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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.

H. E. Rieder et al.

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H.E. Rieder in behalf of the authors:

This is the response to the comments and suggestions of reviewer 1.

First of all we want to thank the reviewer for the comprehensive review and valuable remarks and suggestions that will help to improve the quality of the revised manuscript.

In the following comments of the reviewer will be marked with R1:

Generally:

R1: However the quality of the English needs to be improved. In particular the logic and the reasoning is difficult to follow.

Here a thorough check of the language and of the clarity of the test will be performed. The logic will be improved.

R1: 1.) The authors give values e.g. for the increase of erythemally effective irradiance. But they don’t give any information about the significance or the uncertainty of the results. One example (P970, L4): "...(HMC) shows the best agreement..." Was this result tested on significance?

The performance of the different modeling approaches has been summarized in tables 2-4. In table 3 (for Vienna) and table 4 (for Vienna) the distribution of the estimated UV doses in comparison to the observed ones is presented. Here three different statistical quantities are used to characterize the significance and the uncertainty of the results: RMSE, bias and R^2. The authors will try to mention more often these statistical indicators in the written text.

Especially the modeled monthly values (using the HMC-model) are in good agreement with the observed ones. At Hoher Sonnblick all cases can be found within ś15% of the observed ones while at Vienna 96% of the cases can be found within ś15% of the observed values. The improvement of the accuracy achieved with hourly resolution varies with the seasons. In average the use of hourly resolution improves the accuracy of the reconstruction by 4% in Vienna and 8% at Hoher Sonnblick.

R1: 2.) The number of figures and tables can be reduced without the lost of information.

We went through the figures and the tables. We really do not know which figure to exclude without losing valuable information. We are open for suggestions but at the moment we would tend to keep the number of figures and tables.

R1: 3.) How do the authors treat snow spots (that means that the surface is not completely covered with snow) in your albedo model?

Due to the unavailability of spatial snow data there is no special treatment for snow spots in the albedo model. Details on the regression model can be found in Simic et

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al. (2005).

R1: 4) How do the authors determine the aerosol optical depth as input for the radiation transfer model?

Because of a lack in direct measurements the aerosol optical depth model input parameter is constant throughout the whole reconstruction period (it is of course higher for Vienna (aod of 0.35 at 400 nm was used) than at Sonnblick (aod of 0.16 at 400nm)). The CMF however largely takes into account the aerosol influence since the CMF is also used during cloudless conditions. We will estimate how much of the aerosol effect is not taken into account by the CMF and a more detailed description of the radiation transfer model input parameters (as also asked for by Referee 2) will be given in the revised version of the paper.

R1: 5) The authors very often use phrases like "UV level" or "UV radiation" instead of well defined quantities.

This will be changed in the revised version of the manuscript.

Specific:

R1: Title: Please avoid "UV-level".

We will change to “UV-doses” in the title.

Abstract:

R1: Line 5: What is the purpose of the correction factor as input for your method (correction factor for ...)?

The use of a correction factor and cloud modification factors is widely used within the scientific community (e.g. Kaurola et al. 2000, Reuder and Koepke, 2005). The correction factor is calculated using a period of simultaneous measurements of UV and global radiation and modeled clear-sky values of UV and global radiation. The basic idea behind the method using cloud modification factors (CMFs) and a correction factor

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(C) is that the modeling of clear-sky UV-radiation for a specific site can be done more easily than the modeling with clouds. The correction factor C is used to transfer the CMF in the shortwave wavelength region to the CMF in the UV wavelength region. The correction factor is calculated using a period of concurrent measurements of UV and global radiation and modeled clear-sky values.

R1: Line 11-13: Please try to avoid the repeatition of e.g. listing input parameters. (I would change the structural and logical configuration of the abstract anyway)

The abstract will be adequately changed for the revised manuscript.

R1: P960 - L14: What do you mean with "daily values"?

Daily values mean daily sums of UV irradiance (also called in literature daily doses). These reconstruction models (e.g. global irradiance, sunshine duration …) are based either on daily averages of meteorological input parameters or on daily sum of the meteorological parameters. Text will be changed in order to clarify these points.

R1: P963 - L9: "A comparison against..." -> A comparison of ??? against...?

Here the comparison of modeled ozone for (Arosa, Sonnblick and Vienna) to the observed ozone at Arosa is meant.

