

Interactive comment on “Relationship between drizzle rate, liquid water path and droplet concentration at the scale of a stratocumulus cloud system” by O. Geoffroy et al.

Anonymous Referee #2

Received and published: 15 April 2008

This paper presents modeling study that relates drizzle rate to liquid water path and cloud droplet number concentration. Overall, the paper is well written with clear structure. The main problem concerning parameterizations for the precipitation rate in GCMs is presented first. It is suggested that instead of using autoconversion parameterizations for drizzle formation in GCMs, the drizzle rate should be presented as a function of liquid water path and droplet concentration with parameters from CRM simulations. This is justified as stratocumulus clouds can be very heterogeneous inside typical GCM grid, and thus using mean values for liquid water content can lead to an inaccurate precipitation rate. To solve the issue concerned a new parameterization is developed based on Large Eddy Model simulations. Results from these simulations are

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compared to the results from three different measurement campaigns, and the agreement is found to be reasonable (at least qualitatively). Large difference in values from ACE-2 campaign and the model results is explained to be caused by measurement setup. The parameterization developed might be useful for the GCM-community and it should be tested in practice. After addressing few comments I have, I recommend manuscript to be published in ACP.

Specific comments:

- 1) The simulated cloud fraction is said to be almost unity in all simulations. Does this have any effect on the parameterization as the cloud fraction in GCM grids might be clearly less than unity? It is also stated later that largest convective cells are actually close to the size of domain. Could it be useful to run simulations also with a larger domain to make sure domain size and grid resolution do not affect drizzle formation in LES.
- 2) In the parameterization developed there is no minimum value for the mean LWP that is able to produce rain. This is not reasonable for a single cloud, so should there be some minimum value also for larger domains?
- 3) On page 3923: I don't understand why there is a reference to Facchini et al. (1999) when there is discussion about microphysical processes during cloud formation. Many other, more relevant references could be found for the actual effect of surface active species on cloud droplet formation.
- 4) On page 3937 before equation 7 LWP is printed twice.
- 5) Figure 5: It is possible to use colors, so could you please use them to make figure easier to read. There is too little difference between black and grey.
- 6) Could the font be slightly increased in some figures to make reading easier.

Interactive comment on Atmos. Chem. Phys. Discuss., 8, 3921, 2008.

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