Review of "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"

This paper describes aerosol layers in the neighborhood of altocumulus clouds observed near Huntsville, Alabama on August 12th 2013, using a ground-based lidar and the NASA DC-8 aircraft. Based on a comprehensive analysis, the authors are able to make some tentative conclusions concerning the origin of the aerosols.

The analysis is comprehensive and the paper well-written. It is useful to analyse case studies in detail, especially in the difficult regimes studied here, and the paper is a valuable contribution.

My comments are all minor.

Scientific comments

I am reluctant to suggest adding further content to this already long study. However, it would be great to connect the aerosols to the clouds as tightly as possible, given the promises and inferences made in the introduction, abstract and discussion about the indirect effect. At the moment, the paper is mostly about cloud effects on aerosol but motivated to a large extent by aerosol effects on clouds. There is plenty of valuable qualitative discussion of the clouds present but not much quantitative information on cloud microphysics, which is surely critical to the climate effects of aerosols used to motivate the paper. It is repeatedly mentioned in the text that previous literature has found updraft speeds in these clouds to be low. Presumably, these updraft speeds were actually measured by the DC8 aircraft on the days in question, so can they be presented alongside the existing aerosol concentrations, and ideally CDP cloud droplet number, to speculate on aerosol activation? I appreciate that detailed cloud modeling is not in the scope of the study, but perhaps typical updrafts here could be compared with those found in closure studies in other cloud types (e.g. Guibert et al, JGR 108 8628 (2003); Snider et al, JGR 108 8629 (2003)) to speculate more precisely about the supersaturations and activation diameters of aerosol these clouds might require? Then Hypothesis 6.1 could really be linked more explicitly to the previous sections.

L350 would be helpful to specify the altitude of the melting level
L421 would be helpful to specify approximately how thick the layer is (or if 1km, then how high it is).
L431-4 Could the entire flight track be marked on one of the plots?
L507 The increase in humidity seems quite small when one compares the temperature and dewpoint, but it is probably just my failure to eyeball the plots correctly. Would be helpful to put some numbers in here to quantify how much the humidity increases.
L514 Is "consecutive" the right word here? Simulataneous? And it looks like the nephelometer spike is a touch above the spike from the counters, is that due to sampling line delays or a real effect?
L517 Please specify what is believed to be detraining. SO2, organics, or particles, perhaps?
L594 "they are not directly observed at Huntsville" For MT3 this seems inconsistent with Figure 5c and line 623 of the text.

L733 The phrasing could be improved here – I think the secondary mass should help particles activate and then be nucleation scavenged, but the secondary mass shouldn't be stripped from the particles by the cloud, which is somehow implied here.

L750. I agree with sulfate being produced by homogeneous nucleation, but SO2 tends to be found at relatively similar concentrations at all altitudes in the troposphere, while organics and nitrates and so on decrease in concentration with altitude. I think this is most likely responsible for the increased sulfate fraction in the upper troposphere.

L773-6 Perhaps worth mentioning some more recent work here, for example on tenuous warm low clouds, e.g. Wood *et al* 2018, https://journals.ametsoc.org/doi/abs/10.1175/JAS-D-17-0213.1
Similarly at line 801, are there parallels with the nucleation seen in pockets of open cells, eg. Kazil *et al* (2011), https://www.atmos-chem-phys.net/11/7491/2011/

Textual suggestions

There are a few places where it might be possible to aid readability by better signposting the content of each paragraph in the first sentence. The paper is long and sometimes it's easy to lose sight of the big picture while reading the details..

L107 suggest Ac "formation" by mesoscale lifting
L134 suggest "to examine"
L297 suggest remove comma
L321 "n"->"in"
L364 "phenomenon"->"phenomena"
L369 "was"->"were" or "their"->"its"
L382 "days"->"day's"
L390 can the individual pockets of aerosol be pointed out on the plots?
L452 and 455 Figure 5->Figure 6
L457 "was"->"were"
L505 "combination"->"combination of"
L569 "detriment"->"detrainment"
L628 "actually"->"actual"
L632 "observations"->"observation"

The paragraph starting at line 651 could be swapped with the next one, so the reader learns or is reminded why the water vapor to CO ratio is of such paramount importance as soon as it is mentioned, instead of waiting a paragraph.

L698 "contently"->"consistently"?
L718 "precursors"->"precursor"
L722 "provides"->provide
L728 "exiting" the clouds? Or "existing"
L734 "evidence"->"evidenced"
L782 "high"->"highly"
L875 remove second instance of "consistent with"
L883 "model"->"mode"
L902 "Parungno"->"Parungo"
L983 "imbedded"->"embedded"
Figure A1 caption contains a comment that is unlikely to be intended for publication.