

Weather Clim. Dynam. Discuss., referee comment RC2
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Comment on wcd-2021-74

Anonymous Referee #2

Referee comment on "How intense daily precipitation depends on temperature and the occurrence of specific weather systems – an investigation with ERA5 reanalyses in the extratropical Northern Hemisphere" by Philipp Zschenderlein and Heini Wernli, Weather Clim. Dynam. Discuss., <https://doi.org/10.5194/wcd-2021-74-RC2>, 2021

General comments:

I found this manuscript to be generally well-written and clear. The graphics provide clear illustrations of the main results of the study. The topic of the study has substantial scientific merit, and I expect it will be of interest to readers of *WCD*. I have a number of minor comments for the authors to consider. Once these comments are satisfactorily addressed, I believe this manuscript may be acceptable for publication.

Specific comments:

L83–86: "The combined effects...precipitation." This statement needs references. Also, did you intend to say "from the southeast" instead of "from the southwest" here?

L148–149: A shortcoming of this method is that it does not account for the remote influences that the weather systems can have on precipitation, i.e., the fact that a weather system, such as a cyclone, can still have a significant influence on precipitation at a given location even if that system is not identified close to the location. For instance, a cyclone, as identified using the method of Wernli and Schwerz (2006), may be located well to the west of a location but may still drive moisture transport and forcing for ascent that contributes to the precipitation at that location. Similarly, anticyclones often play a key role in driving moisture transport associated with atmospheric rivers associated with extreme precipitation, but do not necessarily overlap the region of precipitation. Perhaps you can comment on these issues in the text?

L208–209: I find this statement confusing. I understand the argument that high

baroclinicity can favor intense precipitation on warm days, but I do not understand how low baroclinicity provides a favorable condition for intense precipitation on colder days. Please clarify. Perhaps the occurrence of intense precipitation on colder days relates to a tendency for the precipitation in those locations to involve orographic forcing?

L217: Other factors that may contribute to this relationship include surface cold pool formation associated with moist convection, decreased insolation due to increased cloudiness, adiabatic cooling due associated with orographic ascent, and the occurrence of precipitation in connection with the passage of weak cold fronts.

L294: Orographic forcing might also be an important process.

L308: How were the climatological relative frequencies for the weather systems computed? Are they computed using all days during Dec–Feb 1980–2019? Please clarify.

L330–331: This statement is vague. Can you be a bit more specific about what Hobbs et al. found in their study?

L332: It is perhaps worth mentioning is that this pattern is consistent with the occurrence of a cold surge along the Rocky Mountains (e.g., Colle and Mass 1995). Such cold surges involve cold air damming and the establishment of a strong sloping baroclinic zone. Precipitation within the cold air mass could be associated upslope flow along the mountains as well as ascent of warm conveyor belts along the sloping baroclinic zone.

- Colle, B. A., and C. F. Mass, 1995: The structure and evolution of cold surges east of the Rocky Mountains. *Mon. Wea. Rev.*, **123**, 2577–2610, [https://doi.org/10.1175/1520-0493\(1995\)123<2577:TSAEOC>2.0.CO;2](https://doi.org/10.1175/1520-0493(1995)123<2577:TSAEOC>2.0.CO;2).

L337: This sentence is a bit confusing. What do you mean by 'evolve' here? Can you be more specific?

L359–361: I am having difficulty following this physical explanation.

L546: To which "smaller-scale processes" are you referring here? Be specific.

Technical corrections:

L88: "CAPE" has not been defined in the text.

L89: Remove comma after "analyse" ?

L320: Remove "dominating"

L328: Change "Nevada" to "Madre"

L328–330: "Interestingly...convection." This seems to be a run-on sentence.

L388: Insert "those in" before "winter"

L496: Insert "are" after "anticyclones"