Review of: "Clear-air turbulence derived from in situ aircraft observation – a weather feature-based typology using ERA5 analysis"

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Recommendation: Minor Revisions

Overview:

This paper uses four years of EDR measurements from commercial airliners and ERA5 reanalysis data to construct a climatology of different synoptic patterns influencing clear-air turbulence (CAT) in the vicinity of the jet stream. Though the EDR data are mostly confined to midlatitude continental regions, the analysis provides a novel and much-needed preliminary climatology (mostly over the CONUS) showing how different synoptic weather types including large-scale Rossby Wave Breaking (RWB) and warm-conveyor belts (WCB) within midlatitude cyclones are conducive to CAT by different mechanisms. Some interesting results are presented on how turbulence over the western U.S. is more commonly associated with RWB and near the eastern U.S. is most likely to be influenced by diabatic heating within cloudy WCBs with CAT occurring either above or horizontally displaced from clouds. The paper is well written, and I recommend it be published with minor revisions. I have only two general comments that are meant mainly to encourage a little more discussion of potentially relevant topics or applications of the work. The remainder of the comments are minor, and concern suggested changes to English grammar or request some minor clarifications.

General Comments:

1. The in situ commercial aviation EDR data used in this study was obtained between 20000 and 60000 ft MSL and the measurements are understandably grouped together to perform the climatological analysis. Can you comment on the percentage of these EDR measurements are from the lower stratosphere versus the upper troposphere? Are the more favorable of the two locations (i.e., above or below the tropopause) different for the RWB and WCB environments?

2. There are interesting results in this paper, but can you provide some summary discussion on how the relationship of these two different synoptic environments and CAT might be used in forecasting applications (e.g., route planning by airlines)?

Minor Comments:

1. Line 90. Therefore, a revisit to the topic …→ Therefore, revisiting the topic …

2. Line 120 and elsewhere in the paper. In the current usage "as a proxy to RWB" should be changed to "as a proxy for RWB".

3. Line 142. on the opposite → in contrast

4. Line 166. has to be taken care of → must be realized

6. Lines 272-273. This final sentence of the paragraph seems redundant (with the previous sentence) and can be removed.

7. Lines 276-277. Consider simplifying "is more isolated from the background, which in general increases equatorward" to "is enhanced from background values, which increase equatorward".

8. Line 283-284. There are few (if any) studies that directly link turbulence to inertial instability, so I think this statement needs to be better qualified. The negative PV or vertical component of absolute vorticity can be widespread in certain synoptic patterns, but the turbulence is typically much more localized. It's not clear what is happening in these cases, but perhaps the inertial instability results in horizontal accelerations that modify the environment in ways that can support more localized KH or static instability leading to turbulence in such events? There also other possible influences on turbulence including gravity wave emission in inertially unstable flows.

9. Line 289. the shear layers → the vertical shear layers

10. Line 298. It implies → This implies

11. Line 298. particular type → particular synoptic type

12. Lines 311-312. multiplying with vertical wind shear → multiplying this difference by the vertical wind shear

13. Lines 316-318. This is a long and awkward sentence. Please split into 2 sentences with the 2nd sentence starting immediately after the Sharman et al. 2006 reference. Also, on line 317 please change "but negative PV …" to "but diagnosing negative PV".

14. Line 323. Since it is the vertical heating profiles associated with deep convection that is most likely responsible for generating the negative PV in these events, consider changing "… near-cloud events" to "… induced by deep convection".

15. Line 325. To be more specific please change "outflow associated with the WCB" to "outflow associated with organized deep convection occurring within the WCB".

16. Line 327. but at the same time less stable → but less statically stable

17. Lines 327-328. The different properties of the two types of events …→ These differences in the environments of the two types of events …

18. Line 385. It is consistent with → This possibility is consistent with

19. Line 402. Weak large-scale ascent present in the WCB does not directly influence turbulence but instead provides a favorable environment for organized deep convection (e.g., squall lines)

that would likely be more directly responsible for negative PV and turbulence, through the mesoscale modification of the WCB environment. This idea is discussed in the conclusions but probably should be clarified here as well.

20. Line 488. You mention symmetric and inertial instabilities, but it seems that these processes could also result in localized static instability and that could also play a role in the onset of turbulence.