

Interactive comment on “Ultraviolet Radiation modelling using output from the Chemistry Climate Model Initiative” by Kévin Lamy et al.

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Response to the Referee’s Comments

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We would like to thank the referee for his thorough review. The comments have been very beneficial. We hope that the new version has improved the paper (Supplement of this comment).

1 General comment

The paper presents the results from modelling of UVI at Earth’s surface using the TUV model and data from the first phase of the Chemistry-Climate Model Initiative. The results are for clear-sky only, which is a major drawback in terms of their value for UV predictions to input into understanding risks and benefits for human health and the environment. The findings differ to those of previous studies (Hegglin and Shephard 2009 and Bais 2011), including in the direction of change of UVI at high latitudes. An important finding is that GHGs accelerate ozone recovery and return of UVI to pre-ODS levels, and that the most important driver of UVI in the southern hemisphere is TOZ, but in the northern hemisphere aerosol optical density is around twice as important as TOZ. There numerous errors throughout the

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paper in the use of plural vs. singular, e.g. "The spectral solar irradiance. . .range from 280-450nm" (should be 'ranges' or revise the sentence and use 'in the range from 280-450nm'); "The required input for the UV calculation.." (should be 'inputs'); Page 7, line 12: "these types of measurements has an uncertainty. . ." (should be 'have'). There are multiple minor errors in English, e.g. page 12 line 20: "which have affect the circulation"

Regarding the general comment and following up on the reviewer's suggestions, we have looked closely at the level of English of the manuscript, and the cited errors have been corrected.

2 Specific comments

2.1 Introduction

1. *General comment: the most recent literature cited is from 2014 – is there no more up to date information that should be used to support the introduction? For example, the recent paper by Dhomse et al (2018) on estimates of ozone return dates is likely to be relevant.*

Bais et al. (2015) and Dhomse et al. (2018) have been cited to support the introduction.

2. *Line 9-10. Non-melanoma skin cancer is now being referred to as keratinocyte cancer. Only SCC is caused by chronic exposure; the pattern of exposure for BCC is more complicated, and probably more similar to melanoma, i.e. sunburns particularly during childhood years. The cited reference is very old – 2004.*

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We thank the referee for his input, more details on this subject and recent references have been added.

3. *"Studies on human health and UV generally use the UV Index". This statement would be correct only for ecological studies. Individual-level studies would more commonly use some measure of exposure and dose rather than ambient UV irradiance. UVI does not quantify the impact of UV radiation on human skin – this requires a measure of exposure as well as irradiance, and probably for impact, a measure of skin type. The sentence needs to be rephrased – perhaps to note that UVI is the cornerstone of public health messages for sun protection, as a measure of ambient UV irradiance.*

Both sentences have been rephrased.

2.2 Model Validation

1. *Page 7-8: this sentence needs to be revised: "UVIOMI tends to be a lightly higher" (slightly?)*

Corrected.

2. *The comparison between the different UVI measurements is a little confusing – there are the modelled UVI values, the observed from ground-based spectroradiometers, and computed results based on OMI data. At the bottom of page 7 – UVIMean and UVIMedian are the values modelled from the CCMI using TUV; the 'observed climatological UVI' – is the OMI-based estimates? And then 'observations' refers to the measured ground-level data. It would be clearer to consistently use the abbreviations that*

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are used in Table 3, i.e. UVIOMI, UVIMean, UVIMedian and UVIGB and use those to refer to the different datasets. Also later – simulated, CCM1 models, UVIMean – all refer to the same data.

Specific abbreviations have been added in order to clarify the discussion.

3. Page 8 “The global relative difference between these two data sets.” – it is not clear without looking at Fig 3 which two datasets are under consideration.

These two datasets have been specified in the text.

2.3 Conclusion

1. The final part of the conclusion focuses on possible impacts. For human health, the main driver of health risks is sun exposure behaviour. It is not just a direct association between UVI and health risk – this needs to be noted.

We agree with the referee, this has been noted in the conclusion.

2. As noted in the text, the results differ from those of previous assessments. Much weight is placed on these predictions, in terms of, for example, future health planning. Yet, when the estimates are so different, it is difficult to have any confidence in the findings from one model over another. The authors might address this consideration.

This consideration has been addressed in the conclusion.