

## Response to anonymous referee#1

### General comments:

SSA (or  $g$ ) is not obtained now from direct measurements, but is derived by using the measurement-based hygroscopic growth parameters, mixing state, and assumed refractive indices for the different components. Therefore, arguably a more evident SSA dependence on RH is “built-in” based on these assumptions than would be the perhaps the case based on direct measurements. I think it would be interesting to look at the average morning to afternoon contrast of SSA, based on AERONET L2 SSA data from XiangHe site (site that you used now for AOD). Looking at your Figure 2a, the hours of largest and smallest SSA should be covered by such a SZA range that L2 could be used to look whether this SSA pattern is equally significant from direct and columnar measurements (both aspects are very relevant and make AERONET data more justified than indirect surface measurements of SSA, when the aim is to estimate direct radiative effect).

It is mentioned that you derived daily average direct aerosol radiative forcing. First, I think word “effect” should be used instead of “forcing”, since the latter usually refers to the anthropogenic fraction, while you estimated the direct effect of all aerosols. Second, and more importantly, if I understood correctly (in line 202), you only estimated the radiative effect from 6:00 to 18:00 only. Then it is not a daily average radiative effect, while certainly the daily average effects (24h average) would be the most reasonable and interesting quantities to report.

It would be interesting and important to include also plots of the difference in direct effect in absolute units, between different cases. Now only the relative differences are shown. At the very minimum, the direct radiative effect of the base case (case 1, abt) should be explicitly mentioned, so that the reader can get an impression about these reported effects also in  $W/m^2$ .

**Response:** Thanks for your comment. The average morning and afternoon contrast of SSA by using AERONET datasets are not available due to the valid data points of SSA from AERONET at Xianghe site during the similar periods are very limited. During the years from 2001 to 2013, only about one hundred valid data points of AERONET level 2 SSA dataset at Xianghe site in July and August (corresponding to the observation period of this research), and the corresponding results are shown in Figure 1. Therefore, we don’t think the AERONET dataset can faithfully capture the

morning and afternoon contrast, and will not be shown in this research.

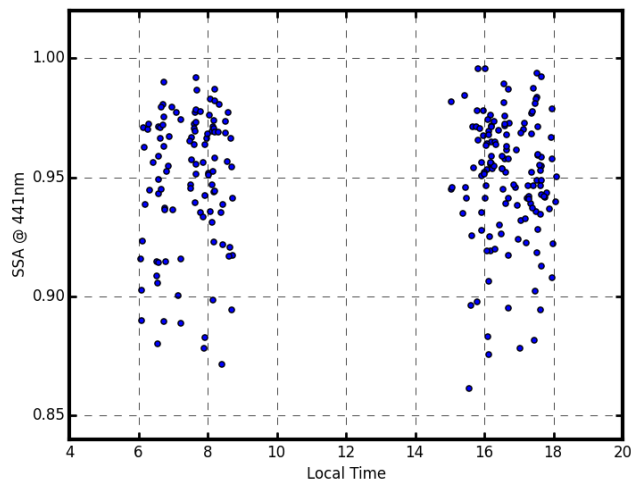


Figure 1. The scatter points of SSA @ 441nm from AERONET level dataset at Xianghe site, from 2001 to 2013 in July and August.

Thanks for the suggestion that the word “effect” should be used instead of “forcing”, and we have revised it accordingly. As for the daily average direct aerosol radiative effect (DARE), in this study, it is also averaged over 24 hours, and we will make it clearer in the revised manuscript. And the values of DARE in absolute units of the base case will be presented in the revised manuscript.

**Specific comments:**

**Comment:** Line 147, in that equation the density of water seems to be missing in the exp-term.

**Response:** We have revised it accordingly.

**Comment:** Figure 1 and 2: what is the wavelength of AOD, SSA, and g shown in these plots?

**Response:** The wavelength of AOD, SSA and g shown in these plots is 550nm, we will make it clearer in the revised manuscript.