

Review of manuscript wcd-2021-37: “Systematic assessment of the diabatic processes that modify low-level potential vorticity in extratropical cyclones”, Roman Attinger, Elisa Apreitzer, Maxi Boettcher, Heini Wernli, Hanna Joos

## **Recommendation: Accept**

This manuscript investigates a more general assessment of different diabatic processes modifying low-level potential vorticity (PV) in extratropical cyclones. To this end, a series of twelve 35-day model simulations along with backward trajectories computation were performed to quantify the relevance of individual diabatic processes involved in the dynamics of 288 rapidly intensifying extratropical cyclones. The processes generated positive and negative PV anomalies along the cold front, warm front and in the cyclone center include condensation, convection, long-wave radiative cooling and heating, turbulent momentum and temperature tendencies. The authors show that, on average, the primary processes modifying low-level PV during the 24 h period of the most rapid cyclone intensification are temporally consistent for all cases considered, while there is a marked case-to-case variability in the dominant processes across individual cyclones.

To my mind, this research is scientifically valid research because of applying comprehensive methodology and good findings through a systematic assessment. The organization and language of the manuscript is also good enough to follow the discussion and analyses throughout the paper. Therefore, I recommend accepting it with some minor revisions.

## **Comments to the authors**

### **• General points:**

- The abstract is too long with too many details included. It needs to be condensed.
- The conclusion section is indeed a summary of the results with repeated sentences without further explanation and dynamical interpretation. This section is also too long and should be shortened to focus on the main findings of the present study with necessary interpretation.
- As described in the pioneer work of Hoskins et al. (1985) and in some other researches, rapid cyclogenesis can be explained by an interaction between low and upper level PV anomalies in which mid-level PV anomalies also act to intensify this process. Consequently, it is not right to assess the relevance of individual diabatic processes involved in the dynamics of rapidly intensifying extratropical cyclones in the absence of complex feedbacks acting in the real atmosphere. Therefore a precise explanation of this important issue in a suitable section would be beneficial.
- It can be useful to calculate some statistical significance level for the differences between the results in the two seasons and/or various categories.

- What is the reason of choosing a specific year (December 2017 until November 2018) as the study period in this paper?
- What is the reason for discussing only a single cyclone in subsection 3.2?
- I pointed to some questions raised in different parts of the paper; please pay attention to these points.

- **Minor points:**

- There are many unclear statements, mistakes, and editing errors throughout the manuscript. In Pdf file, I pointed to a large number of these points. Please pay attention to these points.