LED, perhaps choose a more neutral statement or expand on why it is surprising. From my experience, when looking at one point, reanalysis datasets and coarse mesoscale data often have a higher correlation than high-resolution mesoscale data due to higher variance (temporally and spatially) and phase errors  
*We have replaced the word “surprisingly” with “on the other hand”.*
- P3L60-63 - I think you should reference previous comparisons between ERA-5 and WRF-based datasets for wind resource assessment accuracy, such as Dörenkämper et al. (2020), which you cited earlier in the introduction, which evaluated the models against a large number of masts in varying levels of terrain complexity in Europe and found significant underestimation of wind resources by ERA-5  
*We have added the following sentence: “A similar analysis was performed for the WRF-based New European Wind Atlas by Dörenkämper et al. (2020), who found a significant negative bias for ERA-5.”*
- P8 table 1 - If possible, it would be good to provide the references to the different datasets and WRF physics options  
*We have added the following comment: “All the main setups that have been shown to have a major impact on modeled wind speed (e.g., the choice of the planetary boundary layer scheme and of the atmospheric forcing) are the same between the offshore and land-based*

domains. For some other setups, different choices were made between the two domains in order to optimize and tailor the numerical simulations to the specific needs of each domain.”. Papers dedicated to the presentation of the new WRF datasets and their setups will follow as soon as all the planned regions are completed.

- P8L150-151 - "Confirmed" sounds as if it matches expectations or confirms previous studies showing that, is that the case? I am not convinced that nearest-neighbor interpolation has been shown to definitely be better in most cases  
We have changed this to “showed”.
- P14-15 Figure 8-9 - Why was the blue-to-red colormap flipped for the correlation coefficient subplot? I found it a bit confusing  
The colormap was flipped compared to panels c and e because for cRMSE and EMD, a negative value for the difference between the metric from WRF and ERA-5 will indicate that WRF outperforms ERA-5, whereas for the correlation coefficient the opposite is true. In other words, we wanted to be consistent with the idea that red colors in all three panels will show that ERA-5 outperforms WRF, and vice versa for blue colors.
- P16L261 - Is wind power plant wakes represented at all by WTK-LED? if not I would change it accordingly, now it sounds as if partly represents wakes. In the last line, the conclusions (P17L295) leads me to believe that wakes are not resolved (yet) in WTK-LED  
Thanks for letting us notice this was not clear. We have rephrased the sentence as “This result suggests how wind power plant wakes, which are not represented by WTK-LED, might contribute to its strong overestimation of wind speed during stable conditions.”
- P17L274 - If possible please also offer an explanation, or perhaps just a speculation of the potential explanation, for the exaggerated average diurnal cycle. Perhaps it stems from the PBL and SL schemes used?  
Unfortunately, we do not have a potential explanation at the moment. At the offshore site, we have seen the same behavior also when considering different WRF setups (in terms of different reanalysis product, PBL scheme, SST product, and SL scheme). We have currently in progress an analysis of a similar validation in complex terrain, which might help finding the reasons for the observed variability.
- P17L285 - Bias correction techniques are indeed valuable, but I think it is important to stress that they require observations or another reference dataset, known to do well at the site. Part of the motivation in your paper is that ERA-5 and WRF can serve as a cheap alternative to observations  
We have added the following comment: “With this in mind, we can expect that the worse ERA-5 performance in terms of bias would be easier to accommodate when compared to the WTK-LED underperformance in terms of random error (cRMSE) and correlation, with the caveat that observations of the wind resource, which might be challenging and/or expensive to obtain, are needed for a successful bias correction.”
- P17 data availability - Please state whether WTK-LED data can be obtained, and if so from where

We have added the following statement: “The WTK-LED data for the offshore domain are publicly available at <https://maps.nrel.gov/wind-prospector/>. The WTK-LED data for the land-based site will be available to the public in the future.”

### Technical corrections

- P4L92 - I would suggest using a consistent minus-sign throughout the paper,  $-\$21$  dB instead of -21 dB, etc  
Changed.
- P5 Figure 2 and P5L108 - I would suggest  $24 \times 12$ , e.g. using latex `\textbackslash times\`  
Changed.
- P5L105 - friction velocity and temperature flux units seem to have too much space between letters  
Changed.
- P9L173 - question mark in cite parenthesis, perhaps a reference was not compiled correctly?  
Fixed.
- P14-15 Figure 8-9 - Subplot letters missing  
Added.