

[Responses to the Comment by the Anonymous Referee #3]

>> We deeply appreciate the referee #3 for providing constructive comments. The manuscript is revised following the comments below.

General comment:

The paper provides a nice and detailed analysis of energy dissipation rate (EDR) calculated with several approaches using 1 year of data collected by two commercial aircrafts. The paper is well written, the figures generally well made (but please see my comments below), and the analysis is explained in detail. While this reviewer is not an expert in aviation meteorology, I am sure the topic is of great interest for the community. My review focused on the turbulence calculations and boundary layer meteorology aspects of the analysis, and from that point of view I find the paper worth of being accepted after minor revisions.

Major comments:

1) Most of the abstract explains the methodology applied to derive EDR, which are not novel or unique to this analysis. I recommend re-shaping the abstract so that more focus is given to the results of this analysis, and especially its novelty aspects compared to previous studies in the same field.

➔ Thank you very much for the good comment. We reconstructed the abstract to highlight results of analyses and novelty aspects of the current study in the revised manuscript. [Page 1, Lines 7-27]

2) Page 6, Line 22: How did you select the “predefined inertial range”? Was this selection valid at both high and low turbulence regimes? At all heights? For both aircrafts? This is critical choice that impacts the EDR calculation, and therefore should be explained in more detail.

➔ Thank you for the good comment. We selected the inertial range that minimizes discrepancy between the theoretical slope and observed one for both types of aircraft, whole altitude ranges (above 15 kft), and both high and low turbulence regimes. This statement is included in the revised manuscript. [Page 6, Lines 23-26]

During the revision process, we additionally conducted a sensitivity test on the inertial range. Instead of using a fixed inertial range, the inertial range is dynamically selected for each flight data and EDRs are calculated based on current three estimation methods (EDR1, EDR2, and

EDR3) and compared to the EDR in the fixed inertial range. It is noted that a dynamical inertial range is determined by finding the range has the minimum error between the observed power laws and theoretical one (i.e., $s^{2/3}$ and $f^{5/3}$) for a given time segment. EDRs are calculated based on the three EDR estimations using the dynamical inertial range (EDR1-opt, EDR2-opt, and EDR3-opt) and resultant EDRs are compared to EDRs using the predefined (fixed) inertial range (EDR1, EDR2, and EDR3). Pearson correlation (r) and mean absolute error (MAE) between two different EDRs are also computed. It is found that there exist high correlations more than 0.97 and low MAEs 0.001-0.003 $\text{m}^{2/3} \text{s}^{-1}$ between EDRs using the fixed range and dynamically selected range for Boeing (B) 777 data (Fig. A1). For B737 data, we found $r = 0.93$ and $\text{MAE} = 0.002\text{-}0.007 \text{ m}^{2/3} \text{ s}^{-1}$ (not shown). In the present study, the fixed inertial range is considered, regardless of an underestimation in the magnitude of some EDRs (e.g., EDR1U and EDR1V), as it can be more computationally efficient in calculating the EDR. Further investigation, however, may be required using more and longer data in the future. This statement is included and Fig. A1 is included as a new figure (Figure 4) in the revised manuscript. [Page 8, Lines 4-13]

