

Interactive comment on “The relative importance of macrophysical and cloud albedo changes for aerosol induced radiative effects in stratocumulus” by Daniel P. Grosvenor et al.

Anonymous Referee #1

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1 General comments

This paper uses a case-study simulation at a 1 km resolution with the new CASIM microphysics scheme in the Met Office UM to address several questions of great interest to the cloud and aerosol communities, namely

1. how do stratocumulus clouds respond to aerosol?
2. what model resolution is required to simulate SCu realistically?
3. how important is the subgrid cloud cover scheme?

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On the whole, the paper is well written, and the authors provide valuable answers to all of these questions, to the extent that a case study can answer them. Some questions arise in the manuscript that are not answered, but the authors promise to address them in follow-up work, which is appropriate. I have a few suggestions for minor clarifications (see below) and recommend publication once these have been addressed. I would also like to commend the authors for the level of detail provided in the appendices and for making the model output available.

2 Specific comments

1. The authors use the model to partition the cloud response to aerosols into “macrophysical” (cloud fraction and liquid water path) and “microphysical” (droplet size) responses. Being able to use the model to understand the various mechanisms at work is one of the major benefits of having a reliable model, so I feel this is an important part of the paper. Since the authors point out that their model works to their satisfaction only in closed-cell SCu (p. 13 l. 30f.), the title and abstract should reflect that fact. (The title and abstract should also reflect that the results are based on a model and reflect a case study.)
2. In Sec. 4.2.1, the distinction between LWP and LWP_{ic} is made. This leads me to assume that LWP refers to gridbox-mean LWP throughout the manuscript. If this is not the case, the manuscript should be changed where appropriate.
3. The high model bias in LW fluxes is attributed to low bias in cloud altitude or cloud fraction (p. 20, l. 25). What about the cloud thickness? I realize that the effect of LWP on the LW flux probably saturates pretty quickly, but the modeled LWP peaks at pretty small values.
4. p. 15, footnote 1: more explanation is needed here; I assume “Poisson count-

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ing statistics” means that the uncertainty scales as \sqrt{n} , but that doesn’t tell me whether the ranges quoted are 1σ , 90%, 95%, etc. confidence intervals.

5. The authors are right to point out that the subgrid cloud scheme may play an important role even at fairly high resolution. However, one of the drawbacks of case studies is that it is difficult to tell which conclusions generalize (see my first specific comment above). Changing “demonstrates” to “suggests” on p. 32 l. 10 would make me feel more confident in the conclusion.

3 Technical corrections

The manuscript, while well written, would benefit from thorough proofreading. In addition, units are consistently italicized when they should be roman; I believe `copernicus.cls` provides the `\unit` command for this purpose.

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