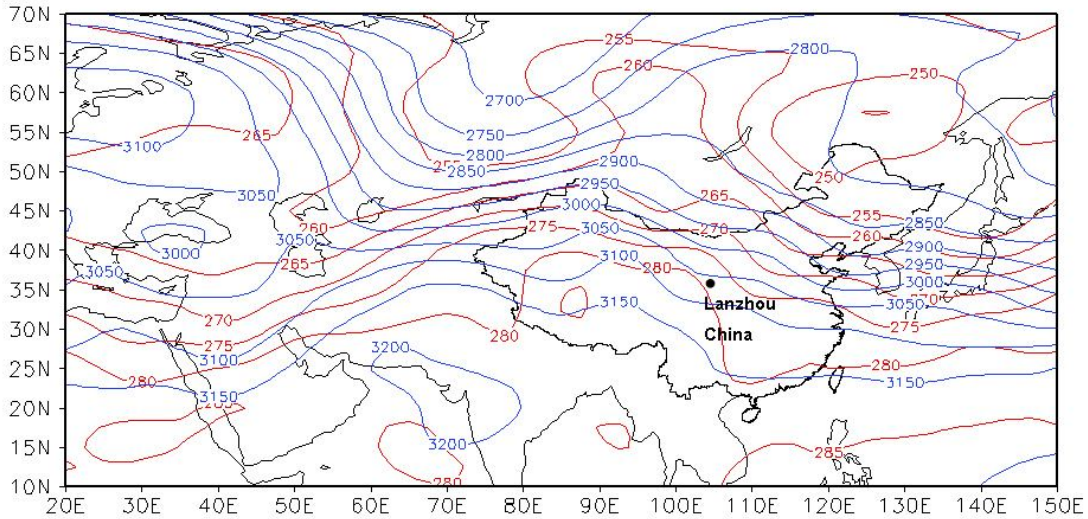
Reply to: Interactive comment on “A case study of dust aerosol radiative properties over Lanzhou, China” by L. Zhang et al.

Anonymous Referee #4

Comment 1:

The authors should give some background for the dust storm event occurred in Lanzhou from 27 to 29 March 2007. What is the meteorological condition (ie. large scale weather system) for this event?

Reply: Grateful to the suggestion of the referee, the large scale weather condition during this dust storm will be presented in the revised manuscript using the NCEP/NCAR reanalysis 1 2.5°×2.5° data. The following figure showed the distributions of 700 hPa geopotential height and potential temperature at 14:00 (Beijing Time) on 28 March 2007. There existed a cold low trough over the west Siberia to the Aral Sea and the Caspian Sea, which would affect the weather condition of East Asia on its east movement. China was located in front of the cold low trough and the SACOL in the northwest current.



Comment 2:

The parameter of lidar ratio (LR) is very important for the lidar retrieval. How sensitivity of it at the Semi-Arid Climate and Environment Observatory of Lanzhou University (SACOL) site? Although the authors mentioned that "there are some previous studies about the LR in Lanzhou (Xia, 2006; Han, 2007)" but it is not clear why choose the value of 25 sr for LR in Lanzhou.

Reply: At the SACOL, the lidar retrievals of aerosol extinction coefficient and AOD are sensitive to LR. In general, the lidar retrievals are in direct proportion to LR, therefore it is significantly important to set an appropriate LR.

25 for the LR was appropriate for this dust storm over Lanzhou, China, based on a correlation analysis of aerosol extinction coefficient from lidar and scattering coefficient from nephelometer in section 4.6, and on a comparison of AOD respectively retrieved by lidar and sunphotometer in section 4.3.

Comment 3:

It will be better to estimate the uncertainties for dust aerosol extinction coefficient, AOD. i.e. adding error bars in vertical profiles of dust aerosol extinction coefficient, AOD in Figure 4, 5 and 6.

Reply: Thanks for the suggestion of the referee. Figures 4, 5 and 6 will be rediagrammed in the revised manuscript as shown in the following. The standard deviations of AOD retrieved by lidar during the dust storm were, in general, rather small with the mean of 0.036 with few exception.

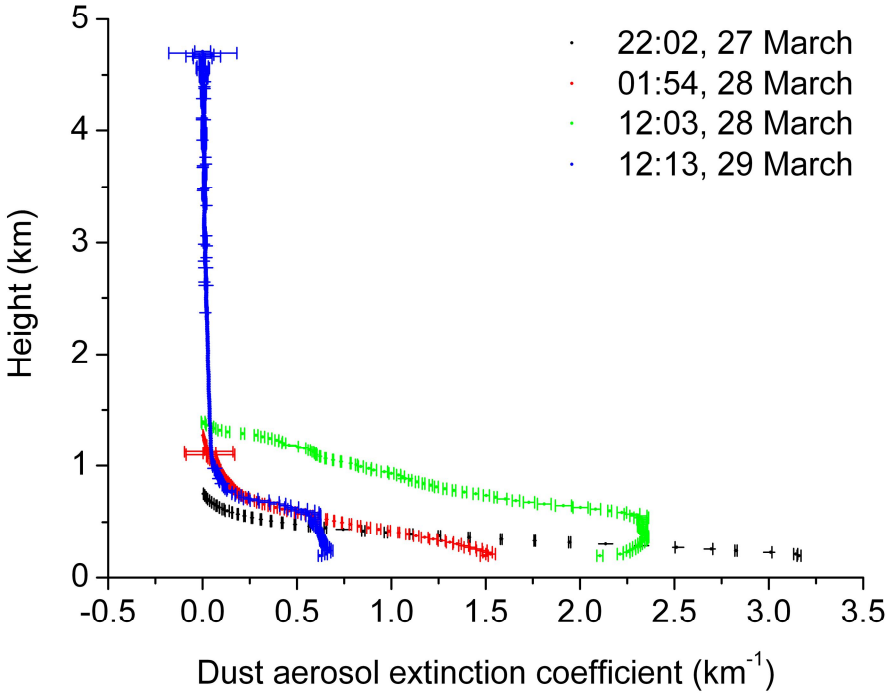


Fig. 4. Vertical profiles of dust aerosol extinction coefficient for four different cases. The dust aerosol extinction coefficient decreases with height.

