Answer to RC2
Author replies are in red

The manuscript evaluates the UV index generated from the UV- Index Operating System (UVIOS) and also conducted sensitivity tests to quantify the uncertainty caused by the different input parameters. The system is important for providing early warning, which will benefit the general public. The evaluation of the UV estimation against ground observation is thorough. However, the presentation of the manuscript can be improved, and I have provided some detailed comments as follows. Lastly, English needs to be improved. There are grammar errors in some sentences.

We want to thank the reviewer for the proposed comments, suggestions and corrections that were incorporated in the revised version of the manuscript.

1. The manuscript mentions that the UVIOS system provides both now-casting and forecasting UV index products. It is not clear how different they are and it would be helpful to provide some information on these two products.

Thank you for giving us the opportunity to explain in more detail the ways that UVIOS is able to operate. Since this system can produce massive UVI outputs of the order of 1.5 million simulations in less than 5 minutes following the proposed computing architecture (section 2.1.2), this means that it can be used for both operational applications and real-time estimations. The exact use of UVIOS depends only on the available input data sources. For this study both nowcasts (clouds) and forecasts (ozone, aerosol) were used as inputs into UVIOS. The nowcasts represent the continuous monitoring dimension (i.e. what is happening now) in terms of cloud microphysics data every 15 minutes retrieved in real-time by the geostationary satellite Meteosat Second Generation (MSG). The forecasts represent the future estimations (day ahead in our study) of aerosol optical properties and total ozone column based on deterministic approaches (ECMWF) and assimilated satellite data for better accuracy. As a result, UVIOS under cloudless conditions operates as a forecast system since it uses forecasted inputs and provides the clear-sky UVI forecasts operationally. By adding the nowcast cloud information as input to UVIOS (i.e. all sky conditions), the whole procedure will follow the time steps of MSG cloud microphysics data collocated and synchronized with the forecast data. So, following the proposed operation method of this study, the UVIOS can be used as a UVI forecast system for cloudless conditions or as a UVI nowcast system for all sky conditions. A future goal is to compare the UVIOS accuracy under cloudy conditions by using, (i) the current MSG cloud information (5 km, 15 min), (ii) the ECMWF forecast cloud information (4 km, 1 hour) and (iii) the forthcoming Meteosat Third Generation (MTG) cloud information (500m, 5 min), in order to quantify the uncertainties of the forecasted cloud data as compared to the satellite observations, as well as the overall improvement of the MTG data compared to the MSG due to the MTG's higher resolution.
The above text has been added in the revised version of the manuscript in order to clarify the UVIOS operating principles and the dependence on the input data sources.

2. Line 298-302 talks about the different stations. It can be moved to the next paragraph where it focuses on describing the geographic and climate information about each station.

These lines have been moved to the next paragraph. Now the revised paragraph includes all the geographic and climate information for all stations. Thank you for the suggestion, which indeed, improved the presentation of this part.

3. I suggest changing title 3.1 to Overall performance of the UVIOS system.

The title of subsection 3.1 has been changed following the reviewer's suggestion.

4. Line 368: how did you decide the criteria for low, moderate and high UVI differences?

There was a typo in the document. The three categories are: low (difference<0.5), moderate (0.5 – 1), and high (differences>1). We used the above categorization for the following reasons:

- Differences below 0.5 are of similar magnitude with the measurement uncertainties and are thus considered low.
- Differences larger than 1 correspond to significant differences in the health effects of the different UVIs, and different precaution measures. For example, a UVI of 5 is considered moderate while a UVI of 6 is considered high.
- Finally, differences between 0.5 and 1 are not that significant regarding the health effects of the different UVIs, and are thus categorized as moderate.

5. For Figure 4, it would be nice to show a map of the annual UV index values from the UVIOS system overlaid with ground observational data.

We totally agree that an annual UV index map produced by UVIOS would be of great interest. To this direction a sequent study is already planned in which a large-scale historical database of high resolution UV index will be developed using all the available climatological and historical input data sources followed by a dedicated online and open access application (web-service). This procedure will require huge computing and storage resources in order to implement (e.g. for 15 years covering Europe and North Africa). Indicatively, just for one-year collocated cloud, aerosol, ozone and surface albedo data for the same region used in this study (2 million pixels), the total amount will be more than 70 billion UVIOS simulations and 25 Tb of input and output data production and use. We want to thank the reviewer for the nice point of view concerning the climatological dimension of UVIOS and we believe that the planned long-term database development will be useful as well for the UV community.

6. Besides Figure 5, it would be helpful to have a scatter plot here to better show the overall performance for all the stations together.

A scatterplot (new Fig. 5) including all stations in order to show the overall model performance is provided in the revised version of the manuscript, additionally to the Taylor diagram (now Fig. 6).

7. Table 3 is hard to read. Figure 11 can be used as a complement. I would suggest showing a histogram distribution of the errors for all the stations together rather than showing each station on one plot with different lines. Histogram for individual station can also be shown as supplementary plots.

We want to thank the reviewer for the helpful suggestions. In the revised version of the manuscript a more explanatory caption of Table 3 is provided for the presented quantities (i.e. U0.5 and U1.0 represent the percentages (%) of data that are within 0.5 and 1 UVI of difference, respectively). Additionally, separating lines were added for better clarity between the station column and the all sky and clear sky statistics. Concerning Fig. 11, we have updated this plot in order the distribution of the whole dataset to be clearer. The distribution of all data is now thicker and station by station lines are thinner. We think that now the information and the visualization of this plot were updated followed by better clarity.

8. Figure 9 and Figure 15 can be put together into one figure.

Figures 9 and 15 were merged into one plot (new Fig. 10) and the related texts were included in the same subsection (3.2.3).

9. Line 84: what is "0 to 8/8"?

It is referring to cloudiness oktas, we have rephrased accordingly now in order to be more clear, i.e. "the change from 0 to 8 oktas for cloud coverage".

10. Line 85-88: This sentence has some grammar errors, please check and reorganize the sentence.

The sentence has been restated as follows: "Although, the transmittance of clouds does not vary significantly with wavelength, some studies (Mayer et al., 1998; Seckmeyer et al., 1996) have found that the diffuse component of the surface UVR is affected by clouds in a spectrally dependent way, due to more efficient scattering and absorption of shorter UV wavelengths, in case of large air masses".

11. Line 91: It is not necessary. Or what is the main conclusion of Calbo et al. (2005)?

This sentence has been deleted in the revised version of the manuscript, since we are not discussing details of this subject.

12. Line 103: what does it mean by in contrast to ozone"? Is ozone column not important for the trend?

This phrase has been eliminated because it is confusing. Our purpose was to highlight the importance of other parameters (clouds, aerosols) to UVR trends, since the influence of ozone is described in detail earlier in the manuscript.

13. Line 160: change next section to Section xx.

We thank the reviewer for the useful suggestions in order to succeed a better presentation of the manuscript. We followed both reviewer's suggestions concerning the structure and presentation and ended up into the provided version.

14. Line 271: change Aeronet to AERONET.

Corrected.

15. Line 339: which section is it for the cloud effect section?

The cloud effect section in the revised version of the manuscript is the 3.2.4.

The authors of this study appreciate the valuable corrections, comments and suggestions of the reviewer and believe that the revised version is substantially upgraded. Thank you.