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Atmospheric Chemistry and Physics Discussions

Interactive comment on "A case study of dust aerosol radiative properties over Lanzhou, China" *by* L. Zhang et al.

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Reply to: Interactive comment on "A case study of dust aerosol radiative properties over Lanzhou, China" by L. Zhang et al. Anonymous Referee 2

Comment 1: Please explain how to get rid of the probable existence of other non-dust aerosols from the observation instrument.

Reply: The atmospheric aerosol is comprised of not only dust aerosol, but non-dust aerosol as well, such as anthropogenic pollution under the condition of dust storm. Nevertheless, the present research mainly discusses the dust aerosol during the selected period of time for three reasons. 1. The observation site (SACOL) is set up in a rural area far from the populated urban area with comparatively few man-made pollu-

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tion sources. 2. The dust storm happened not in heating period of the year, therefore, man-made pollution emissions were comparatively weaker in non-heating period than that in heating period. 3. The wind speed was higher during the dust storm, where the atmospheric condition was rather better at diffusion, hence a smaller amount of non-dust aerosol in the dust storm compared with that in a non-dust period. Based on the analysis above the paper indicates that the observation will reflect the characteristics of the dust aerosol.

Comment 2: Give the possible physical mechanisms about the relationship between aerosol extinction coefficient and relative humidity and temperature.

Reply: Figure 8 illustrates a correlation of aerosol extinction coefficient and relative humidity, which can be explained by aerosol hygroscopicity. Many researches on aerosol hygroscopicity have been carried out with some important progresses. Meier et al. (2009) found that the hygroscopic growth factor (HGF) is 1.33 ± 0.03 for the clean continental air and 1.40 ± 0.03 for the polluted air in Beijing, China. HGF of around 1.0 for one-micrometer dust aerosol and 2.0 for one-micrometer sea salt aerosol were observed during ACE-Asia (Massling et al., 2007). The relative humidity has relationship with temperature, and then the temperature will affect the aerosol extinction properties by modifying the relative humidity condition.

Comment 3: What is the physical meaning of the correlation among PM10 concentration, aerosol extinction and scattering coefficient.

Reply: Fig. 9 presents good linear correlations between PM10 concentration and aerosol scattering coefficient, between PM10 concentration and extinction coefficient. The correlation coefficient between PM10 concentration and aerosol scattering coefficient is 0.98, which indicates that the aerosol scattering properties are mainly determined by PM10 concentration. The correlation coefficient between PM10 concentration and extinction coefficient is smaller than that of PM10 concentration and scattering coefficient due to the unsatisfactory linear correlation of PM10 concentration and

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absorption coefficient, while the extinction coefficient is composed of absorption coefficient and scattering coefficient. The aerosol scattering and extinction coefficients also showed good linear correlations, and the slops in Fig. 9c present the ratios of aerosol scattering to extinction at three different wavelengths. Thus the some contributions of absorption can be analyzed.

References Massling, A., Leinert, S., Wiedensohler, A., and Covert, D.: Hygroscopic growth of sub-micrometer and one-micrometer aerosol particles measured during ACE-Asia, Atmos. Chem. Phys., 7, 3249–3259, 2007. Meier, J., Wehner, B., Massling, A., Birmili, W., Nowak, A., Gnauk, T., Brüggemann, E., Herrmann, H., Min, H., and Wiedensohler, A.: Hygroscopic growth of urban aerosol particles in Beijing (China) during wintertime: a comparison of three experimental methods, Atmos. Chem. Phys., 9, 6865–6880, 2009.

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