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Atmospheric Measurement Techniques Discussions

Interactive comment on "Fast and simple model for atmospheric radiative transfer" *by* F. C. Seidel et al.

Anonymous Referee #3

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This manuscript presents a radiative transfer model (RTM) – SMART – that is offered as an easy and fast tool for applied atmospheric sciences. In any RTM, a balance has to be found between speed and accuracy. Higher accuracy requires more computational steps that take time. For the RTM presented in this paper, this balance has deliberately been pushed toward the "speed" side based on the assumption that in certain applications an RTM is needed that is fast with lower requirements on the accuracy of the results. While for some the accuracy of an RTM is much more important, a simpler and less accurate RTM is justified for the purposes addressed by the authors of this manuscript. The limitations in accuracy and applicability need to be emphasised, but the authors strive to do that sufficiently. Another question is whether a paper on modelling should be published in a journal focussed on measurement techniques. In this case, this question may be answered in the affirmative, as the proposed RTM is

considered a tool to aid measurement-based atmospheric research with as few modelling tweaks as possible to make the tool computationally fast and easy-to-use for "downstream" users, in particular, in remote-sensing retrievals.

I therefore recommend the manuscript for publication in AMT, although a few questions remain that need to be addressed.

The first question that arises when taking the side of a potential user is whether the described RTM will be made available to the public or on request?

Now some more detailed remarks.

Abstract, line 12: The word "uncertainty" is somewhat confusing here, as the reference is unclear. From later parts of the manuscript, this turns out to be the difference between SMART and 6S. This is not immediately clear from this sentence even though 6S is mentioned in the preceding sentence.

Section 2, p. 2229: g is used without explanation

Section 2.1: tau_mlc is used without explanation

p.2230, line 2-3: the parameters and "associated constants" (which?) provided with respect to g: Why do these parameters depend on g, and on nothing else? A little more than a mere reference to Kokhanovsky et al. (2005) should be offered.

line 3: Should the transmittance not be the same for upwelling and downwelling radiation? Does the principle of reversibility not hold here?

line 13: omega = 1: so molecular absorption is entirely neglected, which leads to the restrictions of the wavelength range in which this RTM is stated to be useful. How large is the effect of neglecting the 500-700 nm ozone absorption band?

Section 3.1.2: So far I had had the impression that SMART uses only the HG function. Apparently, use of a full Mie phase function is implemented but not recommended as HG is much faster?

p. 2237, line 1: Please state the value of the third quantity for each plot. For example, plot 4 shows the wavelength dependence of the error for different SZAs. But what was the AOD? Etc.

Section 3.2, p.2238, line 2: Yes, the accuracy was within 5 % for each single test. This sentence seems to imply that if SMART does not exceed 5 % for any single test, it does not exceed 5 % at all. Although the remainder of this section clarifies this, this sentence should be worded more strictly.

Section 3.2: The test is performed at TOA and at 5.5 km altitude. 5.5 km is well above the boundary layer in most cases. What about airborne measurements at lower altitudes? Presumably the simple layer structure of the model atmosphere is a severe limitation when comparing the SMART results to measurements at such altitudes, as the model does not account for any vertical structure within the aerosol layer. Any vertical inhomogeneity would affect measurements within the layer much stronger than one performed at higher altitudes. If this is relevant for SMART, this is another limitation for potential users that should be mentioned in the summary.

Technical remarks:

p. 2227, line 13: “rely”, not “relay”

line 19: uncertainty range of up to 5-10 %

p.2229, line 6: Angstrom’s law – no article

Eq.(4): lambda missing in the last-but-one term

p.2237, line 17: Figure 7-9, not 4-6

Interactive comment on Atmos. Meas. Tech. Discuss., 3, 2225, 2010.