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Interactive comment on “Diurnal variations of aerosol optical properties in the North China Plain and their influences on the estimates of direct aerosol radiative forcing” by Y. Kuang et al.

Anonymous Referee #1

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In this manuscript "Diurnal variations of aerosol optical properties in the North China Plain and their influences on the estimates of direct aerosol radiative forcing", Kuang et al. presents the analysis of the diurnal variations of aerosol optical properties, based on in-situ measurements from "Haze in China" campaign, and their model-estimated influences on the estimation of daily average direct aerosol radiative forcing.

There have been earlier studies to assess the influence of diurnal AOD pattern on the aerosol direct radiative effect (ADRE), while the possible impact by diurnal pattern of SSA (and g) has not been paid much attention to. Therefore, this manuscript offers an interesting look at this topic and is also in the scope of ACP. However, there are

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few relatively minor points to be addressed before the manuscript can be accepted for publication.

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 perhaps the case based on direct SSA 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 the 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 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, ab_t) should be explicitly mentioned, so that the reader can get an impression about these reported effects also in W/m^2 .

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Specific comments:

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

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

Interactive comment on Atmos. Chem. Phys. Discuss., 15, 339, 2015.

ACPD

15, C32–C34, 2015

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