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Response to Reviewers

We would like to extend our gratitude to the reviewers for their time, examination, and constructive feedback on our manuscript. Their insights and suggestions will significantly improve the quality and clarity of our paper and future work. We are thankful for their dedication and commitment to enhancing the rigor and impact of manuscript. This review process has been instrumental in identifying areas for refinement of analysis and strengthening the conclusions of our study. We hope that the responses that are provided below will suffice in answering your questions and addressing your concerns. Thank you.

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See our bulleted responses below:

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Handling Editor:

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6 I think the manuscript is improved from its original version, thanks to the Authors' effort and also
7 thanks to the comments of the original Referees. I nevertheless believe that during the revision
8 process some of the sentences were left incomplete (some are listed below) and I would suggest
9 the authors to give a thoughtful read to the whole manuscript, to make sure all the sentences are
10 complete. I am not sure the algorithm is easily reproducible by the scientific community (but I
11 appreciate the availability of the algorithm through the authors' Git Hub). I encourage the authors
12 to find places in the manuscript where to make the steps involved in the process as clear as possible.
13 There are several options, also listed by the authors, to further improve the algorithm, which are
14 left to future research. One suggestion I might have for future research would be to find a dataset
15 with collocated LiDARs' measurement (or intensive radiosonde launches) to use for validation of
16 your results. This would make your results more robust.

- 17 • *Thank you for your thoughtful feedback and for recognizing the improvements made to the*
18 *manuscript. We appreciate your suggestion regarding sentence completeness and will*
19 *thoroughly review the manuscript to ensure that all sentences are fully formed and clear.*

20 *We also appreciate your recognition of the GitHub repository and will ensure that the code*
21 *is as accessible and well-documented as possible to facilitate reproducibility.*

22 *Your suggestion to incorporate a collocated LiDAR or intensive radiosonde dataset for*
23 *validation is highly valuable. We agree that such a dataset would strengthen the robustness*
24 *of our results, and we will consider this as part of future work.*

25 **Specific comments:**

26 Abstract, page 1, line 18: Please reword “light results”.

- 27 ● *Rephrased: “Results from this analysis have identified a total of 90 south-westerly NLLJs*
28 *from May - September of 2017 - 2021 as captured by the RWP stationed in Beltsville, MD*
29 *(39.05° N, 76.87° W, 135 m ASL).” [Lines 18]*

30 Page 2, lines 5862: It seems that this sentence is missing a correct structure “The Mid-Atlantic
31 NLLJ, while analogous to the SGP NLLJ in its reliance on inertial oscillation theory combined
32 with the influence of temperature gradients induced by sloping terrain (Shapiro et al., 2016);
33 however, with lower wind speed maximums and vastly different topographic influences, with the
34 Appalachian Mountains to the East and North, the Chesapeake Bay and Atlantic Ocean to the West,
35 and the Coastal Plains and Piedmont region in between.” Please rephrase.

- 36 ● *Rephrased: “The Mid-Atlantic NLLJ, though similar to the SGP NLLJ in its reliance on*
37 *inertial oscillation theory and temperature gradients shaped by local topography, exhibits*
38 *consistently lower wind speed maxima. It is influenced by a variety of terrain types,*
39 *including mountainous regions, major bodies of water, and transitional landscapes.”*
40 *[Lines 59 - 62]*

41 Page 2, Figure 1, caption: Please, describe “x” when referring to panel B, not to panel A. Also
42 reword: “horizontal wind speed from (black circle)” with something like: “horizontal wind speed
43 from the location denoted by the black circle in panel A”. Finally specify that panel C shows
44 observations.

- 45 ● *Corrected: “Figure 1: Example depiction of the nocturnal low-level jet in the Mid-Atlantic*
46 *US on May 20, 2021: (A) ERA5 Horizontal Wind Speed at 975 mb; (B) shows the vertical*
47 *profile evolution of the horizontal wind speed taken from a vertical slice (black square),*
48 *(“x”) denotes 975 mb at 4:00 UTC; (C) shows the radar wind profiler observations of*
49 *horizontal wind speed from the location denoted by the black circle in panel A. Dashed*
50 *vertical lines indicate the sunset and sunrise times, respectively.” [Figure 1, Caption]*

51 Page 4, line 109: Specify that the “location reference” is denoted by the black circle in panel A of
52 Figure 1.

53 • *Corrected: “This study uses the dataset of continuous daily wind profiles from the Howard*
54 *University – Beltsville Campus (HUBC) RWP, located in Beltsville, MD (instrument named*
55 *BELT; see Figure 1B for location, marked by the black circle).” [Lines 111 - 112]*

56 Page 4, line 114: “The grey lines indicate the areas where the BELT daily file was available”. Did
57 you mean “The grey lines indicate the times when the BELT daily files were available”.

58 • *Corrected: “Grey lines indicate times when daily files were available from the MDE*
59 *record, while red lines denote periods of unavailability due to instrument failure or*
60 *scheduled maintenance.” [Lines 118 - 120]*

61 Page 5, lines 139-140: This sentence seems incomplete “The conceptual model of the detection
62 method presented here relies on single measured points in vertical and temporal space that with
63 the multiple dimensions of the dataset”. Please correct.

