Atmos. Chem. Phys. Discuss., 8, S122–S127, 2008
www.atmos-chem-phys-discuss.net/8/S122/2008/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Reconstruction of erythemal UV-levels for two stations in Austria: a comparison between alpine and urban regions" *by* H. E. Rieder et al.

Anonymous Referee #2

Received and published: 7 February 2008

Review of "Reconstruction of erythemal UV-levels for two stations in Austria: a comparison between alpine and urban regions" by H.E. Rieder et al..

General comment:

This paper concerns the reconstruction of erythemal UV doses using measurements and a radiative transfer model. Various temporal resolutions of the input data are tested to determine the most appropriate for the best performance. Time series of UV doses are studied at two sites and the contributions of the changes in the ozone content and in the cloud cover are estimated. Though the methodology is a classic one, the data used in this study are new, therefore the results are also new and the conclusions of the

analyses are interesting. Nevertheless, as detailed below, there are several problems in the manuscript: for example the way to obtain ozone data and the explanations of the reconstruction method are really confusing, a complete description of all the input data needed in the RT model is missing, the two independent data sets used are not described... Moreover in the whole text there is a confusion between "irradiance" and "dose".

Summary:

1) Does the paper address relevant scientific questions within the scope of ACP? Yes

2) Does the paper present novel concepts, ideas, tools, or data? Yes

3) Are substantial conclusions reached? Yes

4) Are the scientific methods and assumptions valid and clearly outlined? No

5) Are the results sufficient to support the interpretations and conclusions? Yes

6) Is the description of experiments and calculations sufficiently complete and precise to allow their reproduction by fellow scientists (traceability of results)? No

7) Do the authors give proper credit to related work and clearly indicate their own new/original contribution? Yes

8) Does the title clearly reflect the contents of the paper? No

9) Does the abstract provide a concise and complete summary? No

10) Is the overall presentation well structured and clear? No

11) Is the language fluent and precise?

12) Are mathematical formulae, symbols, abbreviations, and units correctly defined and used? No

13) Should any parts of the paper (text, formulae, figures, tables) be clarified, reduced,

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combined, or eliminated? Yes

14) Are the number and quality of references appropriate? Yes

15) Is the amount and quality of supplementary material appropriate?

Specific comments:

- In the title it should be better to replace UV-levels with UV-doses.

- In the abstract, p. 958, line 14: it is written that a good agreement is found between measured and modelled erythemallly effective irradiance, whereas in section 4.4, p. 969, line 7 it is written doses. Please be consistent.

- In the abstract: there is nothing said about the role of the changes in the ozone content and in the cloud cover on the UV trends. It should be added because, as it is stated in section 6, it is an important conclusion.

- p. 960, line 14: "Most of them were based on daily values.". Of what ? Please give details. - p. 960, line 18: "Only a few studies ... magnitude of the ... levels". Please clarify.

- p. 961, line 18: the word "global" in global irradiance (end of the line) must be explained, since "global" could mean either (direct+diffuse) or "covering the solar wavelength range".

- p. 963, § starting line 17: the authors say that they compare the modeled daily total ozone for Arosa and Vienna (or Sonnblick). Then, they give the value of the mean difference [(model_Vienna - Observation_Arosa)/Obs_Arosa]*100%, the value of the correlation coefficient between modeled values for Vienna and observation at Arosa. They refer to Fig. 1b where x-axis is "Arosa_model". Same thing for Sonnblick and Fig. 1c. This is rather confusing, please clarify. At the end of this §, p. 964, they say that they will use Arosa ozone values for Austria since the differences are smaller than 3%. It would be interesting to show what would be the impact of such a difference on the

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UV dose.

- p. 965, lines 21-22 : "C is a seasonal correction factor". Why do the authors need such a factor? How is it determined ? We learn only p. 968 how it is estimated (Eq 9) but without any explanation on the choice of this equation. Finally p. 969 it appears that there are 2 C, one monthly and the other seasonal. Again it should be clarified.

