This study presents a nice comparison of observations from a temporary LiDAR buoy deployment off of the California coast, to the NREL 20-year Wind Resource Dataset (CA20-Ext), the 2023 National Offshore Wind Dataset (NOW-23), and the ERA5 reanalysis product. This work is important as we look forward to offshore wind development on the West Coast, as model errors in low-level jet (LLJ) representation can affect wind turbine energy generation. This study successful compares three different models to offshore lidar observations and identifies the strengths and weaknesses of each.

I do have a few minor comments that I believe will help the clarity and flow of the paper. Some general comments are that I do think that the figures could benefit from panel titles that have the lidar buoy location/model name. Even though it is explained in the figure caption, I think it would be nice to also add titles for quick referencing. I also noticed that the word "respectively" was very used often in the analysis sections (specifically sections 4.1 and 4.2), as well as a few long run-on sentences which made the paper more difficult to read. The rest of my comments are more specific and are listed below.

Overall, I think this is an excellent study and I am excited to see the results of another offshore lidar deployment. It is difficult to get profiler measurements offshore, and the field needs studies like this one, that can showcase the discrepancies between model predictions and observational data for wind energy applications. I really appreciated how the authors compared how the model bias in LLJ prediction could impact wind energy generation forecasts. I recommend this paper goes to publication.

Thank you very much for your review and for your support of our work! We have improved the sentence structure throughout the text and have removed many of the overused instances of “respectively” in sections 4.1 and 4.2. Additionally, we have added information about the buoy locations and models to the figures in axis labels and text boxes. We have addressed your specific suggestions as follows.

Major Comments:

Lines 30-35: This paper is missing a figure that shows entire study region, including the location of the 2 lidar buoys (at Morro Bay and Humboldt) as well as the proposed 5 lease areas. I think this would be very helpful in providing some context for those that aren't familiar with the study area.

Thank you for this helpful suggestion. The following map showing the locations of the lidar buoys and the lease areas has been added to the manuscript as Figure 1.

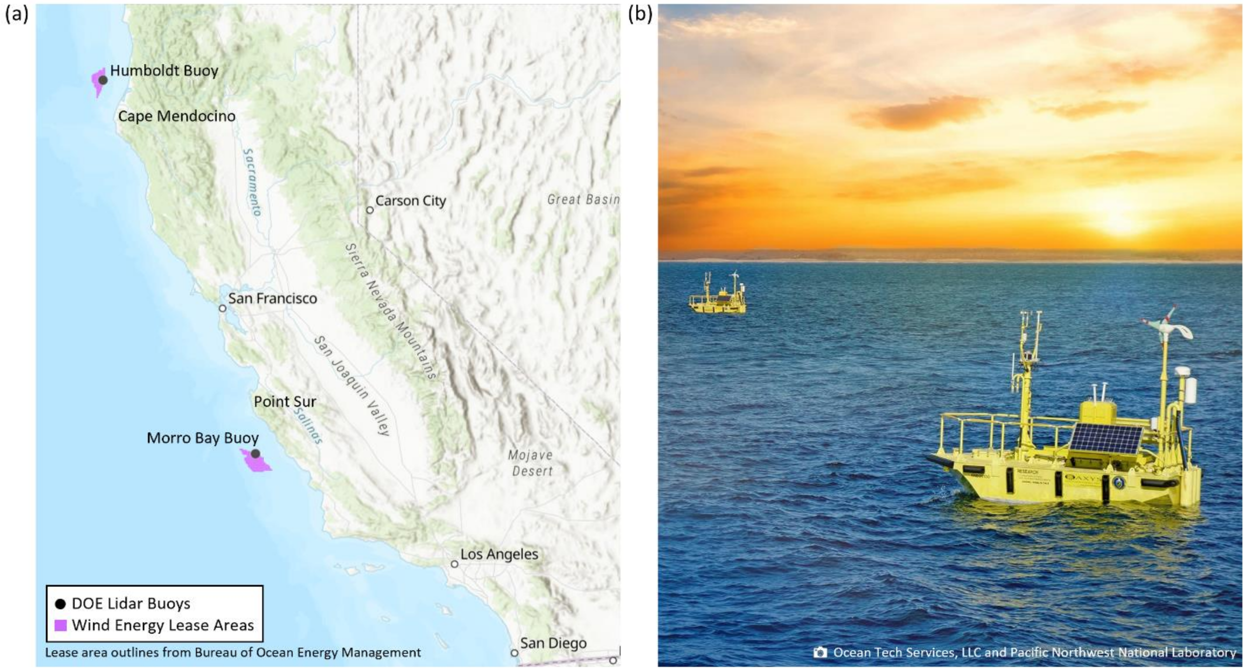

Figure 1. (a) Map of locations of the California DOE lidar buoy deployments and the California wind energy lease areas as of January 2024. (b) Photo of the DOE lidar buoys by Ocean Tech Services, LLC and Pacific Northwest National Laboratory.

