

Atmos. Chem. Phys. Discuss., referee comment RC2
<https://doi.org/10.5194/acp-2021-87-RC2>, 2021
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Comment on acp-2021-87

Anonymous Referee #2

Referee comment on "Morning boundary layer conditions for shallow to deep convective cloud evolution during the dry season in the central Amazon" by Alice Henkes et al., Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2021-87-RC2>, 2021

This manuscript used field observations to study the shallow to deep convective cloud evolution in the central Amazon. Several transition cases are comprehensively discussed. In general, this study discussed an important issue with solid analyses. However, the limited cases may not support statistically significant conclusions. Meanwhile, the significance of this study needs to be better summarized in the conclusion section. Therefore, this paper needs major revisions before potential publication in Atmos. Chem. Phys.

Specific Comments:

1. The evolution of boundary layer cloud can largely differ case by case. Therefore, the mechanism and evolution pattern observed in the several cases may not be representable enough.
2. The impacts of humidity on the development of convective clouds have been intensively investigated in previous studies (e.g., Zhang et al. 2010, 2013). The authors need to address the differences in their findings comparing to previous studies.
3. As a key parameter, this study discussed the positive role of sensible heat flux on shallow-to-deep convective clouds. However, strong sensible heat also can lead to strong entrainment at the boundary layer top, which would induce dry air masses into the boundary layer. Thus, sensible also may negatively affect cloud development. Moreover, besides the impacts of sensible heat on cloud development, clouds can significantly alter sensible heat. Thus, this issue needs to be discussed more carefully.
4. Some variations in the meteorological data may not cause by natural variability, but due to the instrument deficiency. In Figure 4-5, some signals seem a little bit noisy. In Figure 4f, there are some sharp decreases in sensible heat during the daytime. The authors may clarify these odd variations.

References.

Zhang, Y. and Klein, S.A., 2010. Mechanisms affecting the transition from shallow to deep convection over land: Inferences from observations of the diurnal cycle collected at the ARM Southern Great Plains site. *Journal of the Atmospheric Sciences*, 67(9), pp.2943-2959.

Zhang, Y. and Klein, S.A., 2013. Factors controlling the vertical extent of fair-weather shallow cumulus clouds over land: Investigation of diurnal-cycle observations collected at the ARM Southern Great Plains site. *Journal of the Atmospheric Sciences*, 70(4), pp.1297-1315.