

# Reviewer Response: Cloud controlling factors – low clouds

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May 23, 2008

## Review of Feingold

- This possibility is recognized as a footnote
- Yes we were confusing things here.  $\sigma$  was meant to also encode changes in the actual number of drops due to the mixing history, not just shape. This is now clarified by redefining both  $N$  (to be the expected number of activated cloud droplets for an adiabatic cloud) and  $\sigma$ . We also note the ex post facto nature of the changes in the Chosson et al., study.
- Regarding the values of  $D$  and optical depth, we added a comment prior to the introduction of the Weaver and Pearson paper that should now make this argument more clear (the reviewers intuition was correct).
- I am not positive I completely understand the reviewers objection, but the text has been changed to make clear that the surface fluxes change solely as a result of an increase in the aerosol, irrespective of the atmospheric layer in which it arises, or its tendency to scatter versus absorb radiation.

## Anonymous Review

1. This was done, and in looking back at this I found an even earlier reference to the relationship between stratocumulus and temperature inversion (Clayton 1896) which I also now include.
2. Good point, this is now changed, in talking about  $\Delta T$  we simply remove the symbol and spell out that we mean the temperature difference.
3. Perhaps we don't understand the reviewers point. But the argument we make is based on the assumption of the clouds being *thin* and is made "even in the absence of precipitation". We agree with the reviewer that the same result follows for deep clouds, but then precipitation must be invoked. We disagree with the reviewer if s/he is maintaining that the argument does not follow for *thin* cold clouds.
4. Because we wanted to associated the words "percentage" and "point" we spell out the former, doing otherwise encourages the interpretation of a relative change. To make this more clear we now hyphenate the phrase "percentage-point"
5. The definition of  $s$  has been added in words.
6. We now explicitly state that these are "ostensibly external" factors.

7. Thanks, corrected, and symbols introduced.
8. Thanks, corrected.
9. The reviewer is correct. We changes this last sentences of this paragraph to read: “Nonetheless, our ability to begin constraining the models with data in these respects is a significant step forward, and provides an example of the increasingly critical interplay amongst models, theory and data.” Given the context, seeing the glass half full more accurately reflects the fact that it started out empty.
10. The point of distinction here is our claim that transient representations of trade-cumulus may be more relevant than transient stratocumulus representations. To the extent this is valid the divergence become negligible in one case if not the other. We may be wrong about this, but at least to make our conjecture clear we emphasize the distinction as being one of “transience” versus “stationarity.”
11. The point was not to go into detail here. The Lewellen and Yoh scheme falls into the class of rather general assumed PDF schemes, as does Bougeault and Tompkins. However, to indicate that we were thinking about this point quite generally we added references to Bougeault and Tompkins (toward the end) in the revised manuscript.
12. The reviewers point is fair. To address it we revised the end of this paragraph (removing the ATEX reference) to make the more constructive point that for this question too the increasing interplay of models, theory and data is advancing our work.
13. Although the first author was not convinced this was necessary, the subscript notation has been added, in the hope that it makes the issue as explicit as possible.
14. Yes, this has been rephrased. The word heuristic no longer appears, and the text is rephrased to make the point more transparently.
15. We changed this to define cloud depth as  $\zeta$ .
16. Reviewer A did not like the conclusions, so we struck a compromise. This was to keep things mostly like they are, but introduce them better. We also expand on the *Theory First!* section to point towards critical experiments. This point was also raised by an additional reviewer at the workshop and addressed here.