

Interactive comment on “Coupled vs. decoupled boundary layers in VOCALS-REx” by C. R. Jones et al.

Anonymous Referee #1

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Authors of this paper gave a detailed analysis of the decoupling characteristics as related to the boundary layer profiles, drizzle rates, and surface latent heat flux using C-130 aircraft measurements conducted in VOCALS-Rex. Although some previous papers used ΔZM as a critical parameter for the decoupling representation, this study is the first to establish a firm observational basis for that relationship. I have been wondering for longtime how realistic this relationship is; and am really glad about the robust result. Other two conclusions are also interesting, although expected. They are 1) decoupling is not directly correlated to the decrease of cloud cover; and 2) the cloud cover appears to be strongly related to the value of k . I recommend acceptance after following minor revisions are addressed.

Page 8436, Line 10. About “decoupling measure Δq ” Why do you choose moisture

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mixing ratio instead of temperature as the decoupling parameter? Isn't the temperature gradient more representative of boundary layer stability? Could you comment on this? In addition, after reading the paper, one may be wondering what the mean decoupled or well-mixed BL structure look like for a direct comparison. Fig. 2 shows examples for these two types of BLs. But these examples are bit extremes for representations of the structures. It would be much better if authors can provide averaged profiles of the structures based on the classifications

Page 8438-8439, Eq. (4). It looks like $s(z_b) - s(z_{sc})$ can be further related to $(z_b - z_{sc})$; then (5) can be better approximated. But this is really a minor point. Page 8440, line 20-26. In explaining the negative buoyancy flux, you probably want to emphasize that the lack of local buoyancy source just below the cloud base is conducive for downdraft parcels being warmer than updraft parcels, leading to the negative buoyancy flux.

Page 8443, line 10-12. Regarding the LHF contribution to the negative buoyancy flux, I have to confess that I never really understand its physical process even though I perfectly understand the mathematical presentation shown in Bretherton and Wyant (1997). I always think that a larger LHF tends to result in a deeper cloud layer, leading to a stronger entrainment and more favorable condition for the decoupling.

Page 8446, line 13-21. About Fig. 11. Why are there many more red (POC) points in the panels in the middle and right than that in the left? Could you separate the decoupled points from the well-mixed? Then readers will clearly see the relationship (or lack of it) between the coupling and cloud fraction. Specifically, there are 11 points that indicate partial cloudiness in the left panel. Are these points the decoupled or the well-mixed?

Finally, now you have established a robust relationship between the decoupling and the ΔZM . Could you comment on the importance in identifying this relationship?