

Atmos. Chem. Phys. Discuss., referee comment RC3
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Comment on acp-2021-420

Anonymous Referee #3

Referee comment on "A climatology of trade-wind cumulus cold pools and their link to mesoscale cloud organization" by Raphaela Vogel et al., Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2021-420-RC3>, 2021

Review of "A climatology of trade-wind cumulus cold pools and their link to mesoscale cloud organization" by Raphaela Vogel, Heike Konow, Hauke Schulz and Paquita Zuidema.

The paper presents a climatology of trade-wind cumuli based on more than ten years of data from the Barbados Cloud Observatory. Moreover, it makes an attempt to link the cold-pool characteristics to the mesoscale cloud organization. The paper is well written, logically organized and presents very interesting results. It is very nice to see a cold-pool climatology based on observational data over such a long time span. I only have some minor comments.

- Doppler Lidar data: did the authors encounter any issues with the data retrieved by the Doppler Lidar during rainy periods? Often, these periods are discarded from the records. Moreover, the aerosol load can be reduced significantly after rainy periods, deteriorating the signal quality.
- Cold-pool detection algorithm and analyzed near-surface variables: I was missing surface-pressure in the list of analyzed variables. Already in the cold-pool detection algorithm it could be included as an additional criterion to identify a cold pool, but it would definitely be worth adding it to the list of analyzed variables. Increases in surface pressure in connection with the cold pool can give a hint on the spreading cold-air mass. While wind speed is shown, wind direction could be a further interesting candidate.
- Mesoscale cloud organization: The neural-network based classification on the brightness temperature from the GOES-16 Satellite is an interesting dataset to classify mesoscale cloud organization, and the catchy names of the identified patterns are intriguing. Yet, to have a more general classification and to add information to this one single dataset I suggest to widen the classification to more classical approaches such as e.g. spectral analyses (e.g. Wood and Harmann, 2006).

Technical comments:

- Table 1: please specify ΔT_{unfil} .
- Caption to Table 1: I suggest to replace "How the ..." with "The computation of the diagnostics".
- Line 235: add full stop after "mentioned"
- Line 265: replace "like" with "such as".
- Line 328: another study that has looked at the moisture origin within cold pools in detail is Schlemmer and Hohenegger (2016).

References:

Schlemmer L. and C. Hohenegger, 2016: Modifications of the atmospheric moisture field as a result of cold-pool dynamics. *Quart. J. Roy. Meteorol. Soc.*, 142: 30–42.
doi:10.1002/qj.2625

Wood, R., & Hartmann, D. L., 2006: Spatial Variability of Liquid Water Path in Marine Low Cloud: The Importance of Mesoscale Cellular Convection, *Journal of Climate*, 19(9), 1748-1764.