

Atmos. Chem. Phys. Discuss., referee comment RC1  
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## Comment on acp-2021-1060

Anonymous Referee #1

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Referee comment on "Quantifying vertical wind shear effects in shallow cumulus clouds over Amazonia" by Micael Amore Cecchini et al., Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2021-1060-RC1>, 2022

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This manuscript attempts to reveal a complex effects of vertical wind shear on shallow cumulus clouds by applying an off-line cloud tracking model to large eddy simulation data. Large eddy simulations are configured to simulate shallow cumulus clouds over Amazon.

The Lagrangian analysis has an advantage to provide statistical understanding of time evolution of clouds, i.e., lifecycle of clouds. The authors are able to present the lifecycle of an average cloud under non-shear and shear environment. The effects of vertical wind shear to the lifecycle of the simulated clouds are consistent with previous studies.

Although I think the results obtained with their Lagrangian analysis are new for this topic, the manuscript lacks a backup discussion and supportive figures. Also, the results are qualitative rather than quantitative contrary to their intention to provide quantitative arguments. There are several caveats that have to be cleared before acceptance for publication.

First, the manuscript does not give a description of how the model initial condition as well as large scale forcing is constructed. The authors should describe how vertical wind shear is maintained during their simulation. Also, how is radiative heating computed? These are necessary information for reproducibility.

Second, the manuscript does not discuss/present general results of their simulation such as profiles of cloud water, cloud fraction, droplet number, fluxes, etc., time series of liquid water path, surface precipitation, etc. How can readers accept the new results without confirming reasonability of simulations? How are these LESs compared with observations?

Third, their cloud tracking method discards clouds outside of the 10-km radius circle

centered at the domain center. The authors justify this limitation due to the periodic boundary condition and clouds crossing the boundary. Since the domain is 21.6 km x 21.6 km, this means 33% of the domain is not used for their Lagrangian analysis. This leads to less or insufficient statistical sampling, which makes their results less significant. This also leads to statistical bias; mean of all identified clouds with the cloud tracking model has to be equal to the domain mean. The solid and dashed lines in Fig. 4 have to match up. There are ways to include clouds that cross the model lateral boundary. For instance, 1) tile 9 identical snapshots in a square, 2) classify all clouds over 9 tiles, 3) remove clouds whose part is not in the central tile, and 4) remove duplicated clouds that cross the lateral boundary (there are 2 identical clouds for a cloud crossing the boundary; at the corner there are 4 identical clouds).

Fourth, as they discussed in the text, the model horizontal resolution may be too coarse for quantitative argument. For example, wind shear broadens the equivalent diameter up to 100 m on average, which is just 2 grid width.

These caveats have to be cleared before publication. The 4th caveat can be omitted by shifting to qualitative arguments.

I would recommend a major revision. However considering time required for upgrading their cloud tracking model and additional analysis, a longer period may be required.

Minor comments

line 13: Remove "DALES".

line 14: Remove "with" from "The resulting cloud field is analyzed with by applying..."

line 27: Remove "a the" from "However, open questions still remain given that a the individually deepest clouds..."

line 348: Add "9a" between "This figure" and "shows that the core represents between..."

line 357: Change "Figure 9" to "Figure 9a".

line 385: Change "continuous" to "contour"

line 446: Typo. Change "could" to "cloud"

line 448: "it also tends to increase cloud clustering." If clustering is caused by cloud merging, this can be seen in the number of merger from the tracking data.

Figures: Yellow with a white background is hard to see. Change yellow to other color.

Figure 5: Plot time series of CAPE.

Figure 11: The black contour is hard to see. Change its color.