

Interactive comment on “Simulation of solar radiation during a total solar eclipse: a challenge for radiative transfer” by C. Emde and B. Mayer

Anonymous Referee #1

Received and published: 25 January 2007

General

This paper presents a very interesting adaptation of a 3-D radiative transfer model for the simulation of a total solar eclipse, and falls well within the scope of the relevant special issue of ACPD. The paper can be considered as a novel and very useful tool for planning radiation measurements at the ground in future eclipses. The authors present very clearly and with sufficient details the methodology for their modeling approach and have simulated most of the important phenomena during the total eclipse of 29 March 2006, arriving at conclusions that can be used to interpret with sufficient accuracy the radiation-related processes during an eclipse. The authors give proper credit and discuss related work and clearly indicate their own contribution in this subject. Both the title and the abstract reflect the contents of the paper. I have only minor comments

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for improving the manuscript, which are listed below, as well as some suggestions for correcting grammatical and typographical errors.

Specific comments:

I am a little skeptical about the use of word “horizontal” to describe the 3-dimensional transport of photons.

In a few cases I have been confused by the use of the term “backward calculations” of the Mode Carlo. From the text in several places I understood that the photons start at the surface propagating in the atmosphere and they undergo scattering and absorption, as it would be the case if they were starting from the TOA and they were propagating towards the surface. If this is the case, does “backward” refers to the processes or to the direction of the photon paths? Please clarify this issue and consider explaining this better in the manuscript.

Figure 5: These figures do not show the entire domain 1000x1000 km², but only a part of it. Please indicate this in the caption. The same occurs for Figure 8. Although it is not important, it would be better if the distance scales in the two figures are the same.

500, 9: The use of “first accurate” implies that all other simulations reported so far are inaccurate, which is a very strong statement.

500, 15: “Ein most parts of the spectrum.” Please be more specific.

500, 16: Is it true that there are no spectrally resolved measurements under the umbra so far? Probably astronomers have already conducted such measurements.

501, 12: The distribution of solar irradiance at the TOA has nothing to do with clouds. Moreover its distribution is very well known but stating that is known with “very high accuracy” it is probably too strong.

502, 23: From a first reading it is not obvious why the ET irradiance is distributed differently at different locations. Please consider adding “Eis derived, under the eclipse

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conditions.”

506, 2: In Figure 3 ZL (capital L) seem to denote the sum ($z_l + r_e$), which is used in eq 2 and in the relevant discussion, but it not referenced at all. Please make the text and figure consistent.

506, 6: The paper has quite a lot of figures, most of which are absolutely necessary to illustrate the methods and results. One figure that could be omitted is Figure 4, and especially the top panel, because it does not add too much information. The results are very well described in the text, so the figure could be safely removed.

508, 16: From Figure 7 it seems that the maximum of the wavelength dependence occurs at around $X=0.5$. May the authors could reconsider the limits in the x-axis of the small figure.

509, 17: In both Figure 5 and 8 the distance of 400 km is outside the limits.

511, 5: Is the interpolation responsible for the straight segments in the curves of Figure 11, especially in the UV part?

511, 18-21: This description of the photon pathways is a little unclear. The sentence “followed by the \check{E} higher atmosphere” refers to another pathway of photons, less typical? Please rework this section.

512, 12: “factor of three” looks rather as a factor of 2 in Figure 12.

513, 13: The curves in Figure 13 seems to be non-symmetric around $t=0$ s. Could you comment on this?

514, 8: The same stands for Figure 14. Please explain.

Technical corrections

501, 6: Replace “ \check{E} the measurement of the model output \check{E} ” with “measurements corresponding to the model output \check{E} ”.

501, 16: Replace “measuring the output” with “validation of the model output with measurements”

505, 14: Insert “are commonly used and are very convenient”

505, 25: Delete first occurrence of “forward”

507, 4: Replace “entered” with “enter”

507, 7: Replace “value” with “case” or “situation”

507, 22: Replace “second piece” with “essential information”

508, 23: Replace “minor width” with “width of minor axis”

510, 5: Replace “Function” with “function”, remove “out”, and replace “entered” with “enter”.

510, 16: Replace “must not” with “cannot”

511, 17: Replace “wavelength” with “wavelengths”

511, 26: Replace “total irradiance” with “global irradiance”. Replace “total” also in the legend of Figure 11.

511, 28: Replace “irradiances” with “irradiance” (singular)

512, 2: Replace “radiances” with “radiance” (singular)

512, 6: insert “aerosol model”

513, 13: Insert “time dependence of irradiance and radiance from 400 nm”

516, 9: Replace “correctly” with “successfully” (too strong statement)

516, 20: Correct misspelled “aerosol”

Interactive comment on Atmos. Chem. Phys. Discuss., 7, 499, 2007.

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