

Interactive comment on “NO₂ photolysis frequencies in street canyons” by P. Koepke et al.

Anonymous Referee #2

Received and published: 28 June 2010

General comments:

The paper introduces a simple and fast method to include the effects of shading of direct and diffuse radiation by buildings in street canyons in the calculations of the photochemically highly relevant photolysis frequency of NO₂. The effect of three different types of street canyons (garden street, urban street, skyscraper street) is expressed by a reduction factor RJ with respect to free horizon conditions. The results are presented as function of the solar zenith angle, the orientation of the street with respect to the solar azimuth angle (parallel and perpendicular). Several typical atmospheric situations strongly affecting the distribution of direct and diffuse solar radiation (clear atmosphere, turbid atmosphere, single cloud layer) have been investigated in a sensitivity study. To my knowledge this is the first time this topic has been addressed in such

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a way for actinic fluxes and photolysis frequencies. I therefore consider it as an important contribution for the improvement of the estimation of photochemically effective radiation in urban areas with typically enhanced pollution levels. By using a parameterizations based on the global solar irradiance, this method is easily applicable for most of the existing determination schemes for NO₂ photolysis frequencies. In general the paper is clearly presented and well structured but I suggest some improvements with respect to the quality of the figures and the English language. The English is often a bit complicated and hard to read, it should be improved by a native speaker; some few examples:

p. 12829, l. 20: “Since the radiances from all directions participate in the actinic flux with equal importance, and with no cosine weighting as it is the case for the irradiance, also the radiances from large zenith angles contribute essentially.”

p. 12829, l. 25: “Instead of the radiances from the sky, for these angles the radiation that is reflected at the walls of the buildings contributes to the actinic flux.”

p. 12832, l. 9: “Not only the photolysis frequencies for the street canyon have been calculated, but also the values for the same conditions, but with free horizon.”

p. 12840, l. 5: “..... the opposite is the case.”

p.12844, l. 22: “. and thus the effect is accounted for by averaging in the averaged RJ”

General comment on figures:

Excel-figures are not really state of the art for scientific publications. If using excel, there should at least some basic modifications been done: a) better formatting of the exponential labels b) using identical styles and font sizes for all figures

Specific comment on figures:

Add legend in figure 3

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Figs 4-9: I strongly suggest to position the legend inside the figure, it would distinctly increase the readability

The axis labels of the figures are too small, in particular in Fig. 8

Specific comments: p. 12828, l.21: I think its even more important for the prediction of the ozone burden !

p. 12829, l. 12: untypical citation; delete "MPI-Mainz UV-VIS Spectral Atlas of Gaseous Molecules"

p. 12829, l. 11: first sentence rather complicated, my suggestion: "For a given chemical reaction, the absorption cross section and the quantum yield at a given wavelength are only slightly depending on temperature and available from laboratory measurements (Keller-Rudek and Moortgat, 2010)."

p. 18829, l. 18: "...amount of the aerosol particles" add "and type"

p.12831 l. 5: SKOP in capital letters?

p. 12832, l. 3: replace "The effects of the atmospheric conditions, the solar position and the street canyon influence the spectral values of the actinic flux, but not the absorption cross sections and the quantum yields." by "The atmospheric conditions, the solar position and the characteristics and orientation of the street canyon influence the spectral values of the actinic flux, but not the absorption cross sections and the quantum yields."

p. 12833, l. 17: replace "geometrical" by "vertical"

p. 12837, l. 1: "...is too low to the illuminate. ...", delete "the"

Interactive comment on Atmos. Chem. Phys. Discuss., 10, 12827, 2010.