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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Extensive reduction of surface UV radiation since 1750 in world's populated regions" *by* M. M. Kvalevåg et al.

Anonymous Referee #2

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In this paper the changes in surface erythemal UV irradiance between pre-industrial times and the year 2000 are estimated using a radiative transfer model and taking into account changes in various components affecting UV, such as ozone, aerosols (direct and indirect effects), land use, snow cover, SO2, NO2. Overall this is an interesting paper, well organized and generally clearly written. However, I would recommend that section 3: "Method", describing the model adjustments for the UV calculations is presented in more detail. My second point is that the significance of the changes in erythemal UV shown in this paper should be presented or discussed in the results section. I recommend publication after processing the comments and suggestions mentioned below.

1. Introduction (technical comments) Line 5, "We will like" -> "We would like" line 13,

"cirrus"-> "cirrus clouds"

2. Observed and reconstructed surface UV trends

Point out clearly that the trends reported in observational studies are not all for the same period, so that the whole picture is less confusing

3. Method

As stated in the general comment, I would encourage the authors to elaborate on this section, as it is now rather dense in information. I agree with the comments of Rev. #1 on the snow cover/albedo and aerosol optical properties comments.

More specific comments: The use of 5-nm spectral resolution in the UV-B introduces uncertainties in the calculation of UV-irradiance due to the steepness of the ozone cross-section. These uncertainties should be discussed. Furthermore, it is not clear how from the 5nm resolution the erythemally weighted irradiance is calculated.

Also, the last paragraph of the section (page 10462, lines 24-27) should be placed after the second sentence of the section, i.e. after ". . . wavelength intervals." (page 10461, line 1). In this same paragraph the term UV-E as UV erythemal irradiance should be defined before it is used in page 10461 line 20, where it appears for the first time without explanation. Then the sentence 'The model used meteorological data . . .' (10461, line 1) could start a new paragraph.

4. Model comparisons with observations

Here the UV erythemal irradiance calculated by the model is validated against ground based measurements. It would be better to provide further details for the various instruments used, (e.g. type of instrument, location incl. altitude), and the source of the data also in the text and not only in the figure caption.

Page 10463, lines 5-6 (and below in line 23): The main (and highest) contributor to this correlation is the seasonal cycle and the ability of the model to reproduce it. It would

be nice to discuss a bit further the range of differences, their seasonality, and possibly other factors (except ozone) that could contribute to the differences.

In page 10463, line 9 and below: In order to use such a correction, one assumes that the profile differences are constant at all levels at all times. A line explaining this assumption should be added here (or somewhere here) in the text.

Page 10464, line 7 and below, also Figure 3. I'm afraid that this figure does not provide more information to the reader, as it could be deduced by comparison between the yellow, blue and red lines of figure 2.

Page 10464, last line: Indeed the reference should be Arola et al., 2005 instead of Fioletov et al 2002 (as reviewer #1 also suggested).

5 Results

As mentioned above, it would be nice to show (or even briefly discuss/comment) the significance of the UV changes from pre-industrial times compared to the year 2000.

Also, page 10466, lines 15-16: The reduction in the snow cover affects the winter months at high latitudes, while annual mean UV is dominated by summer. Thus the annual averaging suppresses the larger of the winter months. A line could be added here to make it more clear (or to remind) to the reader.

Interactive comment on Atmos. Chem. Phys. Discuss., 9, 10457, 2009.