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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.

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We very much appreciate reviewer 2 taking the time to review the paper late in the game and provide valuable feedback. We agree that that Ac decks in general, and the aerosol-Ac system in particular, need quite a bit more attention in the community. As we remarked to reviewer 1, this system will be investigated in CAMP2Ex, and has received some attention on the ACCP team (co-author Trepte is a SLAT participant).

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Discussion paper

With your encouragement, we have added an additional paragraph to the discussion to more clearly address some of the observation issues. Perhaps part of the reason why the Ac system is so neglected is the difficulty in making even a simple observation? I think Parungo lays out the logic quite well in her 1996 paper. But between the thin cellular nature and the proclivity to form along even minor inversions leads to serious remote sensing and sampling challenges, let alone developing a modeling frame work which can account for these creatures. We explore this much more fully in the added paragraph.

Text edits: Corrected as suggested, thank you.

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?” We added the following text: “The UW-HSRL was able to extract the aerosol backscatter profile to very high fidelity. Unlike more common elastic backscatter lidar measurements that must de-convolve a combined molecular and aerosol signal in an inversion, HSRL systems can separate a line broadened molecular backscatter signal from the total backscatter signal via a notch filter (Eloranta et al., 2005, 2014; Hair et al;, 2008). The difference is used to calculate aerosol backscatter. For this deployment the UW HSRL performed with a precision in aerosol backscatter of better than 10-7 (m sr)-1 for a 1 minute average, and 10-8 (m sr)-1 for 15 minute averages. In comparison, Rayleigh backscattering is 1x10-6 (m sr)-1 at 4 km, and 5x10-7 (m sr)-1 at 10 km. Thus at 15 min averaging, precision is likewise better than 1 to 5% of Rayleigh. This very high sensitivity to aerosol scattering is a result of the combination of the aforementioned HSRL ability to separate the molecular from aerosol scattering, the large signal to noise of the instrument, and the high solar background rejection during daytime observations. It is challenging to make a direct comparison of the ground based HSRL to CALIOP given the very different viewing geometery and sampling combined with the highly variable SNR of CALIOP between day/night observations. The NASA Langley airborne HSRL was used to validate the CALIPSO aerosol retrievals (S.P Burton et al. 2013) and found that only 13% of the layers identified as smoke by the Langley HSRL was correctly identified by CALIOP using the V3 CALIOP products. The UW HSRL, being a stationary ground-based system, provides even greater sensitivity to the aerosol backscatter as it can dwell over the same location for a long period of time.

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