Anonymous Referee #1

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The paper "Reconstruction and analysis of erythemal UV radiation time series from Hradec Králové (Czech Republic) over the past 50 years" partly reconstructs and analyzes a 50-year time series of UV Erythemal UV radiation in Central Europe. The paper is well structured and state-of-the-art methods are used both for the reconstruction and for the analysis of the time series. The paper also includes innovative aspects, especially the relationship of high EUV daily doses and macro-scale circulation patterns is to the best of my knowledge unique. Therefore I suggest the acceptance of the manuscript in ACP with minor revisions.

Remarks:

1. Page 2 Line 6 and caption figure 1: Suggestions for changes radiation intensity –> irradiance
   Changed accordingly.

2. Why do you show mean daily irradiance [W/m2] in figure 1? Daily dose [KJ/m2] would be more consistent with the remainder of the paper.

   The reason for the use of irradiances and not daily doses for the model validation was that the Brewer spectrophotometer EUV radiation measurements, which were used to validate the model, were taken at irregular time intervals, often only several times a day. Therefore, the daily doses calculated from the Brewer data would be very imprecise.
   After the validation of the model, we calculated the irradiance for every hour at a given day over the whole 50-years period, therefore an integration to daily doses was possible for the rest of the study.
   Clarified in the text (p. 6, l. 8 – 11).

3. Page 4 Line 15-17: How long was the training data set? Could you comment on the relationship of the observed short-wave radiation albedo with values one would expect according to land cover and vegetation cycle?

   The whole dataset comprised the data from the 2000–2014 period (4269 applicable cases). For network training, these cases were randomly divided to training set (70 % of cases), testing set (15 %), and validation set (15 %). An ensemble of 10 individual neural networks was trained, with different random divisions to training/testing/validation subsets. The final results were taken from the ensemble average. Sensitivity tests indicated the dominant role of land cover as a single relevant predictor. From the land cover characteristics, the snow cover was the most important one (land without snow, partly covered by snow or full snow cover).
   Clarified in the text (p. 4, l. 15–17).

4. Page 5 Line 17-20: Which radiative transfer model did you use (DISORT, TWOSTREAM, MYSTIC,...)? How do you deal with SZA values close to 90◦?
   We used the DISORT solver (added to the text of the manuscript at p. 5, l. 17).

   The values close to 90° were calculated by the model, however, they weren't added to the training dataset because of the lower precision of both the model and the instruments (we decided to exclude all values exceeding 75° of SZA). The final model for all-sky conditions was then tested on a dataset that included all values including those with SZA close to 90°. The

absolute error was very small, i.e. up to 2.5 W·m^{-2} (see fig. res-1 for illustration, and fig. 1 in the manuscript), so it did not have a large effect on the resulting daily doses.
Clarified in the text of the paper (p. 6, l. 6–8).

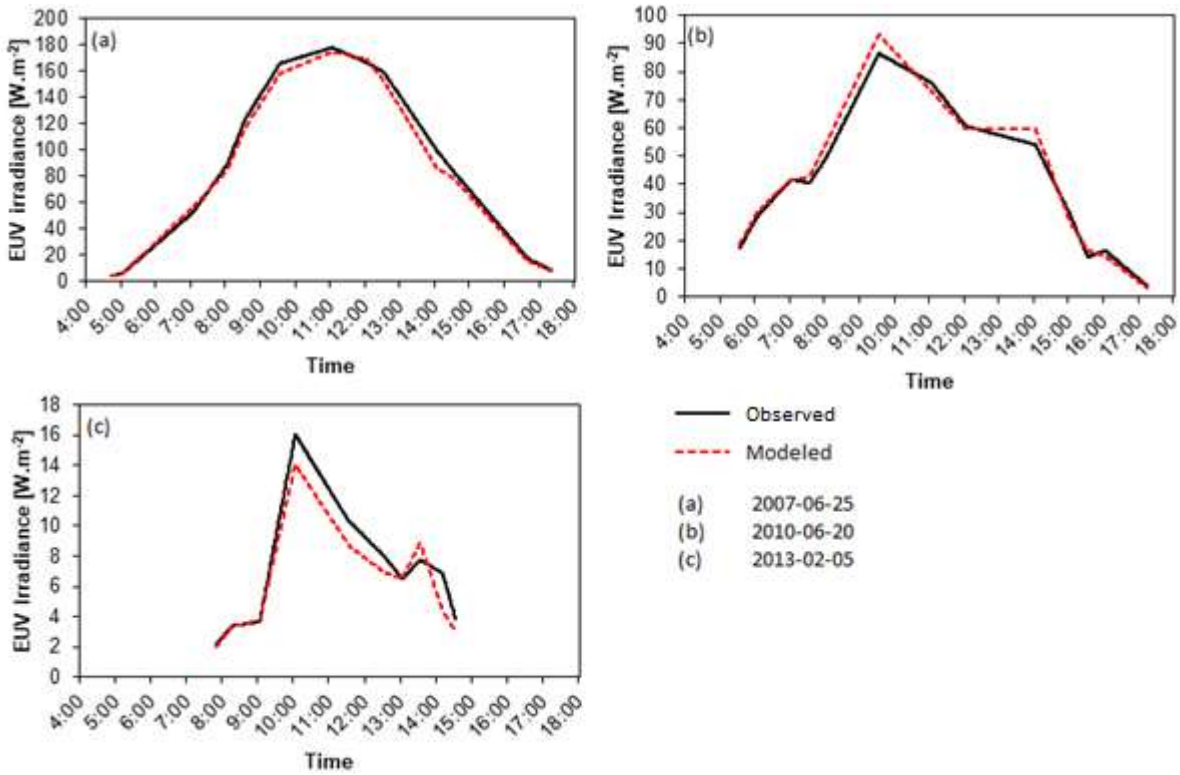

Fig. res-1. An example of observed and modeled irradiances for three different days: (a) clear summer day, (b) partly cloudy summer day, and (c) partly cloudy winter day

5. Page 5 Line 30/31: Can you describe the determination of CMFEUV as f(CMFGLB,SZA) in more detail? Did you generate the cloud modification table according to Lindfors et al. 2007?

