

Second review of wcd-2020-25

“Organization of convective ascents in a warm conveyor belt”

by Nicolas Blanchard et al.

Paper in review in Weather and Climate Dynamics Discussion

1 General Comments

After the first review, the manuscript’s clarity and structure have improved and my previous concerns and questions have been addressed. I appreciate the additional comments and replies to my questions by the authors. I have a few additional questions and specific comments, but I recommend the paper for publication in Weather and Climate Dynamics.

- l. 21: typo ”continously” \gg ”continuously”
- l. 25: ”PV” has not been introduced before. Please add potential vorticity (PV) when the variable is first introduced.
- l. 91: typo ”an horizontal” \gg ”a horizontal”
- l. 141: The ”grey” contours in Fig. 2 are now colored contours.
- l. 156: The authors could replace ”fly over” by ”observe”.
- l. 173: ”The specific value of the threshold has been set at a value equal to that used by Oertel et al. (2019) for comparison purposes.” To my understanding, Oertel et al. (2019) used a higher threshold of $320 \text{ hPa} (2\text{h})^{-1}$ for convective ascent, following also Rasp et al. (2016) who mentioned a threshold of 400 hPa in 2.5 h ?
- l. 229: ”The large overlap in altitude between fast and slow ascents suggests that convection is partly embedded in the slantwise flow, at least where their location also overlap (Fig. 5)”. Could the authors please provide some more information where the spatial overlap occurs, as this is difficult to directly see in Fig. 5.
- l. 230: type ”location” \gg ”locations”
- l. 236: Please rephrase this part of the sentence ”(...) and greater along anticyclonic than cyclonic trajectories”.
- l. 239: I think you here refer to Oertel et al. (2020).
- l. 240: ”This is consistent with the relatively low values of vertical velocity.” I think the lower graupel content is ”due to” the reduced vertical velocity. Hence, the lower graupel content might not necessarily be a contrasting result, but rather a consequence of the differing ascent characteristics of the chosen ascents.

- l. 248: Fig. 7b \gg Fig. 7c.
- l. 249: Please replace "under the dry intrusion" by "below the dry intrusion".
- l. 250: "The most intense, with reflectivities greater than 15 dBZ suggesting a convective origin, extends over a 20 km width." The most intense what? I think a word is missing here.
- l. 255: Fig. 7b \gg Fig. 7c. General comment: The RASTA measurements are referenced as Fig. 7/9**b** instead of (c) several times in the manuscript. Please correct throughout.
- l. 297: Please rephrase this sentence: "Under these high clouds are low and middle layer clouds highlighted by larger, positive reflectivity values."
- l. 305: I think Fig. 9c should be 9d.
- l. 336: "Note that the three regions largely encompass the rapid segments occurring in the vicinity of observations at 16:00 UTC." I'm not quite sure if I understand this correctly. Do you mean rapid segments in the observations at 15 UTC, because the blue and yellow box are rather far away from the observations at 16 UTC?
- l. 354ff: I appreciate the streamlining of the PV discussion. However, I do not understand the decrease and subsequent increase of PV for mid-level convection. Which processes lead to a decrease in PV along ascending trajectories?
- l. 358: This is related to the above comment: "Instead, the evolution at mid levels is similar to that found by Oertel et al. (2020) for trajectories passing through a region under convective influence." Could the authors please elaborate on that?
- l. 425-426: See comment to l. 173, about the threshold used by Rasp et al. (2016) and Oertel et al. (2019).
- l. 455-458: As I understand Harvey et al. (2020) and Oertel et al. (2020), localised heating results in quasi-horizontal PV dipoles located to either side of the ascent region, but does not directly explain a decrease of PV along ascending trajectories followed by an increase. Could the authors please describe and discuss the relevant processes more thoroughly? This comment is also related to the comment to l. 354ff.
- l. 477: "This combination makes it possible to identify coherent structures, while elevated convection remains partly absent from the analysis and would require a specific approach." I think the analysis of elevated convection is an interesting topic. Could the authors please add a short sentence about what is meant with "specific approach"?
- l. 470: I think the authors here refer to Oertel et al. (2020). It might also be worth to mention other studies that address convective PV dipoles, e.g. Chagnon et al. (2009), Weijenborg et al. (2015), Weijenborg et al. (2017), and Müller et al. (2020), even though they do not explicitly refer to convection in WCBs.

- relevant literature: Since the last review an additional discussion paper was published in WCDD which would be worth to mention in this study: Flack et al., 2020 (<https://wcd.copernicus.org/preprints/wcd-2020-43/>), who also analyse the 'Stalactite cyclone' (IOP 6 of NAWDEX).