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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Precipitation and cloud cellular structures in marine stratocumulus over the southeast pacific: model simulations" *by* H. Wang et al.

Anonymous Referee #2

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General comments

The paper presents a model sensitivity study of marine stratocumulus clouds to aerosol concentration and meteorological conditions with regard to the transformation from the closed-cell to open-cell cloud structure. This is a detailed investigation with some interesting new results and deserves published in ACP. I have the following comments.

The authors discussed the formation of POCs in details using a number of sensitivity simulations. But I am not sure what is exactly meant by the open-cell or close-cell structure. Usually, the open-cell structure is established when clouds form in the narrow updrafts with clear descending regions, while the closed-cell refers to the condition

where clouds form around the center with thinning clouds in the narrow downdrafts. For this definition, clouds with the open-cell structure have much less coverage than those with the closed-cell. Figs. 5 -7 show the cloud albedo for simulations with six various conditions. Only PCCN clearly displays much reduced cloud cover over the disturbed area. Although the cloud structures in other simulations (FQV, PSFX and SFLX) become much larger, it is not clear that the cloud coverage is much reduced or that the vertical motion pattern is changed to that of an open-cell structure. Do these cloud structures represent the open-cell? If yes, the authors should provide some statements on why they are different from the PCCN and some satellite pictures that show clear thin and narrow bands of open-cell clouds. Or these cloud structures are simply in a transition to a full open-cell condition. In that case, authors should show some fully developed open-cell plots.

Another issue with the paper is that some conclusions or results are stated or described without the relevant information being actually shown in the paper. For example, in last paragraph on page 8350, it is stated that "solar heating breaks up open-cell walls and cloud fraction further reduced". But no results are shown to support these claims. Another example is about the impacts of PQV. (I believe this is an important conclusion of the paper.) On page 8353, it is stated that drizzle and the broken clouds almost cover the entire domain by t=8h. But the results are not shown here. This makes harder for readers to understand and appreciate the conclusion. I understand that this paper includes many simulations and it is difficult to show most of the results. However, if results are important for conclusion, they should be shown in the paper.

Specific comments

Page 8346, line 15-20 on specification of wind. The initial wind profiles (Fig. 1) show strong baroclinicity across the inversion that enhances v speed below the inversion. Therefore, the geostrophic wind cannot be constant in the lowest troposphere. Without appropriate thermal wind specification, these wind profile cannot be maintained. I am wondering how the geostrophic winds (or large-scale pressure gradient) are specified.

Page 8351, line 25-28. The authors state that the warmer and less turbulent cloud layer in D30 is due to the water vapor solar absorption. I think this is very speculative; and I am not convinced. Many processes may contribute to that. A likely cause is drizzle. Because D30 produces more drizzle than D500, the cloud layer may be warmer due to less evaporative cooling available and the subcloud layer cooler due to more evaporation.

Page 8355 section 3.3. This section is too descriptive and sounds speculative; it does not provide enough information for the results described here. For example, some quantitative data should be given on the "two reasons" for the stronger sensible flux effects. Readers would have difficult time to be convinced about these results.

Page 8368, Table 1. "Delta qv + Delta theta" is confusing. It can be changed to ""Delta qv and Delta theta". Same modification may be applied to "Dela SFX + Delta LFX"

Interactive comment on Atmos. Chem. Phys. Discuss., 10, 8341, 2010.