Wind Energ. Sci. Discuss., referee comment RC1
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Comment on wes-2021-97

Anonymous Referee #1

Referee comment on "Can reanalysis products outperform mesoscale numerical weather prediction models in modeling the wind resource in simple terrain?" by Vincent Pronk et al., Wind Energ. Sci. Discuss., https://doi.org/10.5194/wes-2021-97-RC1, 2021

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
- 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
- P8 table 1 - If possible, it would be good to provide the references to the different datasets and WRF physics options
- 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
- P14-15 Figure 8-9 - Why was the blue-to-red colormap flipped for the correlation coefficient subplot? I found it a bit confusing
- 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
- 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?
- 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
- P17 data availability - Please state whether WTK-LED data can be obtained, and if so from where

Technical corrections

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