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Interactive comment on "McSCIA: application of the Equivalence Theorem in a Monte Carlo radiative transfer model for spherical shell atmospheres" *by* F. Spada et al.

Anonymous Referee #2

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The manuscript is a comprehensive description of a specific Monte Carlo code for a spherical shell atmosphere. The features and techniques are well-described. Basically it may serve as a manual to build such a code from scratch. Although this is valuable in itself, (if one wants to reproduce McSCIA) in my view the manuscript does not qualify as a scientific paper. In particular I don't see any new results or techniques which haven't already been described elsewhere:

1. Several of the techniques which are described in this manuscript have been described elsewhere. E.g.

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- the local estimate technique (Davis et al. [1985]; Marshak and Davis [2005])

- the analytical treatment of Rayleigh and Henyey-Greenstein scattering; the equations in the appendix can be found in identical form in (Cahalan et al. [1994] and I3RC [1999]).

A good overview of different techniques is also given by Cahalan et al [1994], Marshak et al [1995], and the new textbook by Marshak and Davis [2005]. The text could be shortened considerably by replacing some lengthy descriptions with references to the existing literature.

2. The main scientific finding of the paper, the application of the equivalence theorem is also not new. It has e.g. been explicitely described by Cahalan et al [1994] (and references therein), O'Hirok and Gautier [1998], and has been used by several participants of the Intercomparison of 3D radiation codes (I3RC), see also I3RC [1999]. To consider absorption by reducing the photon weight instead of "killing" the photon is quite common for wavelength regions where absorption is high. The good agreement of different codes based on the equivalence theorem and using "tradiational" absorption in the I3RC [Cahalan et al., 2005] illustrates that the equivalence theorem works. If it works in plane-parallel atmospheres there is no reason to assume that it should not work in spherical atmospheres as well.

3. McSCIA is something special in the sense that is consideres a case which is neglected by most of the above mentioned publications: a spherical shell atmosphere in limb geometry. This special aspect is probably the most important aspect of the manuscript and might be strengthened. However, the authors have to make sure that the material has not already been described e.g. by Oikarinen et al. [1999] (see statement on page 1203 of the manuscript: "The implementation is similar to SIRO (Oikarinen et al., 1999]), but the refractive bending is not implemented."

As I understand the purpose of the manuscript is to provide a reference to McSCIA for future work, one suggestion is to shorten the manuscript considerably (following the

ACPD

6, S358–S361, 2006

guidelines listed above) and to submit is as a "technical note". An alternative would be to add some more scientific content, but in any case the technical description needs to be shortened. The best alternative, in my view, would be to add the shortened model description as an appendix to a paper presenting scientific results based on McSCIA (as e.g. in Cahalan et al. [1994]) instead of publishing it stand-alone.

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ACPD

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