

Response to Anonymous Referee #2

The authors would like to thank Anonymous Referee #2 for his/her comments. Below, please find attached our response to each one of the referee's minor comments:

1. insert 'the' before 'Mediterranean' throughout the whole MS.

We have addressed this in the revised version of the manuscript.

2. replace 'ocean' with 'sea'.

We corrected this.

3. 6, 33 'such as' > 'such that'.

We corrected this within the manuscript. We also changed this on Figs. 7 and 10.

4. 7, 13 Li et al (2013) is missing from the references

The reference has been added.

5. 7, 27-28 needs editing.

This sentence has been rephrased to "...This correction results to an improvement of the AOD532 product. Comparison against spatially and temporally co-located AERONET observations (Amiridis et al., 2013) returned an absolute bias of ~ -0.03 ..."

6. 8, section 2.4: give the definition of the AAI (I assume you mean the absorbing aerosol index) and explain that is a qualitative measure for aerosol absorption, give a reference.

We thank the reviewer for giving us the opportunity to clarify this. We mention in the revised version of the manuscript that this is the UV Aerosol Index (AI) also known as Absorbing Aerosol index and it is a qualitative indicator of the presence of UV absorbing aerosols in the atmosphere such as biomass burning and dust. We added the following reference: (Torres et al., 1998) and we also mention that positive AI values generally represent absorbing aerosols while small or negative values represent non-absorbing aerosols.

7. 8, 25 'is applied on spectral measurements from both TOMS and OMI sensor' > 'is applied to spectral measurements from both the TOMS and OMI sensors'.

We corrected this.

8. 14, 5 is there a reason for these large overestimations of sea salt contribution to the AOD?

Probably it has to do with the use of Smirnov (2003) formula for the calculation of marine AOD. It works well for open seas where we have stronger winds and sea salt

dominates (when other types of aerosols dominate usually their AODs are pretty high, e.g. Saharan dust over the Atlantic Ocean). So, when the formula returns values higher than the MODIS AOD all the AOD is attributed to sea salt which is OK for marine aerosol dominated regions. However, for the Mediterranean Basin (closed sea and not an open ocean) where other types of aerosols dominate the formula leads to a very frequent attribution of the total AOD to sea salt. Consequently this leads to a significant overestimation of marine aerosols. As there is already enough discussion on the tests we did in order to fine-tune the algorithm we prefer not to get into details about the reason of the overestimations.

We also have to mention that we mistakenly wrote in the original version of the paper that we used the 0.5 critical value for AI. We used this value in our tests but in the end we preferred to use 1 which is in accordance to other studies in the area. We have corrected Fig. 2 accordingly.

9. 17, 21 is it useful to give both the EE and pIEE? They are not very different and in principle do not provide additional info for this kind of study, or does it?

We believe yes. We wanted to show that even though in some cases the MODIS data have a lower percentage than 66% within the EE (the EE is a result of global validation studies) can still have a percentage within the pIEE which was defined encompassing the sum of absolute and relative AOD errors prior to the launch of Terra (Kaufman et al., 1997).

10. 18, 10 'about' > 'for the'.

We corrected this.

11. 18, 16 why don't you use the same area as for DT?

Basically, we use the same spatial window for the validation ($25 \times 25 \text{ km}^2$) for both DT and DB. In order to be in line with previous studies using Col. 5 MODIS AOD₅₅₀ from DT and DB we also did a DT validation using the 50 km window as in Levy et al. (2010) and a DB validation using high quality retrievals and a 25 km window as in e.g. Shi et al. (2011). In the case of DB we also wanted to show that the use of all the data instead of high quality data only did not change the correlation with the ground-based data significantly but diminished the statistical sample by a factor of 5.

12. 18, 18 25x25.

We corrected this.

13. 19,22 taking this into account

We corrected this.

14. 20, 26 and elsewhere throughout the MS (e.g. 30, 22): formulation. Due to the low precipitation (removal) the AOD remains high, but actually the AOD is high because of emissions and atmospheric processes forming aerosol particles

We thank the reviewer for giving us the opportunity to correct this in the revised manuscript. We added the following in 20,26: "...It has to be highlighted that the AOD₅₅₀ over these regions is high primarily due to the emissions and the atmospheric processes forming aerosol particles. The low removal rates from precipitation just preserve the AOD₅₅₀ levels high..." and in 30,22: "...Precipitation is the major washout mechanism of atmospheric pollutants., Low removal rates from precipitation contribute in preserving high the AOD₅₅₀ levels which are a result of emissions and other atmospheric processes..."

15. 21, 4 same as 20,26: the sources are what they are (important when large) but they do not become more prominent due to limited washout.

We rephrased the sentence to: "...The limited washout by precipitation (see also Papadimas et al., 2008) and also the enhanced photochemical production of secondary organic aerosols (Kanakidou et al., 2011 and references therein) contribute to the high AODs appearing over local sources..."

16. Rephrase 27, 20 add 'with' after winter month.

We corrected this.

17. 28, 33 remove 'region of'.

We corrected this.

18. Figure 2: the text in the boxes is very small: could you make this larger?

We did them larger where possible (all the boxes except for the last line). We will keep the figure as big as possible in the final paper.

19. Figure 3: the headers above the text are difficult to read and not needed since they are all the same; removing them leaves more space to increase the font size of the statistical results given there. In the caption an expected uncertainty is mentioned (line 12) which does not occur in the text. Is this different from the EE, and if so, please explain how evaluated.

We agree with the reviewer, we have revised the Figure accordingly. The expected Uncertainty refers to the MODIS DB data and is given in Section 4.1 "... The MODIS Terra DB data overestimate AOD₅₅₀ by 21.38 % (NMB) with 51.90 % of the data falling within the expected uncertainty (EU) envelope assuming a DB expected uncertainty of $\pm 0.05 \pm 20\% \text{AOD}_{\text{AERONET}}$ (Hsu et al., 2006)..."