

Review for the manuscript wcd-2021-60: “A global climatology of polar lows investigated for local differences and wind-shear environments” from Patrick Johannes Stoll

Main comment:

This study focuses on polar lows (PLs) climatology in both Northern and Southern Hemisphere and on finding suitable identification criteria to discard PLs from other mesoscale cyclones. This study makes a significant contribution in referencing and comparing PLs found in the ERA5 reanalysis to previous observational climatologies.

The author corrected the manuscript following the comments of both reviewers, which contributed in improving the manuscript. Although some minor typos remain after the correction, the manuscript is clear and well-structured. Therefore, I would recommend the manuscript for publication after some small minor revision.

Specific comments:

- P. 2 L. 54: A quick sentence should be added in the text on why those criteria differ from the ones used in previous studies.
- P. 3. L. 66: Maybe a quick definition of the shear could be added into parenthesis.
- P. 4 L. 92: It should be noted that, although band-pass filtered approaches may include synoptic-scale cyclones, spectral filtering can be used to only retain the wave-numbers equivalent to mesoscale features with similar scales as PLs. This has been successfully done for PLs using spectral filtering to the vorticity field by previous studies such as Zappa et al. (2014), Yanase et al. (2016), Smirnova and Golubkin (2017) and Stoll et al. (2018).
- P. 10 L. 292-293: This sentence is a bit confusing. Maybe rephrase it by stating “criterion” after the “first/second/etc.”.
- P. 11 L. 302: A sentence could be added on the fact that these criteria, although relatively efficient, do not detect all observed PLs from the previous lists.
- P. 14 L. 337-340: This is an interesting suggestion: has it been verified for some PLs of this study or in other studies?
- P. 15 L. 378-379: Instead of “punishing” the region, how about decreasing the SST-T500 criterion for the Southern Hemisphere then? Have you tried different thresholds/criteria for SH PLs and if so, would using different thresholds/criteria for NH and SH PLs be more beneficial (since SH PLs seem less “responsive” to your criteria than NH PLs)? Maybe a word on this could be added.
- P. 24 Section 5.2: It would be interesting to know if trends appear in the different PL shear distributions (in the global of each shear distributions and the distributions for each region). If you already calculated it (or if it’s not too much work) a sentence or two on this would be appreciated.

Technical comments:

- P. 1 L. 18: I think references to books should contain the page numbers corresponding to the citation.
- P. 11 L. 300: I think “Furthermore” might be more appropriate than “Further”.
- A few typos (misplaced coma/point/capital letter/e.g.) are found along the text (ex: L. 120, 397).