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Interactive comment on "Observations and hypotheses related to low to middle free tropospheric aerosol, water vapor and altocumulus cloud layers within convective weather regimes: A SEAC4RS case study" *by* Jeffrey S. Reid et al.

Anonymous Referee #2

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The paper addresses covariability of cloud, water, and aerosol features for mid-level Altocumulus (Ac) clouds in a detailed case study based on observations during the August 2013 NASA SEAC4RS airborne campaign. Observations from high sensitivity ground-based lidar are combined with measurements from the NASA DC-8 aircraft look at residual from a storm system near Huntsville, AL, on August 12, 2013. The complex variability of aerosol and trace gas species along with water vapor, cloud features, and thermodynamic profile suggest several hypotheses regarding relationships of aerosols

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Discussion paper

and Ac clouds.

The paper is well written and thorough. Aside from a few textual suggestions below I have only a minor comment that the paper could include some further statement of the significance of studying this phenomena, and would welcome some further speculation on approaches. The introduction points to a paucity of literature on Ac, but also cites literature that speculates on relationships between Ac clouds and increasing aerosol burden in the future. It seems significant that 30% of cloud area fraction is characterized as Ac. But we have no estimate on the aerosol-cloud radiative effect for this class of phenomena? Is that a significant hole in our understanding of aerosol indirect effects? What kind of observing system would it recommend? The authors are well aware of the ongoing NASA Aerosol & Clouds, Convection (ACCP), and Precipitation study being carried out in response to the NRC Decadal Survey. Where does observing these systems fit into overall goals for ACCP? What observational demands does it imply? Is there a particular form of space-based lidar that contributes to this study, or it hopeless to do from space? Or do systematic observations from selected ground sites with aircraft and ground-based lidar, along with high resolution modeling, hold the key to unraveling these systems and addressing the hypotheses posed?

Minor points:

76: Two references to Warren et al. 1986. Maybe Warren et al. 1988 for one of them?

182-185: Could you put these numbers in context of CALIOP, just to give a sense of how hard this will be to do from space?

321: "in the next section"

344: I don't think omega_v has been defined at this point, but I see it is later (450).

473: "trace," not "tracer"

698: "content," not "contently"

Figure A.1: read and correct the caption.

Figure A.3: "images," not "mages"

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