

## ***Interactive comment on “Retrieval of aerosol absorption properties using the AATSR satellite instrument: a case study of wildfires over Russia 2010” by E. Rodríguez et al.***

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### **General comments:**

The authors thank reviewer number 2 for the excellent suggestions which have certainly contributed to improving the presentation of the paper. The method part has been rewritten and the clarification you were asking for have been included. And also your comments about figure 6 have been taking into consideration adding the reference and information you suggested. Thanks for your suggestion to check the comparison of SSA from AATSR and the AOD from AERONET: I found a bug in my script. It was  
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not filtering the AOD results from AATSR lower than 0.2 when calculating the SSA, after taking in to account this restriction the low SSA values retrieved with AATSR were discarded.

### **Specific Comments:**

Page 9841, line 16: Please note that in reality the SSA for aerosols (even pure black carbon) will never be lower than 0.2 due to diffraction effects.

*You are right; one sentence has been added in the revised text with your clarification.*

Page 9841, lines 27-28: Note that northern India is not a biomass burning aerosol dominated region, as the other two are, since in northern India the aerosols emissions in most seasons are mainly dominated by fossil fuel combustion, and in the pre-monsoon season by dust.

*We removed India from the text.*

Page 9842, line 2: Change ‘biomass to burning’ to ‘biomass burning’

*The text has been changed as suggested.*

Page 9842, lines 18-19: Dubovik et al., 1998 is not a reference for the AERONET retrievals. The primary references for the AERONET retrievals are Dubovik and King, 2000 and Dubovik et al., 2006 neither of which you have cited here.

*The references were changed as suggested.*

Page 9843, line 11: You can never eliminate surface reflectance effects in satellite retrievals since you can only minimize them. Therefore change ‘eliminate’ to ‘minimize’ and ‘only’ to ‘mainly’ in line 11.

*The text has been changed as suggested.*

Page 9843, line 29: 'there' should be 'here'

*The text has been changed as suggested.*

Page 9844, lines 10-11: Please give a few more details about the dust climatology applied in your algorithm. Is it a monthly mean climatology and what is the spatial resolution? What was the dust fraction for the Russian region analyzed in this paper?

*This information has now been included in section 2 "SSA retrieval method"*

Page 9844, lines 16-17: Please discuss in the text whether there is any accounting for ozone and nitrogen dioxide absorption in the AATSR retrievals.

*This information has now been included in section 2 "SSA retrieval method"*

Page 9847, lines 2-3: Please state here that the AERONET direct sun measurements Interactive of AOD are accurate to  $\pm 0.01$  in the visible and near infrared and  $\pm 0.02$  in the UV Comment wavelengths (Eck et al., 1999).

*The text was added as suggested.*

Page 9847, lines 10-11: The statement you make about the accuracy of AAOD is not valid. Since the accuracy of AOD is 0.01 (for the wavelengths used in the almucantar sky scan retrieval) and since the uncertainty of SSA is 0.03 and furthermore  $AAOD = (1 - SSA) * AOD$  then the accuracy of AAOD varies as a function of AOD magnitude.

*The uncertainty in the AAOD considered here was suggested by O. Dubovik (private communication), but also if you consider  $(1 - 0.03) * 0.01 = 0.0097$  which can be considered 0.01.*

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Page 9847, line 12: 400 nm should be 440 nm

*The text has been changed as suggested.*

Page 9847, after line 13: It should be noted here that comparisons of in situ versus AERONET retrievals of SSA have shown excellent agreement, typically within  $\pm 0.01$  to 0.02. See Leahy et al., 2007 for highly absorbing biomass burning aerosol comparisons, Schafer et al., 2014 for weakly absorbing fine mode aerosols, and Reid et al., 2005 for smoke from major biomass burning regions.

*This was added as suggested.*

Page 9847, line 23: For the most probable wind direction do you mean the climatological average wind direction in August?

*With the dominant wind direction we mean the climatological median wind direction, as reported by Witte et al 2011, Huijnen et al 2012, Chubarova et al 2012 and Mei et al 2011. These authors provide more details about the weather conditions over Moscow.*

Page 9848, line 4: You say that you expected high SSA values. Please explain why you had the expectation of weakly absorbing aerosols (high SSA).

*This expectation was based on a previous paper which reported weakly absorbing aerosols in the area during the wildfires, E.g. Chubarova et al 2012 and Witte et al 2011.*

Page 9848, line 12-13: Please explain why you chose only low altitudes for the back trajectory analysis. Although 500 m is often chosen it is usually coupled with 1000 m or 1500 m to be close to the mid or upper mixed aerosol layer.

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*The arrival height of back trajectories has been chosen to be sure that the air parcel is travelling inside the boundary layer*

Page 9848, line 19: Explain why CALIPSO satellite lidar data could not provide some vertical profile information on aerosols here.

*Calipso does not have overpass this day over the area of interest.*

Page 9849, line 8: Your choice of  $\pm 10$  hours for a time match between AERONET and satellite data is very large. Please give more justification for this in the text, especially since you say the large time differences may contribute to the scatter in comparison plots.

*The number of samples is reduced here due to the limited swath of the instrument which is 512 km leading to an overpass every time of 3-4 days over this area, this condition together with the limitations to obtain results in level 2 from AERONET inversion products force us to extend the limits of the spatial-temporal windows out of what is usually the standards for satellite comparisons.*

Page 9850, lines 10-16: Your discussion of Figure 6 data is cursory and fails to mention several key facts. The site name, AOD levels, fine mode fraction (computed from the retrievals), fine mode effective radius or volume median radius and Angstrom Exponents are missing and should all be given in the text and/or Figure caption. Also see comments above in 'General Comments' regarding Figure 6 and your conjecture about dust contributions.

*The information has been added in the caption of Figure 6.*

Page 9851, lines 1-3: You suggest that  $\pm 3$  hours differences between satellite measurements can result in significant differences in optical properties. This certainly con-

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tradicts your earlier stated choice of  $\pm 10$  hours for AATSR versus AERONET time matching for comparison purposes.

*The explanation is connected with the previous question.*

Page 9851, lines 9-11: Please give a more specific and quantified comparison for the 'areas where the forest fires are.

*We decided to use only the case study in the revised paper, so the global comparison has been removed.*

Page 9852, lines 23-25: However, the map you show in Figure 8 (top) suggests similar SSA values for both the Amazon region and southern Africa. This contradicts both in situ (Reid et al., 2005) and AERONET retrievals (Dubovik et al., 2002; Giles et al., 2012) that both show lower SSA values in southern Africa as compared to Amazonia. The discussion of this global map of SSA is much too brief and lacks significant analysis. I suggest you either remove this Figure or alternatively describe and analyze the SSA data in much greater detail, including comparison to values in the refereed literature.

*We decided to use only the case study in the revised paper, so the global comparison has been removed.*

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