Weather Clim. Dynam. Discuss., referee comment RC2
https://doi.org/10.5194/wcd-2021-30-RC2, 2021


# Comment on wcd-2021-30

Anonymous Referee #2

---

Referee comment on "The role of tropopause polar vortices in the intensification of summer Arctic cyclones" by Suzanne L. Gray et al., Weather Clim. Dynam. Discuss., https://doi.org/10.5194/wcd-2021-30-RC2, 2021

---

General comments:

This research investigated the relationship between Arctic cyclone (surface cyclone) and tropopause polar vortices (TPVs) using the same tracking algorithm. The authors analyzed the features of the track density and composited structure for Arctic cyclones by separating matched and unmatched cyclones. The results showed that most of the Arctic cyclones are far from the TPVs at their initiation, and about one-third of the Arctic cyclones developed associated with the TPVs. They also showed that while the genesis of the unmatched cyclones is along the Eurasia coastline, that of the matched cyclone generated over the Arctic Ocean, North America, and the Canadian Arctic Archipelago. The rearward title of relative vorticity for matched cyclones is less than that for unmatched cyclones. The topic is very interesting, and this study shows the relationship between Arctic cyclones and TPVs clearly for the first time. The findings in this study would promote the understanding of the cyclone development over the Arctic in summer. Therefore, the reviewer recommends for publication of this article in WCD after minor revisions.

Comments:

Lines 37: Tao et al (2017, QJRMS) also showed the importance of TPVs for the intensification of an Arctic cyclone.

Tao, W., Zhang, J., & Zhang, X. (2017). The role of stratosphere vortex downward intrusion in a long-lasting late-summer Arctic storm. Quarterly Journal of the Royal

Meteorological Society, 143(705), 1953–1966. https://doi.org/10.1002/qj.3055

Line 215: Is the percentage of the cyclone associated with the TPVs within 2º is intermediate between 1º and 3º in Fig. 5? While the author showed the percentage of the cyclone associated with the TPV within 1º, 3º, and 5º at each stage (Fig. 5), the percentage of the matched cyclone (i.e., cyclones satisfied both criteria) is not shown in the results.

Line 279-281: Do the track density and cyclone features show similar results to the Figs. 1-3 in each month? Or these features have monthly variability?

Lines 285: Does the timing of the maximum relative vorticity match with that of the minimum SLP? Or they have some lag?

Fig. 4: Including the NAO index would be better for understanding Line 304-317.

Lines 334-336: Why the number of unmatched cyclones is similar to matched cyclones? Isn't a cyclone classified as an unmatched cyclone when it does not satisfy the criteria of a matched cyclone?

Lines 340-341: Is there any relationship between the location of the local maximum of genesis density for the matched cyclone and surface condition (e.g., cyclone generated over the marginal ice zone in Inoue and Hori (2011, SOLA))?

Inoue, J., & Hori, M. E. (2011). Arctic cyclogenesis at the marginal ice zone: A contributory mechanism for the temperature amplification? Geophysical Research Letters, 38(May), 1–6. https://doi.org/10.1029/2011GL047696

Lines 407-409 and 450-452: Do these sentences indicate that the PV at the middle-troposphere in the matched cyclones is due to the frictional processes? If so, is the middle-tropospheric PV for each cyclone influenced by the surface condition (over the land, ocean, and sea ice)?