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Atmospheric Measurement Techniques Discussions

Interactive comment on "Adaption of the MODIS aerosol retrieval algorithm by airborne spectral surface reflectance measurements over urban areas: a case study" *by* E. Jäkel et al.

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This work sets out a case study to test the adaption of MODIS based measurements to give more realistic AOD measurements in urban environments, focussed on a single city. These retrievals are inherently difficult, given the heterogeneity of the underlying surface. I have a number of comments on the specifics of the paper, which are discussed below.

I also have 3 more major issues:

I think the fundamental question this work poses needs to be discussed more explicitly

- Is it possible to generally improve the retrievals over urban areas

without heavy tuning to each and every site? To apply the measurements to Beijing the authors limited their analysis to 6 months of the year and a restricted sza. Was this necessary? What magnitude are the errors introduced if these restrictions are removed? Also, other analyses (cited in this paper) have modified coefficients to retrieve AOD for cities in China – how do these methods compare? Is there any consensus to be observed? (It would appear so.)

Secondly, you do not have measurements at 2.1um. However, you have values just below 2.0um. Your modelling show that there is not great variability at these wavelengths. Why have you not looked at (say) 1.95um vs 0.65 to at least test the stability of Equation 2? It may be that the S/N is not good enough?

Thirdly, the calculations indicate that C5 (modified) appears to work better than C6 (modified). Given that C6, amongst other things, corrects coding errors (as outlined in detail in equations 5 – 7), why does it perform worse following correction?

Minor issues

Page 7336 L13 change to "when AERONET data were also available."

P 7337 L17 remove comma

P7337 L21 (as ocean water) -> (such as ocean water)

P7339 L4 by -> using

P7339 L21 -> "available at either 250 or 500 m resolution,"

P7340 L22 Levy (2007) produced revised estimates that were used in both C5 and C6. (C6 produced in 2013 – 6 years later!)

P7340 L25 superscript "m" is not explained.

P7340 L 26 This sentence confused me. Above (L15) it was declared that atmospheric

effects were small at 2.1 micron. Now the atmospheric backscatter ratio, transmissivity and TOA reflectance and the use of Look-Up-Tables are mentioned. A reference to the method would help here. Presumably that would also be the reference for the equations 2 – 4?

P7341 Equations 5 – 7. I could not find this in Levy (2013). I suspect that this is documented in the code as well. If this is the case, state that the summary given is derived from both Levy (2013) and the code.

P7343 L1 Presumably the quantity quoted is 1 sigma? Please be explicit here and in the associated table (table 2).

P7343 L5 delete “as presented in”

P7343 L12 -> It took a while to decipher this paragraph, and as written it is still not a constrained problem I believe. I cannot see how the extinction of the well-mixed layer is set. Is it presumed that it has the value at the top of the layer above? Please clarify.

P7344 L5 Remove comma after “Note”

P7344 L10 Given that you define the reflectance retrieval, some of the following text would be simpler to follow if you defined the albedo calculation as well.

P7345 L7. The calculations are for a relatively high AOD of 0.9. It would be useful to know how dependent the analysis is on AOD.

P7345 L 17. Suggest “In wavelength range I (0.4 – 0.6 um) the retrieved surface albedo and surface reflectance is very sensitive to the assumed aerosol properties. As AOD decreases with increasing wavelength, this sensitivity also decreases. At the longest wavelengths uncertainties in the retrieval are dominated by the measurement uncertainty of the SMART detector”

P7346 L12 (Symbol theta_0) Do not recall see it being used elsewhere. Delete?

P7347 L2. Sentence starting with “Therefore” describes what the albedo is dependent

upon. However, the issue here is that the albedo as measured is not very dependent on the conditions directly below. I suggest stating this the other way round.

P7347 L 17 “induces” not sure what this is supposed to mean in this context.

P7347 L 19 “as a function” – add “a”

P7347 L 15 “bias between both regression”. The meaning is very unclear to me, even following the correction to “regressions”

P7348 L8 So what is new here? This seems to imply that, within uncertainty limits, the result would have been replicated by using the value of Levy (2007).

P7349 L10 “Data and pixel were chosen” – So the “pixel” choice is not selecting data? Please clarify?

P7350 L8 Change to “Twenty one days were identified that aligned with the AERONET..”

P7350 L 19 “significant” not “significantly”

P 7350 L 22 “particular,” – also remove “also”

P7351 L1 I don’t understand this argument. Could you clarify please?

P7351 L5 “and”

P7351 L6 remove one “correlation”

P7353 L6 Reword “First the AOD was retrieved with the operational algorithm for each surface type”.

P7354 L8 “This issue was investigated in two ways.”

P7355 L4 Not sure that this sentence is sufficiently clear. “show only a low positive bias” implies that the modified algorithms are known to be better, and then states that the difference is apparently not significant. I would suggest rewording with one message.

P7355 L14 “alloy”? Not certain what is meant here.

P7356 L14 “certainly enhance” Adding an extra degree of freedom does always allow a reduction in the residual but I am not sure that it is guaranteed that the improvement would be significant. Especially in the general case where the target sites are not well characterized.

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