

***Interactive comment on “Comparison of Box-Air-Mass-Factors and Radiances for Multiple-Axis Differential Optical Absorption Spectroscopy (MAX-DOAS) Geometries calculated from different UV/visible Radiative Transfer Models” by T. Wagner et al.***

**Anonymous Referee #1**

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**Summary** The paper reports on the results of a thorough comparison of radiative transfer modelling of sunlight in the atmosphere in the UV/Visible spectral range developed by 8 international institutes involved in ground-based, balloon, aircraft and satellite remote sensing observations of atmospheric composition. A broad variety of models is compared using either Discrete ordinate or Monte-Carlo techniques, in plane-parallel, spherical or mixed geometries, including or not atmospheric refraction. The exercise

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particularly oriented towards the interpretation of MAX-DOAS ground-based observations at elevation varying from  $1^\circ$  to  $90^\circ$  and azimuth from  $0$ - $180^\circ$ , includes also sensitivity studies of ground albedo and aerosol loading on altitude weighting functions (Box-Air-Mass Factors). Overall, after correction of a number of errors in the simulations easily identified in the first comparisons, convergence within 5% between calculated Box-AMF and radiances was reached, providing the calculations are made in spherical geometry, concluded to be mandatory at observing elevation below  $10^\circ$ . On the application side, all simulations agree to confirm the extreme sensitivity of low elevation MAX-DOAS observations to aerosol loading and surface albedo.

**General Comments** The model comparison exercise reported in the paper is the result of a large and well-organised effort of a broad group of scientists involved in atmospheric observations by the UV-Vis technique. The paper fully falls within the area of interest of ACP and is very informative including a number of details of interest for radiative transfer modellers as well as for the general ground-based and space UV-Vis community.

It is carefully written and almost acceptable for publication but the abstract, introduction and conclusion, which would require some reorganisation. Indeed, the paper address two different objectives, i.e. the evaluation of radiative transfer models and a sensitivity study of MAX-DOAS to aerosols, albedo etc, which should be better separated in the description of objectives as well as in the conclusions.

**Specific comments** 1. Some models are including refraction. Others not. But nothing is said about the results of the comparison in this aspect. 2. Is it really needed to provide a full list of publications at each step: 5 ref of satellite observations p 9826, 13 ref on Max-DOAS p 9827, another 8 ref on the same page, then Rozanov 2005, 2004-2006, 2007 p 9836 and again Rozanov 2000, 2001, 2005 a few lines later, etc. Could be easily simplified by quoting the most recent + reference herein. 3. The figures are fine and informative but labels are very small and difficult to read. I would recommend adopting the size of captions.

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