

# ***Interactive comment on “Low-level jets over the North Sea based on ERA5 and observations: together they do better” by Peter C. Kalverla et al.***

## **Anonymous Referee #2**

Received and published: 18 February 2019

### **General comments:**

The manuscript provides an analysis of low-level jet (LLJ) statistics over the North Sea and combines reanalysis model data with actual observations from tall masts. A strength of the paper is that the authors point out the limitations of the respective datasets and show methods to overcome these limitations – some of them less, some more useful. Furthermore, the style and language of the paper is outstanding. The authors manage to explain methods and present results in a simple and clear language. At some places further clarifications would be helpful as detailed in the specific comments below.

I would like to highlight that the authors provide extensive supplementary material in form of a few Jupyter notebooks. These provide detailed information about how the

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results were retrieved and allow readers to reproduce the analysis which makes the paper even more valuable.

A comment needs to be made about the graphics style. The authors use a special python package that revamps figures in a sketchy style. My personal opinion is that I like this style and I think it makes the paper much more attractive and accessible. While it is clearly beneficial for figures that show concepts and where exact curves or numbers are not intended or would even be misleading, it is questionable regarding really scientific graphs that illustrate results (measured or simulated). I assume the authors intend to convey that the results are to be seen with some uncertainty, and in this respect I would support the consistent use of the sketchy style. Perhaps it would be helpful to include a note about this? Otherwise, I believe that there will be some readers which will strongly object to this style and put the seriousness of the paper into question.

In general, I recommend the paper for publication after minor revisions.

### Specific comments:

Page 2, lines 5-11: The literature review on previous LLJ studies, in particular LLJ statistics, is a bit short and should be extended.

Page 3, line 32: “Observations are available from seven sites (Figure 1B).” → Make clear that only LiDAR observations are used, not met mast data.

Page 4, line 1-2: “More information on the quality control and post-processing of the LiDAR data can be found in Appendix A.” Add “data availability” to the sentence → “More information on the data availability, quality control and post-processing . . .”

Page 4, line 20: “At MMIJ (. . .) this representativity bias reaches upwards of 1 ms<sup>-1</sup>” → In Fig. 2A the lines for MMIJ are only 0.4 m/s apart, not 1 m/s, and the bias for many

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of the other sites is much larger. Please correct or clarify what you mean.

Page 4, line 30: “An error diagram of the wind speed in ERA5 versus observations” → Which ERA5 dataset is meant: the full 10-year dataset or the subsets? Please clarify also in the caption of Fig. 2.

Page 4, lines 31-34 and Fig. 2C (error diagram): By definition and as also obvious from the figure RMSE and STDE are the same, aren't they? Your description of the figure and the figure itself suggest that there is a difference.

Page 5, lines 8-9: “We hypothesize (. . .)” → Is there any literature available that could support your hypothesis?

Page 6, lines 4-18 and Fig. 3: Can you add numbers to Fig. 3 (and/or to the text)? By how much is the data reduced from A to C or B to D? It seems as if even below 300 m much more than 50 % of the data is removed.

Page 6, line 20: “Simple visual inspection indicates that ERA5 does not perform well.” → Give more details, e.g. similar height distribution but much smaller falloffs.

Page 6, lines 20-22: “A contingency table (. . .) shows a very low critical success index (. . .) and probability of detection (. . .)” → Explain what this means, maybe also show the table.

Page 6, line 27: “other characteristics appear to be captured quite well” → Add “e.g. the distribution of LLJs with height”. Footnote 2: “In contrast to model level data (. . .)” Elaborate on this: why do the model level heights vary (is clear to me but maybe not to every reader)? How does adding jitter work?

Figure 3: Explain why the points are organized in these “bands”. I assume this is due to the discrete model levels which vary in height.

Page 9, line 14: “the ERA5 data” → The full dataset (A) or the subset (B)?

Page 9, line 10-18: Please clarify this procedure a bit more. It is hard to follow.

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Figure 5A: Is it unclear if the dashed line in Fig. 5A is derived by the procedure described on p.9, l.13-14 or by the procedure described on p.11, l.5.

Page 10, lines 6-9: Clarify that each pair of monthly observed and simulated LLJ is considered. And clarify that all sites are taken together so that you obtain one single scaling factor for the combined dataset.

Page 11, lines 23-24: “It appears that the low-level jets occur throughout the day, but with a small dip around 11 UTC.” → The dip is not so small, the LLJ probability is significantly reduced between 8 and 16 UTC. Do you have explanations for this diurnal cycle and what does the literature say?

Page 11, line 26 and Fig. 7A-C: “but again, the magnitude differs” → In Fig. 7A-C the dashed lines have the same magnitude. Please clarify.

Page 13, lines 2-9: Please describe which area you used to determine the LWT – is it the area shown in Fig. 8? So on how many grid points is the LWT derivation based? I assume you are using the ERA5 sea-level pressure field? How do you obtain the streamlines: Are you averaging all situations belonging to one LWT?

Figure 8: “Amplitude is off by a factor of 2 (best guess)?” → What does this mean? It becomes clear from the text, but I would recommend to omit this information in the figure caption.

Page 14, lines 23-30: Can you give references for this type of procedure?

Page 16, line 15: “Notice that this seasonal cycle is very erratic” → That is not surprising as it is only based on two years of observations.

Page 16, lines 18-19: “we reconstruct the predicted seasonal cycle by grouping and aggregating the predicted probabilities for each month” → Please give more details.

Page 17, lines 1-2: “This is our best estimate of the low-level jet seasonal cycle (. . .)” → Please link to the results in section 6 (which give a similar results).

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Section 9: Very nice summary of the paper!

Figure A1A: What does the colour coding mean?

### Technical corrections:

Page 6, line 2: “observatings” → “observations”

Page 6, lines 12-13: “This effectively filters out all meaningful jet events (. . .)” → I guess you mean “This effectively filters out all **not** meaningful jet events (. . .)”?

Page 6, line 13: “wind profiles” → “wind profile”

Page 9, line 12: “(the dashed black line if panel E)” → replace “if” by “in”

Page 10, lines 2-3: “are required obtain a reliable estimates” → “are required to obtain a reliable estimate”

Page 12, line 12: Add “(not shown)” at the end of the sentence.

Page 16, line 15: “Notice that” → “Note that”

Page 19, line 24: Please add the actual link of the Jupyter notebooks or mention that they are included as supplement to the paper.

Page 20, line 13: “outputted” → “output”

Page 24, line 2: Kalverla et al. (2019): Add the correct volume number (currently “0”).

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Interactive comment on Wind Energ. Sci. Discuss., <https://doi.org/10.5194/wes-2018-79>, 2019.