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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Divergence of sun-rays by atmospheric refraction at large solar zenith angles" *by* R. Uhl and T. Reddmann

Anonymous Referee #2

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This is an interesting paper on the effect of refraction on photolysis rates at large solar zenith angles. This particularly important for high latitudes photochemistry in winter where the sun can stay several hours just below the horizon and bnever above. This manuscript will be a useful contribution to ACP after some changes as indicated below.

The methodology followed by the authors seems to be correct but the paper may be difficult to understand for non specialists. It is very technical and physical explanations are quite short. I suggest to have a longer introduction to explain in more details the physical meaning of the developed concepts.

Computations have been made only at 550 nm. The authors do not indicate why they have chosen this wavelength. Most species are photodissociated in the UV part of the spectrum where I suspect that the relative contribution of increase of transmission is

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much larger than in the visible due to a stronger absorption. Some results in the UV part of the spectrum should be presented.

The effect of the sun angular extension on the resulting flux should be better explained. After a careful consideration of the variuous effects, I have been convinced that it does not change the results presented in this paper but this is not easy to understand for a non specialist from the text. If we look at the sun disk from the atmosphere (neglecting atmospheric absoprtion), the apparent intensity of the sun light per steradian will be constant because the effect of divergence is exactly compensated by the effect of focussing. However, if we condider the total solar flux, the apparent solid angle of the sun is reduced by the focussing and the total flux is reduced by the amount computed with the divergence term. The only remaining effect will be the small difference between the averaging of the divergence on the solar disk and the divergence at the center of the sun, which is probably a second order effect.

Interactive comment on Atmos. Chem. Phys. Discuss., 4, 2037, 2004.