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Alfaro-Contreras et al analyse CALIOP and OMI data sets to investigate frequencies and trends in above-cloud aerosol (ACA) events. In the process, they derive baseline values of above-cloud AOD from CALIOP and Aerosol Index from OMI that can be used (albeit subjectively) to distinguish background noise. The ACA frequencies are then investigated using both these approaches. Overall, I think the manuscript is well written and is easy to follow logically. Scientifically, the manuscript has potential to be published in ACP after improvements. I have some comments/suggestions that authors may like to consider. I will keep it short and to the point.

Specific comments:

1) The first thing that came to my mind: why is the synergy between CALIOP and OMI is not used to further improve the work by Devasthale and Thomas (2011) that was based alone on CALIOP rather than focussing again on CALIOP separately? Considering how deep authors are into these data sets and analysis, it feels like a missed opportunity not to exploit their synergy. For example, OMI is very good in separating absorbing and non-absorbing aerosols. So wouldn't it be scientifically more insightful to do a pairwise comparison of CALIOP and OMI to at least separate smoke and dust ACA using aerosol typing from both CALIOP and OMI? After all, the radiative impact of absorbing and non-absorbing aerosols over clouds could be quite different.

2) Authors subdivide their CALIOP data into summer and winter half years. I think it would be rather interesting, not least to bring out strong seasonality in aerosol and cloud distributions, to analyse and discuss four seasons separately (DJF, MAM, JJA, SON). As shown in Devasthale and Thomas (2011), ACA has a strong seasonal character. The aerosol plume heights and their spatio-temporal distribution over clouds (esp. in the regions of dust outbreaks and biomass burning) differ strongly over four seasons. I can understand that authors may have had statistical robustness of samples or brevity (of space) in their mind when dividing the year into two seasons, but this is also an area where they could complement CALIOP using spatial relevance of OMI.

3) I am not sure what we could learn from the ACA trend analysis using just 7-8 years of data, except the fact that OMI trends could be spurious. I would rather remove this section altogether and focus on points 1 and 2 mentioned above, or at least compress that section. The authors themselves show that (in Figs. 8, 12 and 13) the interannual variability in aerosols and clouds for such short period is high, casting doubts on the interpretation and statistical significance of trends. I think investigating ACA frequencies using CALIOP and OMI has enough scientific merit to stand on its own rather than having add-on trend analysis.

4) Page 4176, lines 10-20: For climate monitoring, one needs to have sufficiently long time series and enough samples as well. But authors seem to confuse between the two (or at least it not clear to me based on how it is expressed). Agreed that passive sensors like OMI could fill spatial gaps compared to CALIOP, but the time series is nonetheless short for climate monitoring.

5) When I first saw Fig. 1 without reading the corresponding text (which I agree is my mistake), I thought it probably shows a nice statistic on cloud heights during ACA events and that it is predominantly low level clouds that are capped by aerosols and that this is contrasted against average cloud height for all clouds (right column). But when I starting reading the corresponding text, the context was completely different, which threw me off a little bit. Fig. 1 is actually shown to argue that CALIOP cannot see super thin subvisual aerosol layers (AOD<0.01). I would rather see this figure with a positive note. I can't help but ask if these “missed” subvisual aerosol layers radiatively matter?

Technical comments:

There is virtually no discussion on what kind of quality control was applied to CALIOP, OMI, and MODIS datasets during analysis. There could be devil in the details. CALIOP data comes with a number of quality flags and CAD score (cloud aerosol discrimination). As we have shown in Devasthale and Thomas (2011), the ACA frequency could be quite sensitive to these flags. In your case the varying selection of these quality flags could easily introduce or explain the differences in observed ACA frequencies from CALIOP and OMI. It is probably worth checking sensitivity to these flags as well.

Reference:
Devasthale, A. and Thomas, M. A.: A global survey of aerosol-liquid water cloud overlap based on four years of CALIPSO-CALIOP data, Atmos. Chem. Phys., 11, 1143-1154, doi:10.5194/acp-11-1143-2011, 2011.