In order to minimize the RMSE, we did not create the cloud modification look-up table. Instead, we have decided to go for a multiple non-linear regression instead. Here is the formula and the coefficients we used:

$$CMF_{EUV} = \left[(a + b\,SZA)\,CMF_{GLB}{}^{(c+d\,SZA)}\right].\left(k + l\,CMF_{GLB} + m\,CMF_{GLB}{}^{2}\right)$$

Coefficient	*a*	*b*	*c*	*d*	*k*	*l*	*m*
Value	3.8199	-0.0081	1.4502	-0.0076	0.4598	-0.2771	0.0738

Both the table and the equation were added to the text of the manuscript (Table 1 & pages 5–6, lines 31, 1–3.

6. Figure 5: It would help the reader, if you would use the same scale for each subfigure (e.g. [-50,50]) both to save space (just one color bar needed) and to enable comparison between subfigures.

The actual values of the principal components between the figures are incomparable, they are only the artifacts of the different PCA analyses. Also, if the scale was to be unified to [-50,50],

some of the subfigures would become illegible due to the relatively small range. Therefore, we have decided to keep the original figure. Another option, to avoid confusion, is not to include the numbers at all, but only to state "high" and "low" (see fig. res-2). This way the relative shapes of the geopotential heights fields created by the PCA are still fully visible.

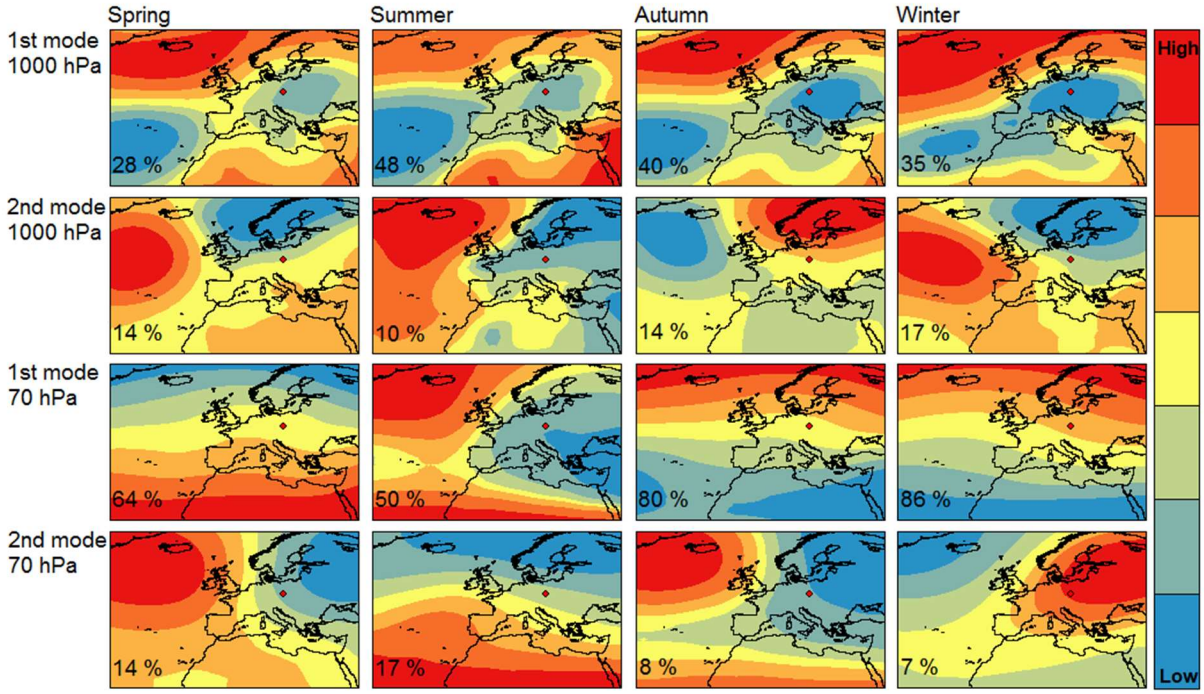

Fig. res-2. An alternative option for Fig. 5, stating only the relative principal components' magnitude.

7. The effect of SZA on radiation daily doses is trivial. I suggest to skip the analysis (table 4, second column and figure 3a) or to investigate the influence of surface albedo instead.

   Thank you for your comments. However, we confirmed that SZA is the most important factor affecting the daily doses; its effect is stronger than the effect of TOC or cloud cover. Therefore, we have decided to keep the analysis so that the effects of TOC and cloud cover can be compared to the very well-known effect of SZA. In addition, we have included the effect of surface albedo in fig. 3 and Table 4 (changed to Table 5 after the addition of Table 1). Please note that with the inclusion of surface albedo the partial correlation coefficients stated in the text (sect. 5.2) had to be changed according to the new regression model.

8. Typos Page 7, line 8 "cover or" –> cover of
   Changed accordingly.