

Weather Clim. Dynam. Discuss., referee comment RC1
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Comment on wcd-2021-74

Anonymous Referee #1

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-RC1>, 2021

I very much enjoyed reading this manuscript on the relationships between temperature, precipitation, and weather systems. Rather than examining the precipitation distributions for different temperatures, the study examines the temperature distribution for intense precipitation days. It then attributes the precipitation to the weather system that is present at the same location to determine the relevance of the weather systems to the precipitation and temperature relationship. One result that I find particularly interesting, and one that clearly requires more investigating is the fact that in particular regions, the precipitation efficiency (the average rainfall per weather system day) is increased in the wettest season, despite decreased temperatures.

The paper is well-written and the figures are clear. I only have one main suggestion and a few typographical changes.

For the composite figures (Fig. 5 and 6), the wind, PV, and CAPE contours are shown for all wet days. These will then be most representative of the most common weather system for wet days at the location. I suggest it would be worth showing the composites for the wet days for each different weather system (even if only in the supplement). Are there other flow configurations that lead to wet days? Or do all the days with different weather systems look like the composites presented?

Minor points:

- Line 145-146: I don't understand what this means. How is the statistical robustness increased by doing this? Could this be explained in a different way?

- Line 321: This is also shown by Hawcroft et al 2012, Catto and Dowdy 2021, Messmer and Simmonds 2021, Owen et al 2021.
- Line 449: "less" -> "fewer".
- Line 450: Is it not the case the WCBs are always associated with cyclones, but not necessarily the other way round?
- Line 456: "less" -> "fewer".
- Line 476-477: I find the structure of this sentence difficult to read. I suggest: "Warm conveyor belts contribute most to the total seasonal precipitation, in contrast to the wettest summer, followed by..."
- Line 517: Suggest slight rewording. -> "Intense precipitation in winter in most regions occurs predominantly on warmer days..." Then "In summer, intense rain falls mostly on colder days..."
- Line 560: Suggest slight rewording: ". hence, a higher temperature does not automatically imply..."
- Figure 1c: I find it unclear what is happening in this panel, and the text does not help - could this be explained differently?

References:

Catto, J. L., and A. J. Dowdy (2021) Understanding compound hazards from a weather system perspective, *Weather and Climate Extremes*, 32, 100313, <https://doi.org/10.1016/j.wace.2021.100313>.

Hawcroft, M. K., Shaffrey, L. C., Hodges, K. I. & Dacre, H. F. How much Northern Hemisphere precipitation is associated with extratropical cyclones? *Geophys. Res. Lett.* 39, L24809 (2012).

Messmer, M. and Simmonds, I. (2021) Global analysis of cyclone-induced compound precipitation and wind extreme events. *Weather and Climate Extremes*, 32, 100324.

Owen, L. E., Catto, J. L., Stephenson, D. B., & Dunstone, N. J. (2021). Compound precipitation and wind extremes over Europe and their relationship to extratropical cyclones. *Weather and Climate Extremes*, 33, 100342.