- p. 966, lines 17-18: "DISORT needs information on ... aerosol optical depth". I don't see where this AOT will come from. It is only in the summary p. 975 line 2 that the authors say that it was assumed to be constant, but they don't give the value. Usually, DISORT needs also the type of aerosols (size or Angstrom exponent, asymmetry parameter), the vertical profiles of aerosols, of ozone, of pressure and temperature, the ozone absorption and the Rayleigh scattering cross-sections. If the authors believe that these parameters are not important they should explain why, otherwise they should add info on them.

- The sections 4.3 to 4.6 are very confusing and need a big work to become consistent:

(i) p. 967: either Eq 4 or Eq 5 must be removed (they are similar), moreover parentheses are missing in Eq 5. What is the difference between Gref (line 12) and Gpot (line 6)?

(ii) What is the need of Eq 4 & 5 since, as I understand, Eq 6 will be used in the study?

(iii) How is determined X, the correction factor in Eq 6 ?

(iv) p. 968, line 3: it is written that the cloud modification factor for UV is derived from UV radiation. Does radiation mean "irradiance" or "dose". It should be specified because in line 19 it is stated that UVmod is for radiation on hourly or on daily resolution and then in p. 969, line 7 (and further), the authors speak of daily doses.

(v) What is the justification of the expression of the correction factor (Eq 9) ? When one reports this value in Eq 1 it comes: UVreko= UVmod * (CMFsol)ˆ2/CMFuv, that is rather strange.

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(vi) p. 969, lines 4-5: Two independent data sets are defined but there are not described, what are are the selected years ?

(vii) lines 8-11: the authors conclude that for Sonnblick there is a best fit with the HMC-model for all seasons. Looking at Table 2, I wonder if the differences between several numbers are statistically significant: for ex. the differences are often equal to 1 (even 0) so it is difficult to conclude that one model is the best. Same thing for Vienna. The conclusion should be reconsidered.

(viii) line 13: the content of Tables 3&4 is not detailed, nor the captions (p. 983-984). It should be specified for ex. that in each column is reported the % number of cases within a certain % difference range.

(ix) line 18: what are the single models ?

(x) lines 23-24: "Figures 2 and 3 show the correlation ... UV irradiance". Accordingly, in the x and y-axes it is written "irradiance" but the unit is that of dose and in the captions it is written "dose"! Please clarify.

- p. 970, lines 9-10: "UV doses compared with the stratospheric total ozone", the total ozone column is not for the stratosphere, moreover it is probably a "yearly average of the total ozone column".

- p. 974, lines11-12: the authors state that the "modeling approach using input data ... with the highest temporal resolution show the best fit between estimated and observed UV doses". In p. 969 lines 14-15 it was stated that "the reconstruction quality decreases with increasing temporal resolution". Maybe I have missed something, but it seems inconsistent. Could the authors clarify ?

- p. 975, line 2: It is the first time that the aerosol loading is described (see a previous comment). Lines 3- 7: The calculation uncertainty is "light", it is not really a calculation but rather a comment on what could be the aerosol impact. The authors should consider performing a more serious uncertainty estimation.

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- p. 975, lines 15-20: I am not convinced with these statements. Ozone concentrations are not at all spatially homogeneous (see p. 964, line 2).

Technical corrections:

- Throughout the text, when several references are given for something, the order looks random, neither alphabetical nor chronological.

- p. 964, line 23: "Two have" -> "To have".

- p. 966, line 20: "(UVMODEL)" -> "(UVMOD)" (to be consistent with Eq 1)

- p. 967, line 6: "whereas" -> "where"

- p. 969, line 5: "quiet" -> "quite"

- p. 982: In Table 2 caption, it should be stated that the BIAS and RMSE values are in %.

- Fig. 4&5 show "UV doses" so the y-axes have to be changed, as well as the text in the top of the figures. Same thing for the y-axes in Fig 6&7.

Interactive comment on Atmos. Chem. Phys. Discuss., 8, 957, 2008.

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