Atmos. Chem. Phys. Discuss., 14, C10927–C10929, 2015
www.atmos-chem-phys-discuss.net/14/C10927/2015/

Atmospheric Chemistry and Physics Discussions

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14, C10927–C10929, 2015

Interactive Comment

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

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Received and published: 6 January 2015

We thank Referee 2 for his/her valuable comments.

1. The authors introduce the topic by showing a heavy drizzling overcast case from VOCALS, yet the DYCOMS-II RF02 case all the simulations are based on is quite different. This VOCALS boundary layer in Fig. 1 is very deep and probably quite decoupled. In contrast, all simulations are based on DYCOMS-II, which is much shallower and less decoupled (see Fig. 3 of Ackerman et al., MWR, 2009). The two DYCOMS-II intercomparison cases (RF01 and RF02) are rather predisposed to thinning and breakup

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Interactive Discussion

Discussion Paper

from excessive model entrainment. For example, the UCLA model needed to have the subgrid-scale fluxes drastically reduced in order to avoid excessive entrainment. The sensitivity of the DYCOMS-II case makes me wonder if it is a representative choice for exploring the authors' hypothesis. I would like the authors to speculate on how or whether the conclusions derived from this case will differ from the deeper and more decoupled SEP cloud systems.

The reviewer raises a good point. Indeed we have used VOCALS radar and GOES data as an illustration of an idea rather than as a rigorous basis for comparison. It is possible that in the deeper VOCALS boundary layers, more rain will be needed to transition to open cells. In fact VOCALS boundary layers tend to be deeper than DYCOMS-II and generate thicker clouds and more rain. To focus on the idea that the spatial distribution of rain is a potentially important factor, we have ignored the influence of boundary layer height (or degree of decoupling) for this study and leave it for future research. It should be noted here that both DYCOMS-II RF02 and VOCALS-REx have been used for open cell transition study: for example, Wang and Feingold (2009ab JAS) used DYCOMS-II RF02, and Wang et al. (2010 ACP) used VOCALS RF06. The underlying mechanisms of interactions between outflows are the same but the degree may differ in deeper boundary layers. We now comment on this point in the revised text.

2. The authors should clarify that they are addressing only the aerosol–cloud– precipitation mechanism driving cloud breakup, and not the warming–deepening mechanism of Wyant et al. (1997).

This is essentially the same as the first comment made by Referee 1. Please see our response to Referee 1 above. We added a paragraph clearly stating that our interest is transformation from closed to open cells in the introduction through aerosol-cloud-precipitation interactions. Additional references are now included.

3. Although this is purely a modeling study, the authors should discuss how this hypothesis might be tested observationally. I would think that drizzle cell statistics from

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the C-band radar during VOCALS would be a good place to start.

At the very end in the text, we stated “Further research will use satellite-based data to test this hypothesis...”. We now expand on this briefly but clearly a detailed investigation of this topic is beyond the scope of this study.

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