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Atmospheric Chemistry and Physics Discussions

Interactive comment on "On the relationship between open cellular convective cloud patterns and the spatial distribution of precipitation" *by* T. Yamaguchi and G. Feingold

Anonymous Referee #1

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In this study LES are used to explore the role of the spatial distribution of precipitation in the transition from stratocumulus closed cell fields to open cellular cumuliform convection. Both the simulations set-up to answer this question and their analysis are novel and extremely interesting. The paper significantly improves our understanding of the mechanisms that govern the closed to open cell transition, and therefore worth to be published in ACP. Although in general well written, and supported by extremely clear and revealing figures, the manuscript could be further improved before being published in ACP. A few points that would need addressing would be:

1. the abstract and introduction should be more consistent in the reference to the

closed to open cellular transition. In the abstract, it is clearly pointed out that the paper is focusing on the transformation of stratocumulus topped cellular convection into open cellular cumuliform convection. In the introduction, the authors refer more generally to low cloud transitions. This is a bit vague and can be misleading, as the reader could think at the stratocumulus to cumulus transition which takes place in the subtropics when air masses are advected by the trades over warmer water, and on which a vast amount of studies had focused in the past (starting with Bretherton, 1992, Albrecht, 1995„ Pincus et , 1997, Sandu et al. 2010, to cite just a few). The question addressed in the paper is really why open cell sometimes form within the persistent closed cell stratocumulus decks.

2. in the abstract the phrase : " Finally it is shown that phase..." is not clear

3. page 25654, l3 - 'most often used method to achieve ..transition' should be rephrased

4. page 25654, l15-18: isn't this in agreement with Wood 2011a study which shows that the cloud remains in a closed cell state if precipitation evaporates before reaching the ground?

5. page 25655, l3-12. The authors should make clearer here what does their study bring compared to previous studies (for e.g. by Wang 2009, 2010, etc)

6. Sect 2.2 - the discussion of the aerosol/droplet concentration in terms of both na and nt is confusing. Why na is fixed in S1 and nt is fixed in S2? How is the activation done? to what an na of 70 for e.g. corresponds in terms of droplet concentration? This is what matters in the end for rain formation...

7. Sect 2.2, the authors say that S3 diverges from S1 at hour 3, but because it is on a bigger domain, it must be re-run from the beginning, right?

8. In fig 2, it would be useful to show as well N250.

9. page 25660, the description of how the mode and the mode index are defined and

computed is not very clear. Also, why is Nd in mm-2 and not in cm-3?

10. It really never happens that because of the delay in Nd and tau with respect to LWp l>1.1 for 1 and l<1.1 for the other two?

11. page 25665 - it would be interesting to discuss more in detail what is happening, rather than state the differences between the simulations, for e.g. why when there is convergence of RWP there is more surface precipitation?

Interactive comment on Atmos. Chem. Phys. Discuss., 14, 25651, 2014.