

## ***Interactive comment on “On the use of satellite remote sensing based approach for determining aerosol direct radiative effect over land: a case study over China” by A.-M. Sundström et al.***

**Anonymous Referee #1**

Received and published: 30 June 2014

### General comments

In this paper, it is presented a method for the estimation of aerosol direct radiative effect (ADRE) over China. More specifically, the estimation of the ADRE is accomplished based on a synergistic use of CERES and MODIS-Terra observations. Additionally, the authors focus their interest in the detailed description of this method. I think that the subject is very interesting and also relevant with the ACPÉijs scientific issues. Nevertheless, there are some parts of the manuscript which can be improved. For example, the description of the satellite data is somewhat confusing to me. Also, the interpretation of the results can be more detailed. I hope that my comments will help the authors

C4290

to improve their work.

### Specific comments:

1. I think that the authors must give a better description about the satellite data that they have use in their analysis. For example, the analysis has been based on daily or monthly data? What about their accuracy? What about their Level?
2. Which aerosol and cloud parameters have been selected?
3. Add a short paragraph about LibRadtran.
4. Lines 147 - 153: Based on the caption of Fig. 3 this analysis about the critical albedo has been made for the September of 2009 but in the manuscript it has not been stated. Why the authors have select only this month?
5. Lines 169 - 170: "In each 0.5o grid cell the cloud-free flux and AOD observations were collected over one month...". According to the caption of Figure 4, this analysis has been made for the October of 2009 but it has not been stated in the manuscript. Why the authors select this month and not all the observations during the study period based on their criteria?
6. Lines 176 - 178: I think that the threshold of the correlation coefficient is too low. Why the authors didn't select only the statistical significant R values?
7. Lines 202 - 203: Could you please explain in more detail the second part of this sentence?
8. Line 205: How these fixed values came up?
9. Lines 218 - 219: It would be better to provide geographical distributions showing the R and RMSE values before and after the normalization procedure.
10. We cannot assume that there is not variability in the AOD and the WV values during the day. Since the authors made this assumption, they must analyze the diurnal variation of the AOD and water vapour based on AERONET or other measurements. If this study shows that there is a substantial variability this part of the manuscript must be removed.
11. Lines 258 - 260: Is there any explanation about this?
12. Section 5.3: I think that this part of the manuscript must be moved to Section 4 since it is described the agreement of the outgoing SW fluxes without aerosols, based on satellite measurements and LibRadtran outputs.
13. Lines 326 - 335: I think that the interpretation of these results is poor. Please provide more details about the spatial and temporal characteristics of these differences.
14. Lines 341 -

C4291

351: Is there any possible explanation about these results? 15. Lines 354 - 356: I cannot understand the second part of this sentence. I suppose that the MODIS SW black-sky albedo values are almost uniform into the grid cell. Is that correct?

Technical comments:

1. Line 27: Replace absorbtion with absorption.
2. Lines 38 - 40: It must be also considered that there are variations in the type of aerosols expressed by variations of other aerosol optical properties (e.g. single scattering albedo).
3. Lines 40 - 41: In this sentence add 2-3 references.
4. Lines 43 - 45: In this sentence add 2-3 references.
5. Lines 45 - 46: In this sentence add 2-3 references.
6. Line 52: Replace Moderate with MODerate.
7. Line 82: Replace focused with focused.
8. Lines 126 - 127: "... where all other quality criteria for lev 2.0 were met except the AOD threshold (Arola et al., 2013)". I think that the authors must put a short sentence describing the AOD thresholds.
9. Lines 143 - 144: It must be added in this sentence that one of the factors that determine the magnitude and especially the sign of ADRE at TOA, is the position of the aerosol layer relative to the clouds.
10. Lines 180 - 181: In this sentence, it is better to state that the upward SW fluxes are changing due to the variances of aerosol load.
11. Lines 225 - 226: Change "Figure 5 illustrates the the absolute values ..." to "Figure illustrates the total number ...".
12. Lines 231 - 232: Remove "... i.e. about 10:30 am local time" or replace it with "... i.e. about 10:30 am equatorial local time".
13. In Equation 3, keep the same symbol for the albedo.
14. Line 258: Change "Some of the highest AODs were observed during spring over area ..." to "Some of the highest AODs were observed in the south-western parts of Wuhan ...".
15. Line 293: Change "190 Wm-2" with "195 Wm-2".
16. Lines 334 - 335: Remove the first the.
17. Lines 336 - 339: Rephrase this sentence.
18. Lines 373 - 374: Remove the parenthesis or add that this time is the equatorial overpass.
19. Figure 5: Add at the right y-axis the corresponding percentages.
20. Figure 5: Re-write the caption of this figure. I didn't understand the sentence "White areas denote pixels where enough data has not been available for a successful linear fitting for any of the months".
21. Caption of

C4292

Figure 6: My proposal is: "Seasonal geographical distributions of instantaneous (left) and 24 h averaged (middle) median values as well as the corresponding median AODs (right) which have been used in the linear fitting against CERES fluxes.". 22. Figure 7: Change "Aerosol radiative effect as a function of AOD." with "Aerosol direct radiative effect as a function of AOD.". 23. Figure 8: Re-write the caption of this figure. 24. Caption of Figure 9: My proposal is: "Geographical distribution of F<sub>0,TOA</sub> values, during March of 2009, according to: (a) satellite-based method and (b) radiative transfer simulations.". 25. Figure 10: Add at the right y-axis the corresponding percentages. 26. Figure 11: Replace colorbars with the corresponding percentages. 27. Figure 11: Replace "The difference ..." with "Differences ...". 28. Figure 12: Replace "The difference ..." with "Differences ...".

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Interactive comment on Atmos. Chem. Phys. Discuss., 14, 15113, 2014.

C4293