

Review of wcd-2021-70:

“Characteristics of long-track tropopause polar vortices”

by

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Recommendation: Minor revisions

The manuscript described climatological aspects of long-lived TPVs using a TPV tracking algorithm. Certain geographic aspects are discussed, especially in terms of genesis of TPVs.

The manuscript is very well written and concise. The number of figures is rather on the limit, also given the complexity of some of the figures, see comments below.

Overall, the manuscript makes a valuable contribution to the field and could be recommended for publication after some comments below are addressed.

General Comments:

Regarding the TPVTrack algorithm, it is understandable that the authors mainly refer the reader to a previous paper outlining the method, but it would still be appreciated by the reader here is a brief description of potential thresholds used in the water-shedding are clarified. For example, if one continues to watershed, at some stage all objects will be unified into one object. The authors should briefly clarify what kind of thresholds are used in the water-shedding to better understand the identification of TPV objects on the PV2 surface. Also the equivalent radius at the end of section 2.1 is most likely depending on a threshold in the water-shedding that ultimately decides the size of the objects one would assume.

Given that there are so many clustering algorithms, it appears strange why the authors decided for a subjective classification given the large dataset that would certainly allow for some automatic clustering. Self-organizing-maps could have also been a rather useful method, given that one interest was the genesis environment. The authors should further substantiate the choice of a subjective clustering and in fact should consider automated schemes, such as self-organizing maps or similar to split the TPV tracks into different classes.

Given the track information of TPVs available to this study, it would have been of great value to include a discussion of the propagating nature of these systems. There is a discussion on genesis and general track density, as well as exit pathways for TPVs. However, to further substantiate the claim that these long-lived TPVs could contribute to enhancing predictability, it would be essential to know about their propagation characteristics and if these can be understood by general vortex or Rossby wave dynamics. The authors are strongly encouraged to consider expanding their analysis to address the kind of nature of propagation for TPVs in their database.

Specific Comments:

Reference to line numbers in the manuscript.

L17: The statement in the first sentence needs backing with literature. Alternatively, as evidence for the statement is provided in greater detail in the ensuing sentences, the first sentence might be removed.

L182: RWB

L220: The formulation “broad region of low potential temperature may itself be a large-scale mid-latitude PV anomaly or may include several embedded PV anomalies” should be clarified further. How could it be seen itself as a PV anomaly and what is meant by several embedded PV anomalies. The authors should more clearly separate between environment, anomalies, and even sub-anomalies if that is what they were aiming to refer to.

L348: “assuming they do so”? Why can the authors not be more certain about this given the track data they have?

L364-366: Please further clarify the tropopause folding all the way down to connect with the low-level stable layer. This seems rather extreme and would need further evidence or a citation presenting this claim.

Figures 4, 5, and 6 are difficult to digest given the wealth of information. The authors are encouraged to limit the number of panels to guide the reader more directly to the essential aspects that these figures are aiming to convey.

Similarly, Figures A1-6 would also benefit from a reduction in complexity. Potentially, the number of panels could be doable, though the type of shading should then be reconsidered to reduce complexity. The latter also applied to the comment on the figures in the main manuscript.