

[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 comments:

This paper investigates two methods of converting derived equivalent vertical gust (DEVG) turbulence measurements to the preferred ICAO standard turbulence metric eddy dissipation rate (EDR), using 3 years of archived AMDAR measurements. The two methods explored were proposed in two previous studies. The original DEVG measurements were subjected to a comprehensive quality control process which is described in detail. The accuracy of the resulting converted EDR values were examined by comparing them statistically to in-situ EDR turbulence measurements over two regions: over Europe and over the trans-Pacific Ocean area. The whole process is well described and discussed. The results of this study would enable a wider range of homogenized aircraft observations of turbulence to be available for development and research work. This would aid the development of turbulence forecasts and enable the construction of an upper-level turbulence climatology over a much larger area of the globe. In general, the paper is well written and well organised, and the results are of considerable interest. I therefore recommend that this manuscript should be accepted for publication with (very) minor revisions.

Specific comments:

1) Page 8, Line 8: I didn't follow why only one of the equations in the best-fit function was used, rather than the correct equation for the aircraft type recoding the DEVG. Is it that the aircraft type was missing from some of the observations in the dataset, so you needed to choose one equation?

The aircraft-related information, such as aircraft type and tail number, is limited in the Aircraft Meteorological Data Relay (AMDAR) dataset. Kim et al. (2017) showed that the two turbulence indicators [the cube root of eddy dissipation rate (EDR) and derived equivalent vertical gust (DEVG)] from Boeing aircraft have higher correlation than those from Airbus aircraft, which is related to differences in the number of decimals and sampling frequency of

the recorded variables for each aircraft type [Table 1 of Kim et al. (2017)]. In this regard, we decided to use the best-fit curve from the Boeing aircraft. This statement is included in the original manuscript.

Technical corrections:

1) Page 1, Line 12: ... in the AMDAR **data** archived ...

The sentence is modified as suggested. [Page 1, Line 12]

2) Page 1, Line 15: The first method **remaps** the DEVG ...

The sentence is modified as suggested. [Page 1, Line 15]

3) Page 1, Line 16: ... while the second one **uses** the best-fit curve ...

The sentence is modified as suggested. [Page 1, Line 16]

4) Page 1, Line 16: “developed in the previous study”. Which previous study was this (I don’t think it’s been mentioned yet)? Perhaps this part should be deleted, or written as: ... developed in **a** previous study.”

The sentence is modified as suggested. [Page 1, Line 16]

5) Page 3, Line 1: some aircraft of **a** Hong-Kong based airline.

The sentence is modified as suggested. [Page 3, Line 1]

6) Page 3, Line 10: “Because **the** two aforementioned turbulence metrics ...”. Actually, I’d re-write this sentence as “As these two turbulence metrics ...” which sounds clearer?

The sentence is modified as suggested. [Page 3, Line 10]

7) Page 3, Line 10: different **airlines**

The sentence is modified as suggested. [Page 3, Line 10]

8) Page 3, Line 14: This may be better worded as “This will lead to improvements in the verification of ...”?

The sentence is modified as suggested. [Page 3, Line 13]

9) Page 3, Line 14: “as well as global climatology of aviation turbulence”. This would be better as “as well as aid the construction of a global climatology of aviation turbulence”, or similar ?

The sentence is modified as suggested. [Page 3, Line 14]

10) Page 3, Line 19: either “some aircraft of a Hong-Kong based airline” or “some aircraft of the Hong-Kong based airline”

The sentence is modified as suggested. [Page 3, Line 19]

11) Page 3, Line 20: (39 months from February 2011 to April 2014) of data.

The sentence is modified as suggested. [Page 3, Line 20]

12) Page 3, Line 25: delete the hyphen between “(NOAA)” and “archives”.

The hyphen between “NOAA” and “archives” is deleted in the revised manuscript.

13) Page 4, Lines 9-11: I would switch the first two sentences around, so it is something like: “The data before the QC procedures have been applied are referred to as the raw DEVG in the current study. Figure 1 shows the horizontal distribution of the number of raw DEVG data collected over 36 months (from October 2015 to September 2018) above 15 kft accumulated within a $1^{\circ} \times 1^{\circ}$ horizontal box. The raw DEVG covers a large portion of the SH ...”.

The sentence is modified as suggested. [Page 4, Line 8-10]

14) Page 4, Line 13: “this raw DEVG can complement the SH turbulence information” I didn’t follow this ... the raw DEVG data complements the in-situ data (which mainly covers the NH), as it provides coverage over the SH. I think this line just needs re-wording?

We would like to emphasize that the raw DEVG data will complement the Southern Hemisphere (SH) turbulence information, given that the in situ EDR data covered most the Northern Hemisphere (NH) (Figure 10 of the original manuscript) and did not provide coverage over most SH regions. The sentence is modified as suggested. [Page 4, Line 12-13]

15) Page 5, Line 11: I would replace “That is, because” with “Since”?

The sentence is modified as suggested. [Page 5, Line 15]

16) Page 5, Line 23: I would replace “Applying the aforementioned QC procedures” with “Applying these QC procedures”

The sentence is modified as suggested. [Page 5, Line 28]

17) Page 7, Lines 18-20: I got a bit confused with the first half of this sentence. Do you mean that there’s a choice of several values of C_1 and C_2 for the altitude ranges in this study? And if so, isn’t there a choice of 4 values? Or did I misunderstand something? I would also re-word the part in brackets so it is shorter and simpler – e.g., ... for three altitude ranges (> 0 ft, 20-45 kft, 10 – 20 kft and 20 – 45 kft).

To avoid any confusion, the sentence is modified. [Page 8, Line 1-2]

18) Page 10, Line 19: “homogenized global turbulence **dataset**” or “homogenized global turbulence **archive**”

The sentence is modified as suggested. [Page 11, Line 4]

References section:

1) There were several references listed here which I couldn’t find in the contents of the paper: Gultepe et al. (2019), Tvaryanas (2003), Warner (2013), Williams (2017).

The aforementioned references are deleted in the revised manuscript.

References

Kim, S.-H., H.-Y. Chun, and P. W. Chan, 2017: Comparison of turbulence indicators obtained from in situ flight data. *J. Appl. Meteor. Climatol.*, **56**, 1609-1623, doi:10.1174/JAMC-D-16-0291.1

Sharman, R. D., and J. Pearson, 2017: Prediction of energy dissipation rates for aviation turbulence. Part I: Forecasting nonconvective turbulence. *J. Appl. Meteor. Climatol.*, **56**, 317-337, doi:10.1175/JAMC-D-16-0205.1.