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Atmospheric Chemistry and Physics Discussions

Interactive comment on "A new method for deriving aerosol solar radiative forcing and its first application within MILAGRO/INTEX-B" *by* K. S. Schmidt et al.

Anonymous Referee #1

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General comments:

This paper describes a new way of determining aerosol radiative forcing from aircraft measurements of spectral irradiances and spectral aerosol optical thicknesses. As (important) by-products, the surface albedo, aerosol single scattering albedo and asymmetry parameter are also found. The new technique requires both above and below aerosol flight legs, or a spiral through an aerosol layer. The new method provides an additional way of determining forcing efficiency; this could be particularly handy in situations when the more traditional gradient method may not work.

However, I found parts of the paper extremely confusing and I cannot recommend

publication until this confusion is cleared up – see the specific comments below.

Specific comments:

(1) Page 2734: second paragraph – The authors should be commended for spelling out the advantages and disadvantages of this approach. (Authors need not do anything).

(2) Page 2740: first paragraph – This text should be re-written. Apparently there's a cloud along the flight path that requires data taken along the center of the flight path to be thrown out. I would state towards the very beginning of the paragraph that the full length of the TOL and BOL flight legs could not be used because of the cloud. Instead, there's a section in the middle of the paragraph that describes the removal of data, but I had to read the paragraph over many times until I could figure out what the authors were doing.

(3) Page 2741: section 2.4.2. In the first paragraph of this section, it is stated that " the slope of the regression cannot be used to measure forcing efficiency directly because during the profile . . .". OK, I understand this sentence. But the author goes on to state that the regression line I used to extrapolate the (net flux?) measurements to tau(0) and tau(max). I could never then figure out how these extrapolated measurements are used in the retrieval. Maybe this is explained in the caption to Fig. 3, but the explanation should be made clearly in the text proper. Also, how is tau(max) determined? Does the determination of tau(max) and tau(0) add some arbitrariness to the retrieval?

(4) Page 2741, second paragraph, step "0". Is "alpha" the surface albedo or the albedo at the bottom of the aerosol layer? It is stated in step "2b" that F(down, measured) is the measured irradiance below the layer. Yet, it is implied immediately below in step "2c" that "alpha", which depends on F(down, measured), is the surface albedo. This seeming contradiction is very, very confusing.

(5) In step "2a" it is said that the rescaling is "optional", yet the first paragraph of page 2743 implies that the rescaling factor "C" is used to determine whether the retrieval

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is successful. Maybe the word “optional” is not quite the right word to use in this circumstance? In any event, this confusion needs to be cleared up. Is it the case that one can either choose the rescaling factor, or the difference in “g” and “g(hat)”, as the success criterion?

(6) Does the method described in section 2.4.2 differ if an aircraft spiral, or if TOL and BOL legs, are used? If so, this difference should be make clear.

(7) Table 1: Given that the AERONET data finds COLUMNAR aerosol properties, how can the AERONET measurements be used to find BOL and TOL forcing? When using AERONET data, does the BOL mean surface and TOL, top of atmosphere?

(8) Table 1 and page 2745, second paragraph. What is meant by “derived directly from the measurements?” Is this the gradient method?

(9) I liked Figure 7 comparing the Angstrom exponent and “g”!

(10) Figure 8 is so small and so cluttered that is it virtually indecipherable, particular for an old person like me. Perhaps ACPD shrinks down the figures too much for us old folks, which certainly is not the authors fault. I would recommend splitting this figure into several figures – maybe one for the over land cases and the other for the over ocean cases. Or maybe even four figures, one figure for each case.

(11) The caption for Figure 8 states the figure plots “spectral forcing efficiencies”, yet the figure plots “relative spectral forcing efficiencies”.

(12) Figure 9 is pretty impressive.

Technical comments:

(1) First sentence of section 2.4.2. Looks like the symbols Z and Zo associated with the word “altitude” did not print out.

Interactive comment on Atmos. Chem. Phys. Discuss., 10, 2731, 2010.

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