

Interactive comment on “Polar Lows – Moist Baroclinic Cyclones Developing in Four Different Vertical Wind Shear Environments” by Patrick Johannes Stoll et al.

Anonymous Referee #1

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This article is a significant new contribution to the knowledge of the environment conducive to PL development. With the application of a SOM technique to a large dataset extracted from ERA-5 the authors extend the separation in forward vs reverse shear for the environmental wind to include four quadrants (forward-right-reverse-left) and examine the characteristics of each, with reference to genesis and development of PL.

A rather surprising conclusion, from my point of view, is the absence of strict hurricane-like events, which would be characterized by low wind shear, warm core and symmetric structure, and surface heat fluxes actively providing energy for the development, as opposed to pre-conditioning the environment. The authors find some cases of warm core

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structure in the decaying stage of PL events, which they attribute, I believe correctly, to a warm seclusion stage of a baroclinic development.

I am not familiar enough with the SOM to say if the application of this technique, or of some of the operations that the authors have applied to the meteorological fields in the course of the work, may be in part responsible for this result. For example I cannot but notice that not only the mid nodes of the 3x3 map based on temperature anomaly (Fig.2 of the paper, better seen in Fig.3 of the supplement), and of the 4x5 map, fig 2 of the supplement, but also the corner node 3 of the map based on full temperature fields (fig 4 of the supplement) have a nice symmetric structure in the center. May the authors comment on the possibility or impossibility of this filtering having occurred in the analysis ?

This was my only "general" comment. I have some small observations on the text listed below:

- I am a bit confused by the numbers on pg. 4. The authors extract 556 tracks from ERA-5, and reduce them to 374 by excluding duplications and mergers. However they state that the Rojo list contains 420 PL events. So my question is are there cases in the Rojo list not found in ERA-5 ? And, secondarily, would a track search not forced to match the Rojo list have found more events in ERA-5 ?

- again pg. 4 ln 112-113. Do you mean all three of initial-middel-final times on land, or just one or two of them ?

- pg.7 ln 180 Has the overbar here the same meaning of area average as for the wind in the previous page, or an average on the square 1000x1000 km area, or is it a sort of "zonal" mean in that area ?

- pg.12 ln 264. Does this QG concept hold on these small scales ? In other words, it is not clear to me if this is a statement of principle, or it is the result of the authors study of the meteorological fields.

- several typos in the references. eg. In 488 De Boor, De Boor, De Boor and De Boor;
In 507 Holton, American Journal of Physics (it's a book); In 510 : what's the title ?

One final observation on the figures. I realize that it would be difficult to carry the same information in less complex figures, but the black dots in Fig.1 are only seen after enlarging the image size, and the 9 (nine!) colored dots of Fig. 4 are a challenge for those who discriminate colors poorly.

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