

## Answer to Anonymous Referee #1

The authors thank the referee for the positive and constructive comments.  
The referee comments are in italic.

*This is a review of the work of Ialongo et al.*

*The paper deals with a very important scientific subject. There are only few publications dealing with UV global changes using satellite derived products, so the publication is a very significant contribution for the UV and ozone community. The authors happen to be the major satellite UV data providers and such a sensitivity, trend analysis study is very important for the UV/ozone community.*

### *Technical comments*

*The first paragraph of the abstract seems more fitting for the introduction section. It can be limited to a few words as an introduction to the results that are presented in the second paragraph.*

The first paragraph of the abstract will be replaced by:

“Long term changes in solar UV radiation affect the global bio-geochemistry, climate and their interactions.”

The first three sentences of the second paragraph of the abstract will be changed as follows:

“The satellite-based dataset of TOMS (Total Ozone Monitoring System) and OMI (Ozone Monitoring Instrument) of erythemal UV products was applied for the first time to estimate the long-term UV changes at the global scale. The analysis of the uncertainty related to the different input information, is presented. OMI and GOME-2 (Global Ozone Monitoring Experiment-2) products were compared in order to analyse the differences in the global UV distribution and their effect on the linear trend estimation.”

16440

*Line 9 Products - > product*

*Line 15 used in the retrieval -> used in the retrieval,*

These changes will be done.

16443 line 25: *needs a reference*

Yang, K., Krotkov, N. A., Bhartia, P. K., Joiner, J., McPeters, R. D., Krueger, A. J., Vasilkov, A., Taylor, S., Haffner, D., and Chiou, E.: Satellite Ozone Retrieval with Improved Radiative Cloud Pressure, In Proc. Quadrennial Ozone Symposium, Tromso, Norway, 2008.

*There are various places in the document that the 50X50 Km and the 60X60Km are mentioned. Also the satellite gaps and measurement periods. All these sections have to be deleted from the discussion and clarified in the satellite data description section.*

The referee perhaps refers to 50°N and S. Anyway this part will be changed.

*Figure 3 captions are difficult for the reader to be read.*

The figure will be modified.

#### *General Comments*

*Synchronous GOME-2 and OMI synchronous satellite products comparison has to be expanded in order to explain if the per cent decadal changes are significant. And also to explain the differences due to clouds, aerosols and surface reflectance inputs to the two satellite algorithms. Pixels or larger areas that are “suspicious” of such differences could be further analyzed. Figure 3 is interesting but conclusions from these plots are difficult to be justified.*

Being not the inter-comparison between OMI and GOME-2 UV levels the main scope of the paper, we did not analyse all the details of the comparison. The percentage difference reported in figure 3 should just help in understanding the potential uncertainties in using data from different instruments but the complete analysis of the input differences could be for example the subject for a further study. Nevertheless we can specify here that we discussed in the text already (P16451 L3-13) for example the differences in the trend values obtained using OMI or GOME-2 in combination with TOMS.

Furthermore the following sentence will be added to the conclusion:

P16453 L13 “The comparison between the trends obtained using OMI or GOME-2 in combination with TOMS showed the largest differences during NH autumn-winter at mid-latitudes, pointing out that the differences in the surface albedo information play the major role in these differences. The trend values obtained using OMI or GOME-2 data differ up to 5%/decade.”

As mentioned in the text (P16448 L16) some suspicious areas were already analysed in section 4.2, describing for example the zonal EDR distribution of OMI data in comparison with GOME-2 UV products around 50°N during several days on February, when UV data from both instruments were available. The distributions (not plotted) showed very similar features but large differences over some definite regions over land, where OMI shows very high values respect to GOME-2 (the relative difference of the average is about 15 %). This is related to the effect of the not-permanent snow cover over land surface.

The complete analysis of the effect of the different factors on the comparison could be the subject of a dedicated paper.

*The statistical treatment of UV trends using three different satellite data with some gaps is not an easy task. So this treatment has to be more clear.*

*Some things that could be clarified:*

*a. Have you used absolute EDR values for each grid/month or de-seasonalized (taking into account the annual cycle) data? If so did you use different annual cycles for each satellite UV product ?*

This sentence will be added in session 3: P16448 L23 “The absolute EDRs were used for the trend analysis.”

*b. How have you statistically treated the gaps between the 3 satellite missions/periods in order to calculate the final trends per decade?*

This sentence will be added in the session 3: P16448 L23 “The data during the period of gap were assumed to follow the linear trend obtained from the available data.”

*c. Inter-satellite differences can add more uncertainty than the one presented in figure 4 while discussing about UV trend analysis errors.*

This sentence will be added in the session 4.3:

P16451 L23 “The large trend values reached the value of 15%/decade, which exceeded by about 10 percentage points the values obtained at the same latitude over sea. Thus, the inter-satellite differences between OMI and TOMS discussed here, add an additional uncertainty to the one presented in figure 4 (upper right panel).”

*d. To discard data at latitudes higher than 35 degrees North makes the analysis weaker and generally raises questions about satellite UV data quality and the need for homogenization actions. As the authors of this paper are the main GOME2 and OMI UV data providers it would be useful for the UV/Ozone community to comment on this issue. For my point of view UV satellite data are not used so far in a high number of scientific papers and such comments would be helpful in order for this hopefully to change.*

We agree that the homogenization of the datasets would be useful for a correct trend calculation, using i.e. the same input information for both instruments. This requires the reprocessing of the whole set of data. At the current stage, the operational products from OMI and TOMS were used in order to check their applicability for trend calculation.

The following sentence will be added to the conclusions:

P16454 L3: “Discarding data at latitudes higher than 35°N pointed out the importance of using a homogeneous dataset (i.e. using the same input information in both instruments algorithms) when calculating the long term UV changes.”

*Figure 4 shows, SH trends from -5% to -6% per decade for January and February with very high correlation coefficients and statistically significant. The possible reasons for this have to be discussed.*

Actually no negative trends have been observed in figure 4. Perhaps the referee means +5% or +6%/decade. As discussed already in the text, this is mainly related to the negative trend in the total ozone in that area during January/February. This sentence will be anyway added to the text:

P16449 L22 “The large positive UV trends observed over the SH in January/February are mainly due to the negative trends in the ozone

observed in the same period.”

*Large differences of GOME2 and OMI are attributed to snow cover, different aerosol approach and cloud approach. It would be very informative for the readers to include a paragraph mentioning some basic algorithm differences of the two satellite retrievals in order to explain such issues more clearly.*

According to the authors both OMI and GOME-2 algorithms details are already described in sessions 2.1 and 2.2.