64 • *Rephrased: “The conceptual model of the detection method presented here relies only on*
65 *the wind speed (SPD), wind direction (DIR), radial velocity (RAD 1-5), and signal-to-noise*
66 *ratio (SNR 1- 5) at each altitude and timestep of the dataset.” [Lines 134 - 135]*

67 Page 5, Figure 3, caption: This caption does not make sense.

68 • *Corrected: “Figure 3: Sample of training dataset creation using masking and gradient*
69 *peak detection in the time and altitude dimensions: (A) Isolated NLLJ; (B) Gradient peak*
70 *detection in the time axis with only Southerly winds; Full profile of wind speed (C) and*
71 *direction (D). Vertical black dashed lines denote sunrise and sunset.” [Figure 3, Caption]*

72 Page 5, line 145: “previously reported” what?

73 • *Corrected: “The training dataset for this experiment was sampled from NLLJ events during*
74 *2021, while the validation dataset was selected from previously reported events, as*
75 *depicted by Sullivan et al. (2017), Delgado et al. (2015), and Weldegaber (2009), all*
76 *captured using the same instrument and station (i.e. HUBC-RWP).” [Lines 138 - 140]*

77 Page 6, lines 157-159: “50 events that contained no low-level wind maxima that contain low-level
78 wind maxima that we do not consider as LLJ relevant to this study for reasons of direction, or
79 evolution”. Please rephrase.

- 80 ● *Rephrased: “The training set is comprised of 50 NLLJ events that were sufficiently isolated
81 and 50 events that contain low-level wind maxima that we do not consider as LLJ relevant
82 to this study for reasons of direction, or evolution.” [Lines 151 - 152]*

83 Page 6, Figure 4, caption: The caption does not help to identify the different portions of the
84 algorithm. I think the execution loop is on the top (green), and the training on the bottom (orange),
85 not left and right.

- 86 ● *Corrected: “Figure 4: Schematic of the supervised machine learning algorithm execution
87 (top: green) and training (bottom: orange)” [Figure 4, Caption]*

88 Page 6, line 167: “These were determined These parameters (or features)”. There is some problem
89 with this sentence. Please correct.

- 90 ● *Corrected: “These parameters (or features) are then transformed into a single matrix
91 where the columns indicate the features and rows indicate the indexes of each variable at
92 a given time and height, in turn, creating a structured dataset ready for input into the
93 machine learning model.” [Lines 160 - 162]*

94 Page 7, lines 203-204: “we have identified 90 warm-season (May – September) NLLJ events using
95 the Beltsville, MD RWP datasets over a 5-year period (2017 - 2021),”. You just said this a few
96 lines above.

- 97 ● *Adjusted [Lines 183 - 184]*

98 Page 8, lines 218-220: “such as those by conducted by Sullivan et al.”. Please correct.

- 99 ● *Corrected: “The final stage involves applying this trained model to previously reported
100 and depicted NLLJs from previous research studies such as those conducted by Sullivan et
101 al. (2017), Delgado et al. (2015), and Weldegaber (2009), all of which used the same
102 instrumentation in the same study area.” [Lines 201 - 204]*

103 Page 8, lines 224-226: “true negatives (top left quadrant: green), true positives (bottom right
104 quadrant; green), false positives (top right quadrant; orange), and false negatives (bottom left
105 quadrant: orange)”. I think you assigned opposite locations to these case in the caption of Figure
106 5.

107 ● *Corrected: “Each confusion matrix provides a breakdown of the model's performance by*
108 *showing the counts of true negatives (bottom right quadrant: green), true positives (bottom*
109 *left quadrant; green), false positives (bottom left quadrant; orange), and false negatives*
110 *(top right quadrant: orange).” [Lines 208 - 210]*

111 Page 9, line 241: “as noted by the circles and dashed boxes in Figure 1”. Did you mean Figure 6?

112 ● *Corrected: “However as noted by the outliers and dashed boxes in Figure 6, the algorithm*
113 *does have certain limitations.” [Line 225]*

114

115 Page 10, Figure 6, caption: “panel 1 shows the isolated NLLJ, panel 2 shows the horizontal wind
116 speed and panel 3”. Change to “panels A1, B1, and C1 show the isolated NLLJ, panels A2, B2,
117 and C2 show the horizontal wind speed and panels A3, B3, and C3”.

118 ● *Corrected: “Figure 6: Evaluation of NLLJ isolation algorithm with reference events from*
119 *literature illustrating the evolution of the NLLJ event reported on (A) June 12, 2015*
120 *(Sullivan et al., 2017); August 03, 2007 and Jun 12, 2008 (Delgado et al., 2015;*
121 *Weldegauber, 2009), where panels A1, B1, and C1 show the isolated NLLJ, panels A2, B2,*
122 *and C2 show the horizontal wind speed and panels A3, B3, and C3 shows the wind*
123 *direction.” [Figure 6, Caption]*