R1: P964 - L14: "We therefore used global irradiance data [...] only if global irradiance data were missing." What do you mean?

For some periods there has been no information on global irradiance at station Hoher Sonnblick (see * at Table 1.). During this periods we used sunshine duration to reconstruct global irradiance values and then used the reconstructed global irradiance to compute CMFsol. We will change that section in the revised version of the manuscript to point that out more clearly.

R1: L23: "Two" -> "To"

Will be changed. Thanks for addressing that typo.

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R1: P965 - L2: Please give a definition of snow depth, snow amount and snow cover (also Line 9).

Snow depth means the accumulated quantity of snow (in cm). Snow amount means the quantity of fresh snow (in cm). Both numbers are needed in the albedo model.

R1: L15: Here I prefer to use the verb "to simulate" instead of "to model".

Will be changed.

R1: L20 and following: Which physical unit is described with UV-radiation? Please specify.

We will change it to “UV-dose” in the revised version of the manuscript.

R1: P966 - L19: Quantity of "UV level"?

We will change it to “UV-dose (J/m2)” in the revised version of the manuscript.

R1: P967 - L7: What is "potential global irradiance"?

Potential irradiance is similar to reference irradiance. Gpot will therefore be replaced by Gref. Text will be changed accordingly.

R1: L8: The same question for the sunshine duration. Please specify.

Potential sunshine duration means maximum sunshine duration (= all day clear sky).

R1: Equation (4) and (5): Please delete equation (4) or (5)

One of the equations (eq.4) will be removed. It was just added in the manuscript to give reference on the reconstruction method from Neuwirth (1979).

2. The transformation of the equation (4) to (5) yields GOBS=a*GPOT + b*(n/N)*GPOT or GOBS= [a + b*(n/N)]*GPOT.

Will be changed accordingly.

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3. Please use the same nomenclature for all equations (e.g. multiplying is represented by a blank or *?)

Will be changed accordingly

R1: L13: How are the correction factors a, b and X defined (fitting parameters?)?

The terms a and b are statistical fitting parameters in the Neuwirth (1979) approach. For our study we adopted this approach to hourly values. The term X used in equation 6 is calculated by the following equation: X= (GRADobs(n)/GRADref) * 0.1

R1: L14: Again, what is "potential sunshine duration"?. Please clarify.

See former remark.

R1: P 968 - L3: Please specify UV radiation.

UV-radiation means here once again UV-dose. This will be changed in the revised version of the manuscript.

R1: L15-18: typing error: UVMOD(H), UVMOD(D) -> the first inferior brackets

Will be changed.

R1: P969 - L4: Please describe the independent data sets.

For developing the model, data from the years 1999 and 2002 (Sonnblick) and 2000 and 2005 (Vienna) have been used. For testing the model, data from the years 2000 and 2003 (Sonnblick) and 2003 and 2004 (Vienna) have been used. The combination of these years has been chosen to secure that the same number of days for the comparison is available. This will be mentioned in the manuscript.

R1: L4-11 and P970, L4: Can you give an explanation why HMC shows the best agreement?

Statistical significance of the results will be addressed in more detail in the conclusion. Regarding the Bias and RMSE the HMC model shows the smallest numbers (table

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2). Following this it gives the best fit between observations and model results. Due to smallest time resolution of the input parameters, daily fluctuations are better taken into account.

References:

Kaurola, J., Taalas, P., Koskela, T., Borkowski, J., and Josefsson, W.: Long-term variations of UV-B doses at three stations in northern Europe, J. Geophys. Res., 105(D16), 20 813–20 820, doi:10.1029/2000JD900258, 2000.

Neuwirth, F.: Beziehungen zwischen den Monatswerten der Globalstrahlung und der Sonnenscheindauer in Österreich, Arch. Met. Geoph. Biokl., Ser. B, 26, 171–182, 1978.

Reuder, J. and Koepke, P.: Reconstruction of UV radiation over Southern Germany for the past decades, Meteorol. Z., 14, 237–246, 2005.

Simic, S., Weihs, P., Kromp-Kolb, H., Vacek, A., and Laube, W.: Factors affecting changes of spectral UV irradiance at the Sonnblick Observatory (3106 m, Austria), Proc. Spie., 5979, 597927-1–597927-9, 2005.

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