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Atmospheric Measurement Techniques Discussions

Interactive comment on "Retrieval of Eddy Dissipation Rate from Derived Equivalent Vertical Gust included in Aircraft Meteorological Data Relay (AMDAR)" *by* Soo-Hyun Kim et al.

Anonymous Referee #1

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This study attempts to map the values of a turbulence diagnostic (derived equivalent vertical gust–DEVG) to a standard measure of turbulence intensity (cube root of the eddy dissipation rate–EDR). The motivation for obtaining such a mapping is that a limited fraction of commercial aircraft report either EDR or DEVG; therefore, establishing a correspondence between the two would allow turbulence data to be collected, studied, and exploited over an expanded global arena using a single, consistent metric–the aircraft-type-independent EDR.

The derived relationships are based on statistical comparisons of mutually exclusive data sets for DEVG and EDR over specific world regions. Although reasonable rela-

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tionships result from the analysis, because DEVG and EDR measurements were not made simultaneously on the same flights, care must be taken to assure that apples are being compared to apples. Specific comments on this and other issues are given below.

Major Comments

1. Section 2.2: QC procedures. Quality control is absolutely critical for the DEVG data. Fits to the PDFs of DEVG (e.g., Figure 9) is at the core of this analysis. The PDF tails are very sensitive to small changes in the bin counts. However, these tails are where the raw DEVG have quite large bin counts in some regions that manifest as secondary modes in the PDF. The post-QC PDF tail is the residual of the difference between fairly large numbers. Thus, it is important to justify the QC procedure.

a. Why are there so many invalid DEVG values? Are there documented case studies that show how these errors occur? And why do they occur primarily in certain regions?

b. Related to (a), can you provide physical justifications for the four steps of the QC procedure?

c. Page 5, lines 29-30 state that the threshold values used in the QC steps are empirically determined. This empirical process needs to be explained clearly in detail. How can you tell that too few or too many reports were not removed? This is crucial, because errors in this process directly affect the tails of the DEVG PDFs.

2. Is parsing DEVG PDFs by northern or southern hemisphere the most meaningful and useful classification? There are reasons why the PDFs might differ for flights (a) over land vs. over ocean, (b) at different altitudes, (c) during different seasons, (d) during day vs. night, (e) in different |latitude| bands, etc.

3. As noted in p. 2, line 22, DEVG estimates may be inaccurate during ascent or descent, and, thus, the data at cruise altitudes (> 15 kft) only are used. However, even above 15 kft, aircraft can change altitudes and direction that could affect the

measurements. Why not restrict the use of data by only accepting estimates made during straight-and-level flight?

4. Figure 9 (and explanation in p. 7, lines 26-29). How do you justify throwing out some of the points in the PDFs for the fitting procedure?

5. In Figures 1 and 8, there is an oddly abrupt change in the data count right around the equator over the central Pacific. There is much more data across a wider swath south of the equator. Is this real? What is the cause of this sharp transition?

Minor Comments

1. DEVG and EDR have different units. Is there a physical basis on which to make a unit conversion? Or is there an explanation of why it is acceptable to ignore the difference in units?

2. Page 6, lines 6-7: It's not very informative that some MOD and SEV turbulence reports coincide with a high Ellrod1 index. Unless a statistical analysis is conducted to show a meaningful correlation, this remark should be omitted.

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