

# ***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 #1**

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Review of ‘Low-level jets over the North-Sea based on ERA5 and observations: together they do better’, by Peter Kalverla et al.

### General comments

To my knowledge the authors are the first to publish a spatial climatology of low-level jets over the North Sea. This feat alone is a welcome initiative given the importance of this area for the wind energy sector, which will only increase in the coming decades. Moreover, the authors combine the spatial and temporal coverage of state-of-the-art reanalysis data with an extensive set of lidar observations from ten offshore platforms. Carefully addressing the pros and cons of both the model data and the observations, as well as properly discussing the difficulties in issues like LLJ detection, they provide a highly relevant and balanced overview of LLJ characteristics in the area of interest.

The manuscript has a clear focus and the results are described to-the-point. Methods are valid and the interpretations justified. For readers interested in more details, or want to reproduce the results, the authors provide extensive supplementary material. Overall, in my view this work can be finalized after minor revisions.

#### Specific comments

p1,ln8: 'bias of 1m/s' Ambiguous. Clarify that this is compared to the long-term mean.

p4,ln10: Specify on what grid the ERA5 data was retrieved for the present study.

p4,ln2: Given the large variability in data availability, it would be worthwhile to have Fig A1 here in the main text.

p4,ln14: 'gridpoint closest to meas. location'. Is this the case for the entire manuscript? I guess spatial gradients in ERA5 cannot be a priori ignored off the Dutch coast, in particular when plotting subtle differences as in Fig 2C. From suppl. inf. I note that interpolation is used, but this is good to mention this explicitly in the main text.

p4,ln23: 'the same ... technique': unclear, please clarify

p4,ln30: 'The sites with ...' This is a too strong statement since it depends totally on the HKZ lidars: ignoring them would lead to an opposite statement. Scatter is large.

p5,ln1: Please add a (few) lines on the observation uncertainty. To what extent could this contribute to the scatter in Fig 2C? Is it all the fault of ERA5?

p5,ln5: Valuable observation!

p8,ln6: 'average ... time steps'. This adds up to only 50 minutes of data, not an hour. Typo? Also, in 1 line explain the third representation of Fig4 in the text

Sect 3: Nice section clearly illustrating the non-trivial character of LLJ detection!

Figure 3: For clarity reasons, I suggest not to plot every single LLJ event. Suggestions:  
1) apply some form of colour coding depending on the number of events for a number

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of falloff bins per height interval, 2) distinguishing between the various sites has little added value in this plot.

p9, l26: 'calculated the ratio ... ERA5 data'. Specify if this is done for each location (and each month) separately. Line 27: 'months': I don't understand the plural form in relation to 'this factor' in the same sentence. Do you mean 'Months for which this factor is much smaller/larger than 1 are characterized by etc.'? Please clarify.

p10, ln 7. 'fixed' clarify: the same for all stations, for all months, or both?

p14, ln13: Mention the low LLJ frequency off the British coast, even for offshore wind directions. Seems to behave differently that the continental coast.

p14, ln 13: Refer to the work of Ranjha et al. 2013, who demonstrate that this increased LLJ occurrence along coasts is a global phenomenon. Ranjha et al. 2013: Global distribution and seasonal variability of coastal low-level jets derived from ERA-Interim re-analysis, TELLUS A, <https://www.tandfonline.com/doi/full/10.3402/tellusa.v65i0.20412>

p16, ln23: '1%' ambiguous in case of frequency of occurrence. I guess, also given Fig 9B, it should be 1 percent point, meaning a relative difference of ~10%. Please clarify

p18, ln 19: see comment p16, ln23

Technical comments

p4,ln5: typo near )

p5,ln4: 'downwards of' check formulation. I would say something like 'sharp decrease in the bias of ~0.5 m s<sup>-1</sup> for most stations.

p9,ln12: 'if' -> 'in'

p10, ln2: 'required ... estimates' correct the sentence

p10, ln 10: remove 'fits to the monthly means for'; 'each' -> 'the'

p11, ln17: obtained -> obtain

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p11, ln25: 'smoothing' -> 'smoothing and scaling'

p11, ln26: 'magnitude differs'. This is a bit inconsistent in the text: the magnitude of the (scaled) dashed lines in Fig 7 corresponds quite well, but here you refer to the unscaled cycles. Please clarify.

p11, ln 31: specify over what depth the bulk Ri was determined. Lowest observational level and something equivalent for ERA5?

p11, ln 33: 'Panel D' -> 'Panel D/E'

p12, Fig 6b: prevent tick labels in legend from overlapping

p14, ln 21: correct 'rates is'

p14, section 7: Given the fact that LLJ occur predominantly in spring/summer, but also for certain Lamb weather types, it would be interesting to see if these particular weather types also have a preferential occurrence in spring/summer.

p16, ln 7: 'day of year' > 'time of year'?

p18, ln1: remove 'The' at start of sentence

p18, ln24: 'about'??

p19, ln4: 'they' > 'this mechanism' or 'it'

p19, ln18: 'coast line' > 'coastline'

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

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