Lines 85-90, 188: Again, referencing a map of the study region here would help your discussion.

References to the new Figure 1 have been added at the recommended lines (99 and 223).

Lines 153-156: Why did you choose a 2 ms^{-1} windspeed drop off threshold in your LLJ identification? Is this based off a percentage of the mean wind speed that is typically seen in the region? I think explaining why the 2 ms^{-1} works well in this offshore environment will be helpful in making this study more applicable in other areas.

We felt that 2 m s^{-1} was an appropriate drop off threshold given the vertical extent of the wind profiles that we had to work with (240 m for the observations and 200 m for the model comparisons). Nunalee and Basu (2013) employ a drop off threshold of 4 m s^{-1} above and below the jet core using observations up to 2 km above ground level. Similarly, Carroll et al. (2019) utilise a fall-off threshold of 5 m s^{-1} using wind profiles over the lowest 1.25 km of the atmosphere. We desire to be consistent with the multiple LLJ studies we came across that use wind profiles covering the lowest 500 m or less of the atmosphere, such as Kalverla et al. (2019), Hallgren et al. (2020), and Aird et al. (2022), all of whom employ a drop off threshold of 2 m s^{-1}. We have added Lines 184-186 to provide clarity on our decision: “To provide consistency with similar LLJ studies that utilise wind profiles within the lowest hundreds of meters of the atmosphere, this work employs a fall-off threshold of 2 m s^{-1} above and below the core speed to define an LLJ.”

Aird, J. A., Barthelmie, R. J., Shepherd, T. J., and Pryor, S. C.: Occurrence of Low-Level Jets over the Eastern U.S. Coastal Zone at Heights Relevant to Wind Energy, Energies, 15(2), 445, https://doi.org/10.3390/en15020445, 2022.

Hallgren, C., Aird, J. A., Ivanfell, S., Körnich, H., Barthelmie, R. J., Pryor, S. C., and Sahlée, E.: Brief communication: On the definition of the low-level jet, Wind Energy Science Discussions [preprint], https://doi.org/10.5194/wes-2023-74, in review, 2023.

Kalverla, P. C., Duncan Jr, J. B., Steeneveld, G-J., and Holstlag, A. A. M.: Low-level jets over the North Sea based on ERA5 and observations: together they do better, Wind Energy Science, 4, 2, 193-209, https://doi.org/10.5194/wes-4-193-2019, 2019.

Lines 159-165: Did you consider any other variables when identifying the LLJs? You mention that there is no restriction set on the vertical distance of the 2ms^{-1} fall off, but did you set a minimum or maximum wind speed threshold? If not, why? What is the mean windspeed at 140m at these buoy locations? Is the jet windspeed maximum generally higher than the mean windspeeds? I think in order to help make this LLJ identification algorithm more relevant to other offshore locations, it would be helpful to explain your specific choices and thresholds in a little more detail.

We explored using minimum (8 m s^{-1}) and maximum (40 m s^{-1}) wind speed thresholds during our initial investigations using these datasets. Ultimately, however, we were curious as to what the observations showed for the simple LLJ definition as a local wind maximum, employing a 2 m s^{-1} fall-off threshold. We found that, using this definition, the ranges of jet core wind speeds at each deployment location were relevant to the cubic portion, maximum power production portion, and the cut-out or derating portion of wind turbine power curves. Lines 234-235 relate the LLJ core speeds to power curves.

The jet wind speed maximum is typically higher than the mean deployment-wide wind speeds at most heights, except the very lowest heights. Per your helpful question on this topic, we added the median deployment-wide wind speeds at each height a.s.l. to Figure 7. We selected the median deployment-wide wind speeds to correspond with the LLJ statistics presented in the box plots. The following discussion was also added to Lines 236-240: "At most measurement heights, the median LLJ core speeds exceed the median deployment-wide wind speeds. The differences between the median LLJ core and deployment-wide wind speeds are especially pronounced at Morro Bay (e.g., differences exceeding 10 m s^{-1} at heights of 200 m and above), where the wind profiles tend to have less shear than those from the Humboldt deployment (Sheridan et al., 2022)."

Minor Comments:

Line 16: You mention that these cold season LLJs generally occur below 250m and that the warm season LLJs are generally higher. It might be nice to mention the height the warm season LLJs are observed at for context (e.g. higher altitude California coastal jet (typically at heights of 300–400 m) influenced by the North Pacific High).

Thank you for the helpful suggestion. We have reworded the sentence as follows: “LLJs were observed more frequently in colder seasons within the lowest 250 m above sea level, in contrast with the summertime occurrence of the higher altitude California coastal jet influenced by the North Pacific High which typically occurs at heights of 300 m – 400 m.” (Lines 15-17)

Line 18: I think you could cut out a couple words in this sentence to simplify it (it is a long sentence). "The lidar buoy observations also support the validation of LLJ representation in atmospheric models that are essential for assessing the potential yield of offshore wind farms"

We have reduced the sentence to: “The lidar buoy observations also validate LLJ representation in atmospheric models that estimate potential energy yield of offshore wind farms.” (Lines 18-19)

Line 25: It might be helpful for the reader to briefly define the term "false alarm" here.