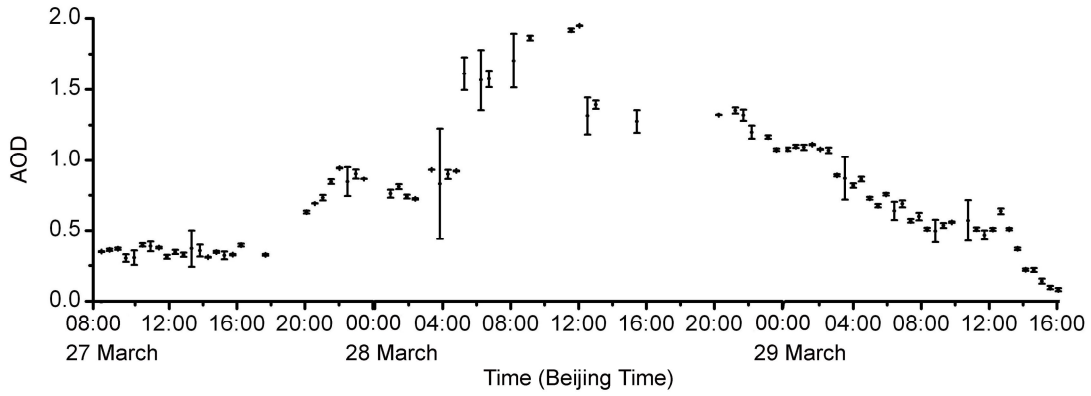


Fig. 5. AOD temporal evolution from 08:00 (Beijing Time) on 27 March to 16:00 on 29 March 2007. The sub-maximum appeared at 22:00 on 27 March and the maximum at 12:00 on 28 March.

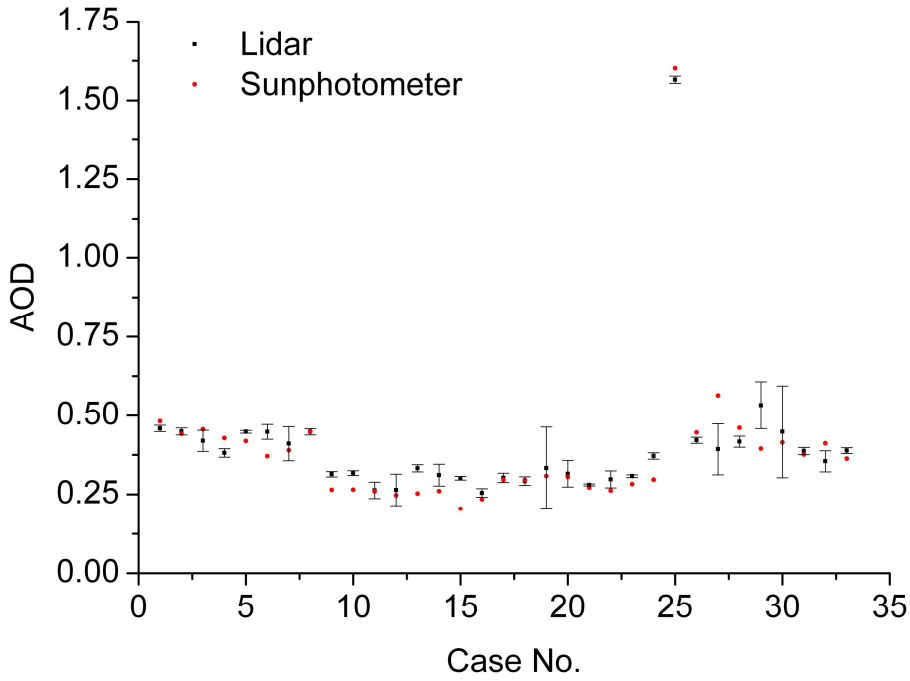


Fig. 6. A comparison of AOD derived by lidar and sunphotometer (Case No. is the same as that in Table 1). It shows a good consistency between the two retrievals.

Comment 4:

Please be careful to use the word of “identical”. When compare the aerosol scattering coefficient and PM10 concentration in Figure 7, there is still some different trends between them.

Reply: We will carefully polish the manuscript according to the referee's comment.

Comment 5:

The correlation among dust aerosol extinction coefficient, scattering coefficient and PM10 concentration is high at 450 nm, what is the correlation coefficient for 520 nm, 700 nm? Please make it clear in the abstract, section 4.6 and conclusion.

Reply: As regards the wavelengths of 520 and 700 nm, their linear correlation coefficients between aerosol scattering coefficients and PM_{10} concentration, between aerosol scattering coefficient and extinction coefficient were the same as that for 450 nm. All the correlation coefficients between aerosol scattering coefficient at 450, 520, and 700 nm and PM_{10} concentration were 0.98 (see Fig. 9a). The correlation coefficients between aerosol scattering coefficient at 450, 520, and 700 nm and extinction coefficient were 0.96 (see Fig. 9c). However, in Fig. 9c, the aerosol extinction coefficient was retrieved by lidar at the wavelength of 532 nm.

We will make it clear in the corresponding sections.