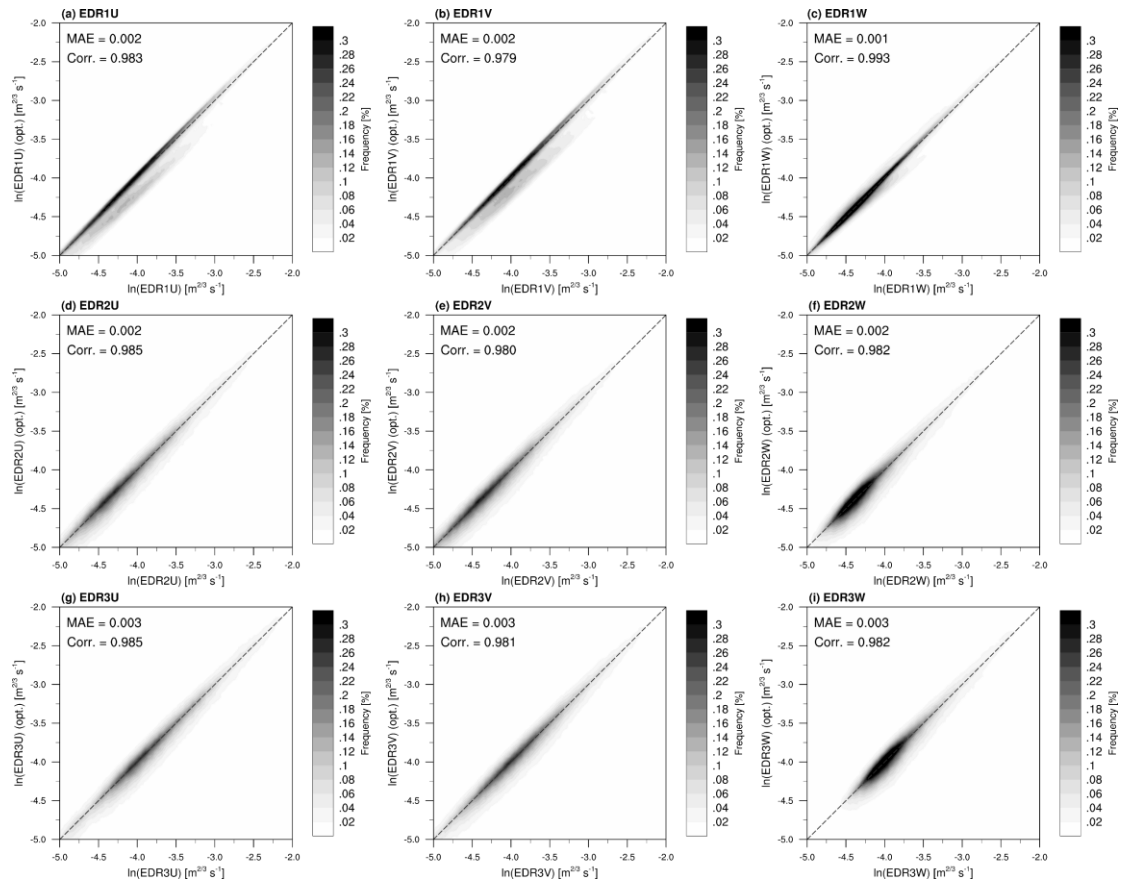


Figure A1. Scatter density plots of EDRs using the fixed and dynamical inertial ranges for the B777 data. Pearson correlation and MAE are given in the top-left corner of each panel.

Specific comments:

1) Page 2, Line 22: Should be “Southwest”. Also, these references to commercial airlines probably require a citation.

➔ Thank you for the comment. The phrase is modified, and references are included in the revised manuscript. [Page 2, Lines 23-25]

2) Page 4, Line 5: The following sentence is confusing and somewhat misleading; you should just say that the B737 data were recorded at 0.25 Hz. The same type of misleading information is used many times in the rest of the paper. “The aircraft flight parameters used in the current study were recorded every second (1 Hz) for both the B737 and B777. Because the 1-Hz wind direction and wind speed of the B737 records had the same values within a 4-second time window, the wind direction and wind speed of the B737 records seem to have 1/4-Hz sampling frequency.”

➔ We are sorry for if the statement of the original manuscript brought a confusion. The B737 data is also recorded every 1-Hz. The related statement is modified in the revised manuscript to avoid any confusion. [Page 4, Lines 4-5]

3) Page 6, Line 3: Please delete the following sentence as you have already stated this piece of information: “(264,867 and 1,065,855 reports from B737 and B777 recorders, respectively)”.

➔ The sentence is deleted as suggested.

4) Eq. 5: Please define what the brackets “ $\langle \rangle$ ” mean.

➔ Thank you for pointing out this. The bracket notation is defined in the revised manuscript. [Page 6, Line 22]

5) Page 15, Line 2: missing “)”.

➔ Thank you for pointing out this mistake, parenthesis is included in the revised manuscript. [Page 15, Line 21]

6) Page 16, Line 6: “and so on” is not appropriate for a scientific paper, please rephrase.

➔ The phrase is deleted in the revised manuscript.

7) Figures 9, 11, 13: Can you consider using a log scale on the y-axis of panels b, c, and d? Right now, the plots are very hard to read.

➔ Thank you for the suggestion. The y-axis of Figs. 11, 13, 15 (b), (c), and (d) is changed into the log scale in the revised manuscript.

8) Figure 12: It's hard to see the black circle(s), please use a different color.

➔ The color of circles of Fig. 14 is changed in the revised manuscript.

9) Throughout the paper, please consider using a different color scheme. The rainbow color has quite a lot of issues, see for example <https://www.climate-lab-book.ac.uk/2014/end-of-the-rainbow/>.

➔ Thank you for the good suggestion. We use a different color scheme instead of the rainbow color throughout all figures of the revised manuscript.