This is a great suggestion for clarity, and we have modified the sentence to read: “However, CA20-Ext also produced the most LLJ false alarms, instances when a model identified an LLJ but no LLJ was observed.” (Lines 24-25)

Lines 38, 145-155: Another study you could take a look at is McCabe and Freedman 2023 (https://doi.org/10.1175/WAF-D-22-0119.1). That paper discusses another shear based approach to identifying LLJs that occur during sea breeze events on the east coast.

Thank you for this important reference. We have added McCabe and Freedman (2023) to the list of sources that provide analyses on meteorological impacts on wind profiles on Line 41. Additionally, we have added the following to the discussion of LLJ identification: “McCabe and Freedman (2023) define an LLJ as having a shear exponent at least ±0.2 above and below the jet maximum, along with a wind speed threshold based on the mean wind speeds in the rotor plane during days with sea breeze events.” (Lines 182-184)

Lines 40-45: You mention the impact of the LLJ on wake effects and turbine fatigue, but you don’t mention how the LLJ may be able to increase wind speeds across the rotor plane, therefore increasing potential energy production until the end of the paper. I think it might be helpful to add a sentence on that here.

Thank you for pointing out this omission. We have added the following to the discussion of LLJ impacts: “LLJs can result in significant acceleration of the wind speed at heights within the wind turbine rotor-swept area (Banta et al., 2008), which can lead to increases in wind energy generation.” (Lines 43-44)

Banta, R. M., Pichugina, Y. L., Kelley, N. D., Jonkman, B., and Brewer, W. A.: Doppler lidar measurements of the Great Plains low-level jet: Applications to wind energy, IOP Conference Series: Earth and Environmental Science, 1, 012020, doi:10.1088/1755-1307/1/1/012020, 2008.

Line 101: Just to clarify, here you mention the buoy being equipped with the Leosphere WindCube 866 lidars, and in the past section (line 81), you mention the AXYS WindSentinel buoys are have Leosphere WindCube v2 lidar systems. Are these lidars the same?

They are the same lidar systems and we appreciate you mentioning how this can be confusing. We have changed the mention of “v2” to “866” for consistency. Thank you!

Lines 183-184: You refer to figure 3a and 3b, but figure 3 only has one panel.

Thank you for pointing out this typo! We have changed the references of Figure 3a and 3b to simply Figure 5 (based on the updated figure numbering from new figures suggested by the reviewers).

Lines 190-194: The second half of this sentence is a little confusing for the reader. I would suggest re-phrasing the sentence (especially the part after "directions associated with ... ") for clarity.

We agree, and have reorganized the sentence as follows: “During LLJ events, the rotor layer winds at Humboldt tend to be land-based, from the north-northeast (0°–20°) and Cape Mendocino to the south-southeast (160°-180°), though some LLJ events are associated with the offshore flow directions of 180°-220° (Figure 6c).” (Lines 224-226)

Line 226: I would consider reminding the reader that *L* (Obukhov length) is defined in equation 1.

Good idea. The reminder to reference Eq. 1 has been added to that sentence as follows. “The deployment-wide assessments of Sheridan et al. (2022) found predominantly near-neutral atmospheric stability ($z/L \approx 0$) at $z = 4$ m a.s.l. and L as defined in Eq. 1 for both Humboldt and Morro Bay.” (Line 266)

Lines 288-289: For ease of reading, it might help to break this sentence into two sentences. You could simply add a period after the word "phenomena".

Thank you for the suggestion and the solution. The sentence has been split into two sentences per your recommendation. (Lines 335-337)

Line 325 (Figure 10): I think you need some sort of legend, or just an explanation in the figure caption, that clarifies what the numbers on the plots represent.

We agree and have added the following to the caption: “The markers are coloured according to season and are labelled by month (1 = January, 2 = February, … 12 = December).”

Lines 340-345: How does the LLJ core wind speed bias vary with height? Is it more pronounced at certain LLJ core heights than others?

We appreciate the suggestion to add an analysis of the LLJ core wind speed bias according to height, and have replaced the scatter plot in Figure 11 (now Figure 14) with just such an analysis. We found that overestimation of the observed LLJ core wind speed occurs at the lowest observed LLJ core heights, with a trend of biases approaching or achieving underestimation with increasing observed core height, and have added this discussion to Lines 294-396.

Line 378: I would suggest putting the abbreviations you are using as the subscript in equations 2 and 3 for lowest (*lo*) and highest (*hi*) in parenthesis.

We have added (*lo*) and (*hi*) to the sentence as you suggest.