

Interactive comment on “Switching cloud cover and dynamical regimes from open to closed Benard cells in response to the suppression of precipitation by aerosols” by D. Rosenfeld et al.

Anonymous Referee #2

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The authors' response to my initial comments states that the manuscript contains both a novel hypothesis and new data/analyses that support the hypothesis. I stand by my initial claim that the manuscript contains neither. This is why:

1. Novel hypothesis. At the 2004 ICCP Cloud Physics Conference in Bologna 2004, a paper on open cells and aerosols was presented by Petters et al. which concluded that "Our observations are also in accord with model results (Hegg, 1999) showing that decreasing CCN concentration modulate decreasing liquid water path and shortwave optical depth. If these pockets are indeed the consequence of low accumulation mode

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aerosol concentrations, then small perturbations of the aerosol (e.g. anthropogenic pollution or increases in wind speed) may destroy the pockets and dramatically increase the cloud fraction over these regions." This work was submitted for publication shortly thereafter and recently appeared in The Journal of Geophysical Research (Petters et al. 2006), and succinctly hypothesized that "the low accumulation mode concentrations associated with the pockets are proposed to be necessary for their maintenance".

In addition, the paper on pockets of open cells by Stevens et al. (2005) states that "our data provide empirical support for the idea that by modulating precipitation formation, perturbations in the atmospheric aerosol can affect patterns of cloudiness".

It is understandable that the authors may not have been aware of the 2004 conference proceeding (although the lead author has several manuscripts at the same conference), and that the 2006 JGR paper was published after the manuscript was submitted, but the Stevens et al. (2005) paper was cited in the manuscript, and the fact remains that the hypothesis discussed in the paper is not a new one and has been actively discussed and examined by the research community for several years.

2. New data.

The data in Fig. 1 cannot be used to support the hypothesis that aerosols are responsible for switching cloud cover from closed to open cells because this analysis shows only that cloud cover and effective radius appear to be correlated over a wide band of subtropical ocean (upper left panel). As I mentioned in my previous review, this correlation may be purely fortuitous (for example, if regions with extensive cloud cover happen to lie near land) and/or may reflect problems with effective radius retrievals in broken clouds. More importantly though, no attempt has been made to determine if the transition from closed to open cells is the major cause of the variations in cloud fraction in these observations. I therefore don't understand how they support the hypothesis.

It is my view that an adequate screening to remove contamination from broken and thin clouds is necessary before correlations between effective radius and cloud cover (e.g.

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Figs 3 and 4) can be taken seriously. The problem with regions of open cells is that both broken AND thin clouds exist within them on the km scale, and so a particularly stringent screening is required here.

References:

Petters, M. D., J. R. Snider and I. C. Faloona, 2004: Aerosol and pockets of open cells, Proceedings of the ICCP Conference on Clouds and Precipitation, July 2004, Bologna, Italy.

Petters, M. D., J. R. Snider, B. Stevens, G. Vali, I. Faloona and L. Russell, 2006: Accumulation mode aerosol, pockets of open cells, and particle nucleation in the remote subtropical Pacific marine boundary layer. *J. Geophys. Res.*, 111, D02206.

Stevens, B., Vali, G., Comstock, R. Wood, K., vanZanten, M. C., Austin, P. H., Bretherton, C. S., and Lenschow, D. H.: Pockets of Open Cells (POCs) and Drizzle in Marine Stratocumulus, *Bull. Amer. Meteorol. Soc.*, 86, 51-57, 2005.

Interactive comment on *Atmos. Chem. Phys. Discuss.*, 6, 1179, 2006.

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