

Interactive comment on “Changes in the shape of cloud ice water content vertical structure due to aerosol variations” by Steven T. Massie et al.

Anonymous Referee #1

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This paper is generally well written. After addressing my major concern below, the results of this paper would undoubtedly motivate worthwhile future research efforts in this field.

My major concern is that this study uses only MODIS AOT to analyze vertical structure changes of ice clouds under various AOT amounts. It is noted that MODIS can not distinguish aerosol types. While aerosols could perturb the vertical profiles of clouds via cloud particle size change and latent heat release, and thus invigorate convection (Rosenfeld, 2008), absorptive aerosols could result in less solar radiation at the surface and more stable vertical temperature profile and thus inhibit cloud development (see work by Ramanathan 2005, 2007). I noted in most cases different aerosol types are mixed, which may explain why only very small changes of cloud vertical structure were found by this study. My suggestions is to expand the database to include OMI absorp-

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tive aerosols, or perhaps Aura MLS CO (the newest version 4) and thus the cases for absorbing aerosols can be identified and distinguished.

Minor comments:

- (1) Figure 1. The reason for conducting the study in 12 different regions should be explained more clearly. For example, the regions can be defined by cloud dynamics, which varies from region to region.
- (2) Figure 5, and also page 12 Line 7. You mentioned the largest derivatives are over India, why? Also, how derivatives in the 12 regions differ?
- (3) I also suggest the authors to analyze the vertical velocity field in each of the 12 regions using MERRA data, which could provide additional information.

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