

A global climatological perspective on the importance of Rossby wave breaking and intense moisture transport for extreme precipitation events

General comments

In this paper diagnostics are used to identify PV streamers, extreme precipitation events and high IVT structures in reanalysis data. The relationship between these features are examined and relative importance of the different features contributing to extreme precipitation events quantified. Events are partitioned into 5 synoptic categories summarising the main influences allowing a climatology of categories and their geographical locations to be produced. Overall the paper is well written with careful analysis of the data and interpretation of the results. 60% of the extreme precipitation events can be attributed to one of the 5 categories and over 85% of the most intense extreme precipitation events demonstrating the importance of these combined features. The subject of this paper is suitable for publication in WCD although before publication some minor changes to the text are required (see below).

Major comments

1. Line 11, line 129 and elsewhere: There is little motivation for this work in the abstract and introduction. I agree that previous studies have considered RWB and IVT separately, but what is the motivation for considering them together? Why is this a good idea? I assume that the author regards the fact that ascent (or cooling) is necessary to convert water vapour into liquid water and further precipitation is unnecessary to include. However, given the number of studies that use IVT as a proxy for precipitation and EPE I think this is a key point to include to motivate the work.
2. Introduction: A vast amount of literature is covered in the introduction section. To the extent that it is quite difficult to read the paragraphs due to the very large number of references. I appreciate that the statements included in the introduction need to be supported by published literature, but is it necessary to include well over 100 references? This would be suitable for a review paper but not for a paper containing new science. The material included in the introduction needs to be more focused to identify the knowledge gaps in the published literature and motivate the study presented in the paper.
3. Figures: Most of the figures use a rainbow colour bar. This made it difficult to view the figures in black and white and is also very difficult for red-green colour-blind people. Please consider using a different colour bar in your figures.

Minor comments

1. Line 8: 'Frequently' should be 'frequent' I think.
2. Line 17: The statistics presented here are rather one-sided. For example, if > 90% of EPEs are associated with RWB, how many RWB events are not associated with EPE's.
3. Line 21: I'm not familiar with the term 'outer tropics', is this the same region as the subtropics?
4. Line 58: What is the difference between a tropical moisture export and an atmospheric river?
5. Line 121: What does the author mean by 'the precise connection between the driving synoptic processes and the generation of extreme precipitation often remains more in the background and less understood'. This is a bit cryptic. Are they referring to microphysical processes?

6. Line 286: What do the modulus sign represent. Is the 2 PVU definition of the tropopause appropriate in the tropics? E.g. Wilcox et al. (2011)
Wilcox, L.J., Hoskins, B.J. and Shine, K.P., 2011. A global blended tropopause based on ERA data. Part 1: Climatology. *QJR Meteorol. Soc.*
7. Line 328: Given that the climatologies are so different when different thresholds are used, does this mean that there is no robust definition of this feature?
8. Line 330: Why is an area of 10,000 km² used? How sensitive are the results used to this threshold?
9. Line 333: Why are the IVT structures 'provided with an extended area'? How was this area chosen? Are the results sensitive to the size of this area?
10. Lines 392-400: There are 12 case studies presented in figure 4 but only 1 paragraph devoted to their description. Given that they represent a variety of time evolving processes, it seems simplistic to group them into 2 different constellations. More evidence is needed to support this binary grouping.
11. Line 421: The PV streamers are 'relatively frequent' compared to what?
12. Line 430-434: I'm afraid I didn't follow the argument regarding the IVT_{pct}. Could this section be made clearer?
13. Line 459: Here the statistics are rather one-sided. How many PV structures are not associated with EPEs?
14. Pages 15, 16 and elsewhere: Here and elsewhere the author makes use of lists to analyse the figures. While this can be a useful scientific writing tool, overuse becomes a bit repetitive after a while and I found myself skipping to the end of the list without reading each point.
15. Line 498: Why are many regions of combined RWB and IVT positioned at the equatorward exit regions and poleward entrance regions of the extratropical storm tracks?
16. Line 532. I'm not sure figure 7 is necessary. What does it add to the arguments already stated in the paper?
17. Line 634 and elsewhere: Here the author refers to 'category 1' and later to categories 2-5. Perhaps I missed this, but where are these different categories defined? Are these the categories in the synthesis section? If so, they shouldn't be referred to in section 6.
18. Line 740: What do the numbers in brackets mean? >90% of what?