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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Modeling microphysical effects of entrainment in clouds observed during EUCAARI-IMPACT field campaign" *by* D. Jarecka et al.

Anonymous Referee #3

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The authors present a LES simulation of a stratocumulus-over-cumulus case observed during the EUCAARI-IMPACT field campaign, focusing on the mixing of the cloud with its environment. Although the topic is interesting, because we need to advance our understanding of mixing at cloud edges, the paper does not manage to bring forward what is novel about this investigation or how it improves our understanding of such processes. In its current status, the paper therefore resembles more a "deliverable" report than a scientific paper. For being worth to being published in ACP, the authors should think what are the important points they want to make, and rewrite the paper trying to bring these points forward. My main concerns join the concerns brought out by the other reviewers, namely:

(i) in the introduction instead of the approach :" there is this observed case and we simulate it with our LES and it kind of works", it would be far more interesting if the authors were highlighting what are the issues with mixing at cloud edges, what we know about it and what we don't, and what questions the new development in their LES can help addressing. And then construct the paper so that it responds to these questions.

(ii) as highlighted by another reviewer, the resolution at cloud top is really too coarse for focusing on mixing at cloud edges, and particularly at the top of the stratocumulus. Indeed Sandu and Stevens (2011) went down to a resolution of 5 m at cloud top to be able to reproduce the sc to cu transition, and the grid they used is used ever since in all intercomparisons of GASS (composite transitions, ASTEX, now CONSTRAIN). Given the demonstrated sensitivity of cloud top entrainment to grid size in LES, I would not consider the results as reliable, unless the authors redo the simulation with a vertical resolution of at least 5m within the cloud layers.

(iii) It is well demonstrated now the role played by the shortwave radiation within the diurnal cycle of the cloud. If the authors want to quantitatively compare the cloud evolution with the observed one, both the shortwave and longwave radiation should therefore be accounted for. When wanting to look at something as sensitive as mixing at cloud edges, the more precise we can get the better it is. So why not using one of the radiative transfer codes available in the different LES models, like done nowaways by all the participants to the latest intercomparison exercises related to boundary layer clouds ? This would allow including the shortwave but also having a more precise description (rather than using tuned numbers) of the cloud to radiative cooling which is the main driver of mixing at cloud top.

(iv) it would be also good to make the distinction between what is it done in the submitted JAS paper and this one, especially that the JAS paper is not available for the readers at present.

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