EGUsphere, referee comment RC3
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Comment on egusphere-2022-351

Anonymous Referee #3

Referee comment on "The composite development and structure of intense synoptic-scale Arctic cyclones" by Alexander F. Vessey et al., EGUsphere, https://doi.org/10.5194/egusphere-2022-351-RC3, 2022

Summary:

Overall very interesting and well-written paper. The paper studies the climatology of intense Arctic cyclones, something that has previously been done mostly based on case studies. The authors utilize a system-centered composition analysis following the cyclones through their lifetime allowing for complete and easily comparable climatologies to be made. The paper extends our knowledge on summer Arctic cyclones and makes the important point that Arctic cyclones can be structurally different depending on the season. Some minor corrections could be made into the text to enhance readability and clearing out some of the method choices made.

Comments:

- Line 69: Any newer references on this topic? Maybe Varino et al. (2018) or Wicktröm et al. (2017)?

- Line 99: How are the identified cyclones grouped as cyclone tracks? The authors mention the nearest neighbor approach, but I assume there has to be some sort of limit, as to how far connected cyclone instances can exist from one another in order to be considered part of the same cyclone?

- Line 111: Why only North Atlantic winter storms were compared, why not compare winter storms to winter storms and summer storms to summer storms?

- Line 155: Adding another reference would be good.

- Line 173-180: The discussion on 850hPa winds is interesting, but it made me curious how different the results would be if you looked at wind speed closer to ground (and maybe over land vs. ocean). A paper by Valkonen et al. 2021 showed that over different sea ice regimes the cyclone wind speeds were different and one would assume even larger differences between land and sea surface. Any comments?

- Line 219-222: Please rephrase this sentence, it is very long and a bit difficult to understand.

- Line 301-302: As the size of the cyclones in this paper is compared to that of the Aizawa and Tanaka (2016) cyclones, it would be important to know if the size of the cyclone was determined in the same way in both papers. If it was not, it would be good to give an explanation as to why the last closed isobar was chosen as the area of the cyclone in this paper.

In text references:

Varino, F., Arbogast, P., Joly, B. *et al.* Northern Hemisphere extratropical winter cyclones variability over the 20th century derived from ERA-20C reanalysis. *Clim Dyn* **52,** 1027–1048 (2019). https://doi.org/10.1007/s00382-018-4176-5

Wickström, S, Jonassen, MO, Vihma, T, Uotila, P. Trends in cyclones in the high-latitude North Atlantic during 1979–2016. *Q J R Meteorol Soc*. 2020; 146: 762– 779. https://doi.org/10.1002/qj.3707

Valkonen, E., Cassano, J., & Cassano, E. (2021). Arctic cyclones and their interactions with the declining sea ice: A recent climatology. *Journal of Geophysical Research: Atmospheres*, 126, e2020JD034366. https://doi.org/10.1029/2020JD034366