

Interactive comment on “Averaging kernels for DOAS total-column satellite retrievals” by H. J. Eskes and K. F. Boersma

Anonymous Referee #2

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Review of MS2003-01; "Averaging kernels for DOAS Total-Column Satellite Retrievals", by H. J. Eskes and K. F. Boersma

General comments:

The subject of the paper is a sensitivity of atmospheric trace gas total column amounts retrieved from satellite measurements employing the DOAS technique to *a-priori* information. The idea to use the averaging kernels to investigate this sensitivity is scientifically meaningful. As pointed out in the manuscript, vertical columns obtained convolving independently measured or modeled vertical profiles with DOAS averaging kernels can be easily compared to DOAS total columns. Thus, a properly derived expression for DOAS averaging kernels would be of great interest for the scientific community. This

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expression is supposed to be given by Eq.(13) in the manuscript. Unfortunately, this formula was derived under assumption of a weak absorption only and any definition of “weak absorption” is missing. Authors just state it is the case for NO_2 . Other assumptions needed to obtain Eq.(13), which is main scientific content of the manuscript, were $\frac{\partial S}{\partial y} \frac{\partial Y}{\partial S} \approx 1$ and $S = \sum_l M_l x_l$. Any comments concerning validity of these assumptions are missing. It is clear that presented results can not be used for stronger absorber because all the assumption employed are certainly no more valid. The only solution proposed by authors in this case is to start from Eq. (5), i.e., from general Rogers approach. This means that no solution for this kind of absorbers is proposed. Furthermore, authors fail to demonstrate that one of the concluding statements, namely, “The use of the AK together with the retrieved column removes the (often large) dependence on a-priori assumptions about the profile shape”, is true. Actually, the averaging kernels do not remove this dependence they just introduce the same dependence into reference data allowing the vertical columns obtained from different methods to be comparable.

Although the idea to investigate DOAS averaging kernels is of great interest, the manuscript requires a major revision and is not acceptable for publication in the presented form.

Specific comments:

1. In the present formulation of the paper it has to be proved that NO_2 can really be treated as a weak absorber and any quantitative criteria of the absorption weakness have to be introduced.
2. Validity of assumptions $\frac{\partial S}{\partial y} \frac{\partial Y}{\partial S} \approx 1$ and $S = \sum_l M_l x_l$ has to be demonstrated, for example, by means of numerical simulations. In the presented form of the paper in is absolutely unclear at which conditions the assumptions are valid.
3. After Eq. (12), “The right hand side shows that this is computed in the same way as

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the total airmass factor, ...”:

Right hand side of Eq. (12) shows nothing, the left hand side, however, have nothing in common with the standard expression for airmass factor.

Interactive comment on Atmos. Chem. Phys. Discuss., 3, 895, 2003.

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