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Interactive comment on “An explicit study of aerosol mass conversion and its parameterization in warm rain formation of cumulus clouds” by J. Sun et al.

Anonymous Referee #3

Received and published: 9 December 2013

Review of ACPD-13-590 by Sun et al.

General Comments:

This study uses a 1.5-dimensional non-hydrostatic convective cloud and aerosol interaction model with bin microphysics to examine the conversion of aerosol mass in cloud droplets to aerosol mass in raindrops. The study points out that there is not a linear relationship between this aerosol conversion and precipitation production as is often assumed in the parameterization of aerosol removal in global models. The study goes on to present numerous regression equations for this conversion under different

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aerosol size distributions and thresholds for raindrop size. The topic is appropriate for Atmospheric Chemistry and Physics but there are certain major concerns, as outlined below and as summarized by other two reviewers that would need to be carefully addressed before the manuscript is suitable for publication.

Major Points:

- 1) Details should be provided about the activation parameterization used. The text does not address how these results might be dependent on the representation of activation and as a result how applicable these relations are to models with other activation parameterizations.
- 2) A large number of regression equations are provided but the text is not clear about how these are to be applied in a global model or if the authors consider such an implementation appropriate.
- 3) The results also depend on the autoconversion and accretion parameterizations used in this study. How does this limit how broadly generalizable are the conclusions of this study, likewise for the activation scheme used? This should be explicitly addressed.
- 4) How does the neglect of mixed phase and ice cloud microphysics influence the conclusions of this study?
- 5) Do you expect the results to be different for stratiform as opposed to convective clouds?
- 6) The discussion, particularly in the Section 10 could be more concise for easier readability.

Minor Points:

Page 25500, lines 22: Should this be a reference to Table 4, not 3 here?

There are a few spelling errors , page 25505, line 11, change 'raio' to 'ratio' and page 25510, line 21, change 'remarkble' to 'remarkable'

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Interactive comment on Atmos. Chem. Phys. Discuss., 13, 25481, 2013.

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13, C9412–C9414, 2013

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