Interactive comment on “Magnetic signatures of natural and anthropogenic sources of urban dust aerosol” by Haijiao Liu et al.

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Reviewer #2

Major points:

1. Authors mainly applied magnetic susceptibility to resolve the natural and anthropogenic signatures. Because $\chi_{lf}$ and $\chi_{fd}$ can be controlled by various factors including mineralogy and grain-size, more detailed magnetic data should greatly improve the quality of this paper.

Reply: Thanks for your suggestion. We added more magnetic measurements to assess the grain size and mineral type (see a detailed response to the first reviewer’s comment).

2. Such a qualitative result may be estimated only by dustflux ratio without $\chi_{lf}$ data. To clarify the discussion 4.1, authors are highly encouraged to present quantitative magnetic data such as a saturation magnetization.

Reply: To clarify the discussion 4.1, we used the method of running median (Härdle and Steiger, 1995; Zhen and Yan, 1988; Marron, 1987; Mudelsee, 2006) to estimate the background of the observed weekly dust flux (see Fig. 2a, Lines 8-19 in Page 10 in the revised version) and then calculate monthly local anthropogenic contributions LCflux by ratio of monthly local background and total dust flux (see Fig. 2a, Lines 20-22 in Page 10 and lines 1-2 in Page 11 in the revised version).

Saturation magnetization (Ms) of representative samples (Fig.1 h-m) were measured to identify concentration of ferrimagnetic minerals. We found that the averaged values of Ms in different sources show a rising trend from the natural surface sediments (0.04 Am2/kg) to atmospheric dustfall (0.81 Am2/kg) and street dust (1.03 Am2/kg), and then to anthropogenic pollutant (1.58 Am2/kg), which correspond to the characteristics of averaged $\chi_{lf}$ in different sources. This indicates that the high $\chi_{lf}$ of urban dust is caused by the ferrimagnetic mineral from local anthropogenic source. In consequence, the LC contribution could also be estimated by the average $\chi_{lf}$ ($25 \times 10^{-8}$ m3 kg-1) of the surface sediments and local street dust ($550 \times 10^{-8}$ m3 kg-1). On this basis, we calculated the LC$\chi$ (see Fig. 2b, Lines 3-12 in 11 Page in the revised version).

The result showed that LCflux and LC$\chi$ values have the same trend and show a distinctive seasonal pattern (Fig. 2a-b), with the maximum in autumn (92.4 %, 92.3%), followed by winter (90.8 %, 74.7 %), summer (83.5 %, 71 %), and spring (73.0 %, 53.1%). Both the LCflux and LC$\chi$ are the lowest in spring, implying that distant natural dust input makes a great contribution to atmospheric dustfall during this period.

The LC variation exhibits a similar seasonal pattern with $\chi_{lf}$, but opposite trend to that of dust flux (Fig. 2a-b). This means that dominant anthropogenic magnetic signals were diluted by less magnetic natural dust input. Hence, the local contribution is reduced as
a result of increasing natural dust flux in spring (see Fig. 2a-b, Lines13-21 in Page 11 in the revised version).

Minor points:
1. Figure 1: Insert a scale bar in a road-map.
Reply: We inserted a scale bar in the top left corner of road-map in Fig. 3b.
2. Page 3, line 6: Check the reference (Maher et al., 1988)
Reply: We checked the reference and deleted it.
Reply: We added description on sampling time. The sample of fly ashes were taken from dust bag of electrostatic precipitators at the Baqiao thermal power plant (see Lines 16-21 in Page 4 in the revised version).
4. Page 6, lines 10 and 11: Why \( \chi_{lf} \) indicates different mineralogy?
Reply: We corrected this sentence to “The different distribution patterns of \( \chi_{lf} \) indicate that the assemblage of magnetic minerals in the NCD and TD may different from those in the MG and TP” (see Lines 18-19 in Page 7 in the revised version).
5. Page 6, line 15: Difference in mean \( \chi_{fd} \) values of 6.9%, 5.1%, 4.6%, and 2.5% have any scientific meaning?
Reply: \( \chi_{fd} \) is sensitive to the superparamagnetic (SP) component. There are virtually no SP grains when \( \chi_{fd} \) is < 2 %, while a mixture of SP and coarser grains is indicated with \( \chi_{fd} \) in the range of 2-10% (Dearing et al. 1994) (see Lines 9-11 in Page 7).
6. Page 7, line 13: Is that platinum or carbon coat for SEM observation?
Reply: Samples were mounted on SEM stub with the double-sided carbon tape and then coated with thin gold film (see Lines 4-5 in Page 6).


Please also note the supplement to this comment:
https://www.atmos-chem-phys-discuss.net/acp-2018-452/acp-2018-452-AC2-supplement.pdf
Fig. 1. $\chi$-T heating (red line) and cooling (blue line) curves (a-f) and magnetic hysteresis loops (g-l) of representative samples.

Fig. 2. The estimated local anthropogenic contributions by dust flux (a) and $\chi_{lf}$ (b).
Fig. 3. Locations of natural surface sediments (NSS) in the East Asian sources (a) and urban dust samples in Xi’an (b).