

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

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Received and published: 22 June 2010

We wish to thank B. Bohn for the constructive and detailed comments. We will improve our paper with respect to all mentioned aspects.

Detailed responses: Comment: A statement is missing on the magnitude and the direction of the temperature dependence of $J(\text{NO}_2)$

and comment 8) The question is why the complex parameterisations of the temperature dependence of the absorption cross sections and quantum yields are stated here when they are not applied.

Answer: As mentioned in the paper, the effect of street canyons on NO₂ photolysis frequencies dominantly results from the modification of the actinic flux due to the ob-

C4339

struction of sun and sky. Since these effects are wavelength dependent, the NO₂ spectrum must be taken into account to derive the final variations in $J(\text{NO}_2)$. However the temperature change of the NO₂ spectrum is only a second order effect. Moreover, the results of the paper are focused on the ratios of the photolysis frequencies in the street and that under undisturbed conditions, which belong to the same temperature, with the consequence that any temperature effect is further reduced. Thus, as mentioned by the reviewer, the complex parameterizations of the temperature dependence are omitted.

Comment 1) and 10): Use italic fonts for quantities

Answer: OK

Comment 2): The estimated 5% uncertainty of the reduction factors RJ should be increased.

Answer: This uncertainty of $\pm 5\%$, mentioned in the abstract, was thought as uncertainty for the NO₂ photolysis frequency for known solar zenith angle, resulting from the uncertainty of the atmospheric conditions. However, we agree with the reviewer that this uncertainty, as it is mentioned in the abstract, will be associated with the average values of RJ as result of the parameterization shown in Fig. 9. Since the aspect of uncertainty is very complex, due to the different reasons and the information that is available in general, the uncertainty no longer will be mentioned in the abstract. Instead, the discussion of the uncertainty, as already given on page 12844, will be enlarged.

Comment 3): Please use Φ rather than φ , as in the text.

Answer: We will change Φ to φ in the text, to avoid the same symbol as used for the quantum yield.

Comments 4) to 7): Include units to make the equations dimensionless. Answer: These comments are essential and all the equations should be improved, however in the final version of the paper these equations are omitted.

C4340

Comments 9) to 14): Style and printing errors.

Answer: Thank you for the detailed reading.

Comment 15): Radiance rather than irradiance?

Answer: The radiation coming from a reduced part of the sky is not a radiance, but it is also not an irradiance, as this quantity per definition is the integration of the radiances over the half sphere. To avoid these difficulties we will simply use the word "radiation", since this is clear in the context of the sentence.

Comment 16): Use "ozone column" rather than "ozone".

Answer: We used "total ozone" for the ozone content in the vertical column, but we will accept the suggestion of the reviewer.

Comment 17): It would be easier to read the text if the indices were only "sun" and "shad".

Answer: We used the index "freeshad" to make clear that the shadow is not result of a cloud. However, we will change the indices and say thank you for the good recommendation.

Comment 18): What is the meaning of the * indices ?

Answer: The * were points to indicate a multiplication, which have been transformed to stars by the system. We will avoid the points as also in the other equations (See comment 9)) Comment 20): Eqn. (13): Is Φ_{sun} an angle or an integral number of angles?

Answer: Φ_{sun} is the largest azimuth angle where the sun is shining into the street canon, depending on the width of the street and the height of the buildings, using the definition that $\Phi = 0^\circ$ for sun shining parallel to the street.

Comment 21): Fig.3: An assignment of colours to the quantities of Eqn. (1) in the

C4341

caption would be helpful.

Answer: This is a good recommendation, and we will improve the caption of Fig.3. But since the colours now are described there, they are no longer mentioned in the text. The caption of Fig. 3 will be changed to: Spectral values of NO₂ photolysis frequency and its contributors in relative units (see text). The mentioned symbols are that used in Eqn. (1). NO₂ Photolysis frequency, $J(\text{NO}_2)$: red Actinic flux; $F(\lambda)$: blue Absorption cross section, $\sigma(\lambda)$: black Quantum yield, $\Phi(\lambda)$: yellow

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

C4342