

## ***Interactive comment on “Modeling erythemal ultraviolet diffuse fraction” by Guadalupe Sanchez Hernandez et al.***

### **Anonymous Referee #1**

Received and published: 7 August 2017

The manuscript describes adoption of models of the total solar diffuse irradiance to the erythemal weighted ultraviolet diffuse irradiance. Several models are proposed and tested against measured data for the location of Badajoz, Spain.

The manuscript is well-organised and include description and verification of new/adopted model results. The English language may be improved in places. It is recommended to have the manuscript proof-read by a fluent English speaker.

Specific suggestions for improvements are given below.

- **Page 1, line 7:** The title is rather general while the topic of the manuscript is rather limited and does not at all cover what is promised in the title. The words “surface” and “irradiance” should be included in the title and also preferable the

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location for which the study was made. A suggestion for the title is “Modeling the erythemal surface diffuse irradiance fraction for Badajoz, Spain”.

- **Page 1, line 7:** “inspired on” → “inspired from”.
- **Page 1, line 12:** The RAU3 acronym has no meaning unless the full manuscript is read. Maybe rather write “the best performing model (RAU3) is based on a model proposed by Ruiz-Arias et al. [2010] and shows values . . .”.
- **Page 1, lines 13-14:** Maybe write this sentence as: “The performance achieved by this entirely empirical model is better than those obtained by previous semi-empirical approaches, and therefore needs no additional information from other physically-based models.”
- **Page 2, line 40:** Craig et al. reference missing in References.
- **Page 2, line 41:** It is the variations in the clouds and aerosols that affect the diffuse/direct partitioning and not the variations in the ultraviolet irradiance. Please clarify this sentence.
- **Page 2, line 55:** Please include a reference and/or an example of a physically-based model.
- **Page 2, line 58:** You state that empirical model have a “wide use by the scientific community”. May you please provide some references reflecting the wide use? In the next sentence, line 60, it is stated that “few studies have applied empirical models . . .” contradicting your claim on line 58.
- **Page 2, line 69:** “contribution in” → “contribution to”.
- **Page 3, line 78:** The acronym UVI is introduced without explaining what it is and how it is related to UVER. It is not used later in the manuscript. Please explain UVI.

- **Page 3, lines 84-86:** It may be argued that at least two important processes that largely affect UVER are not included in the dataset used here. One is the effect of snow on the surface which significantly changes UVER. The other is altitude. Both these processes affect both total UVER and the direct/diffuse ratio. It should at least be mentioned that these processes are not included in the dataset and that the proposed models thus have not been tested for these processes.

- **Page 4, lines 109-110:** On line 84 you argue that the dataset includes a “large variety of situations”, then you reduce the variety significantly by hourly averaging this dataset. Please provide a sound justification that the reduced dataset also includes a “large variety of situations”. And it should be shown that the reduced dataset with hourly resolution produces similar results as the original higher time resolution dataset.

Should not the proposed model also account for short-term fluctuations? If not, why are not these important for users of these type of models? If short-term fluctuations are not included, this should be stated as a limitation of the model.

Did you hourly average the solar zenith angle? It would seem more appropriate to average the cosine of the solar zenith angle. May you please comment on this?

- **Page 4, line 119:** “fraction determines the” → “fraction describes the”.
- **Page 5, line 149:** It should be mentioned that the solar constant is not a constant and that it may vary over the solar cycle, especially in the UV, see for example Lean et al. [1992] and Kopp and Lean [2011]. Please mention the uncertainties in the estimated erythemally-weighted solar constant due to the variations in the solar constant.
- **Page 5, line 160:** “radiometric magnitudes” → “radiometric quantities”.
- **Page 6, line 185:** What is meant by “adding the a term”? Please clarify sentence.

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- **Page 6, line 203:** “in clear” → “on clear”.
- **Page 10, line 319:** The description of  $x_i$  and  $x_i^*$  should follow immediately after Eqs. (19) and (20) and not later in a different paragraph, lines 325-326.
- **Page 11, line 334:** When reading this sentence I thought results from all models would be included in Table 1. However, the results for GCU1, RAU1 and RAU2 are excluded. It is stated that results for these models were calculated. Hence please include these results in Table 1 to make the manuscript complete.
- **Page 12, Conclusions:** It should be mentioned in the Conclusions that the models have not been tested for high albedo (snow) conditions nor for high altitudes. Also, the testing have been limited to solar zenith angles less than  $70^\circ$ . Hence the models may not be suitable for the large solar zenith angles encountered at high latitudes.
- **Page 22, lines 485-486:** It should be stated in the caption that the black dot is the observation. Also describe what value the green lines represents.
- **Page 23, Table 2, caption:** This tables does not only list the “Empirical fitting coefficients and their corresponding standard error” as stated in the caption, but the full functional form of the models. This should be mentioned in the caption. It should also be mentioned in the caption that these coefficients are only applicable to the Badajoz, Spain, site. This to avoid that others misuse these equations for other locations.

## References

- Kopp, Greg and Lean, Judith L., A new, lower value of total solar irradiance: Evidence and climate significance, Geophysical Research Letters, 38, 1, L01706, DOI:10.1029/2010GL045777, 2011.

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- Lean, Judit, Michael VanHoosier, Guenter Brueckner, Dianne Prinz, Linton Floyd and Kenneth Edlow, SUSIM/UARS observations of the 120 to 300 nm flux variations during the maximum of the solar cycle: inference for the 11-year cycle, Geophysical Research Letters, 19, 2203-2206, 1992.

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Interactive comment on Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2017-524>, 2017.

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