**Atmospheric
Measurement
Techniques** Open Access

Discussions

Interactive comment on "High resolution and Monte Carlo additions to the SASKTRAN radiative transfer model" *by* D. J. Zawada et al.

Anonymous Referee #2

Received and published: 8 April 2015

The paper describes two new spherical radiative transfer solvers that have been implemented in the SASKTRAN model, a high spatial resolution (HR) solver based on a successive order of scattering method and a Monte Carlo solver. The HR solver also includes an improved method to compute weighting functions. The original SAKSTRAN model included only a simple successive orders of scattering solver (SO). As an example, Odin-OSIRIS scans were simulated using the Monte Carlo model and the O3 retrieval (with SO or HR as forward model) has been applied on the synthetic data to test the accuracy of the retrieval. It could be shown that using SO as forward model results in a systematic bias in the ozone retrieval.

Generally the paper is well written and well structured. The newly developed methods are a significant step forward for the analysis of limb sounding measurements.

However, the solver descriptions are not very precise and partly difficult to understand. I recommend to publish the paper after improving the solver descriptions (see more detailed comments below).

General comments:

Description of HR model:

- Please include figures showing the coordinate system for 1D/2D/3D atmospheres. These could may be include the locations of the diffuse profiles which are considered for the simulation of a specific observation point. Also the points s_j, s_{end} ... could be included

- How are the angles defined? Are viewing zenith angle and solar zenith angle defined w.r.t. the tangent point. For 3D the definition of the azimuth angle (where is South, East, ...) also matters. These definitions might also be included in the figures.

- Does the model include surface reflection? If yes, how is it handled? If not, when can it be neglected?

- How is the ray-tracing done in the 3D atmosphere, the equations for intersection points become more complex?

Description of Monte Carlo Code:

- Is surface reflection included? If yes, how?

- Is polarization included? If yes, how?

- Please include a figure and show r and omega, which are mentioned in the description

- Also please include the definition of viewing angles and sun position

- Is the Monte Carlo code for 1D, 2D and 3D geometry?

OSIRIS-Simulation:

- If I understood correctly, all simulations are performed for 1D geometry. Is this correct? Please include precise setups for the simulations.

- How important is the 3D variability of the atmosphere for O3 retrievals?

Specific comments:

p1., l.10: Please specify what is retrieved (O3). Also please specify for which settings is the bias of up to 4

p.9, Eq. 15: Derivation of the equation could be included in appendix.

p.11, l. 305: "A target transmission is chosen uniformly between 1 and ..." -> should this be "randomly" instead of "uniformly"?

p.13, l. 365: "Variance of solar source term" -> please explain this, do you only mean the change of solar zenith angle along the line of sight?

p.14, Tab.1: Definition of sza in table not clear

p.15, l.439: "Solar zenith angle at the tangent point varies between 60 and 120 degrees ..." -> The largest SZA is 89 degrees, is it possible to simulate SZA>=90 degrees?

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Technical corrections:

p.13, l. 376: "for standard deviation 0.2

p.15, l. 431: "at 600 km ..." -> "at 600 km altitude"

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