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Atmospheric Chemistry and Physics Discussions

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 signitures. Because χlf and χfd 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).

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Discussion paper

2. Such a qualitative result may be estimated only by dustflux ratio without χlf 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 χlf in different sources. This indicates that the high χlf 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 χlf ($25\times10-8$ m3 kg-1) of the surface sediments and local street dust ($550\times$10-8 m3 kg-1). On this basis, we calculated the LCχ (see Fig. 2b, Lines 3-12 in 11 Page in the revised version).

The result showed that LCflux and LCχ 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 LCχ 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 χlf, 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.

3. Page 4, line 18: Sampling time? Fitering? Dust bag? Not enough information for sampling.

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 χlf indicates different mineralogy?

Reply: We corrected this sentence to "The different distribution patterns of χlf 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 χfd values of 6.9%, 5.1%, 4.6%, and 2.5% have any scientific meaning?

Reply: χfd is sensitive to the superparamagnetic (SP) component. There are virtually no SP grains when χfd is < 2 %, while a mixture of SP and coarser grains is indicated with χfd 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).

Dearing, J. A.: Environmental Magnetic Susceptibility, Chi Publishing, Kenilworth, UK, 1994.

Härdle, W., Steiger, W.: Algorithm AS 296: Optimal median smoothing, Journal of the Royal Statistical Society. Series C (Applied Statistics)., 44, 258-264, 1995.

Marron, J. S.: What does Optimal Bandwidth Selection Mean for Nonparametric Regression Estimation?, Department of Statistics, University of North Carolina at Chapel Hill, 1986.

Mudelsee, M.:Short note: CLIM-X-DETECT: A Fortran 90 program for robust detection of extremes against a time-dependent background in climate records, Computers & Geosciences., 32, 141-144, https://doi.org/10.1016/j.cageo.2005.05.010, 2006.

Zheng, Z. G., Yang, Y.:Cross-validation and median criterion, Statistica Sinica., 8 , 907–921, 1998.

Please also note the supplement to this comment:
https://www.atmos-chem-phys-discuss.net/acp-2018-452/acp-2018-452-AC2-supplement.pdf

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Interactive comment on Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2018-452, 2018.

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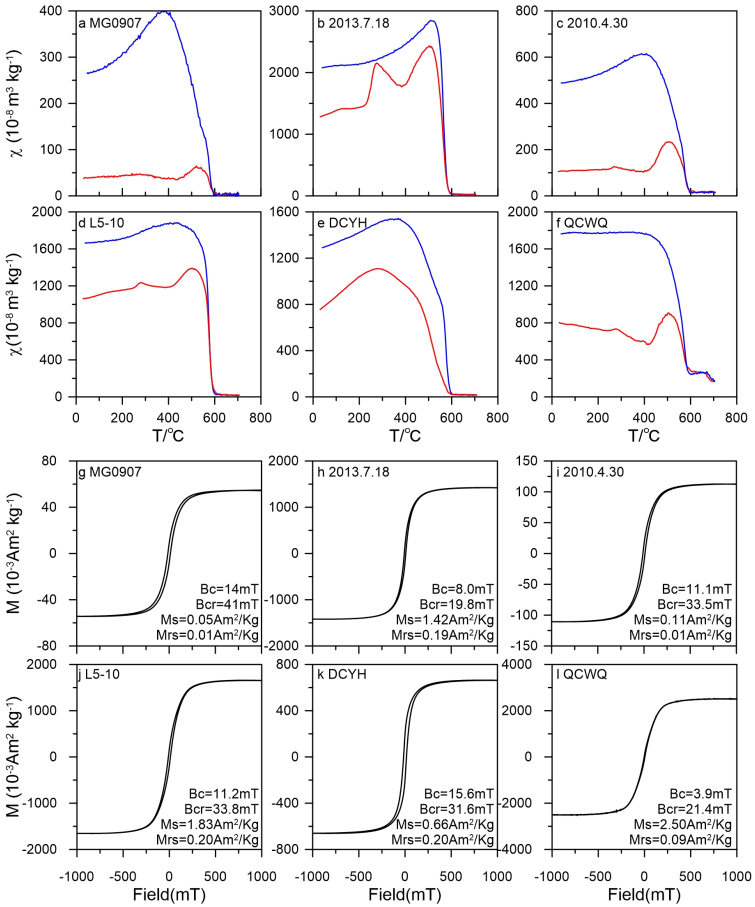

Fig. 1. χ-T heating (red line) and cooling (blue line) curves (a-f) and magnetic hysteresis loops (g-l) of representative samples.

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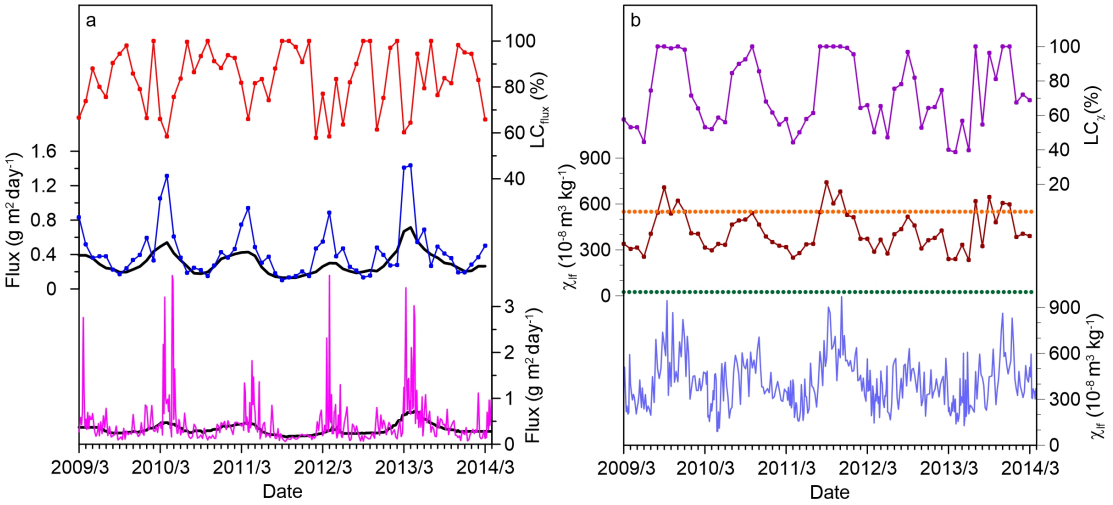

Fig. 2. The estimated local anthropogenic contributions by dust flux (a) and χlf (b).

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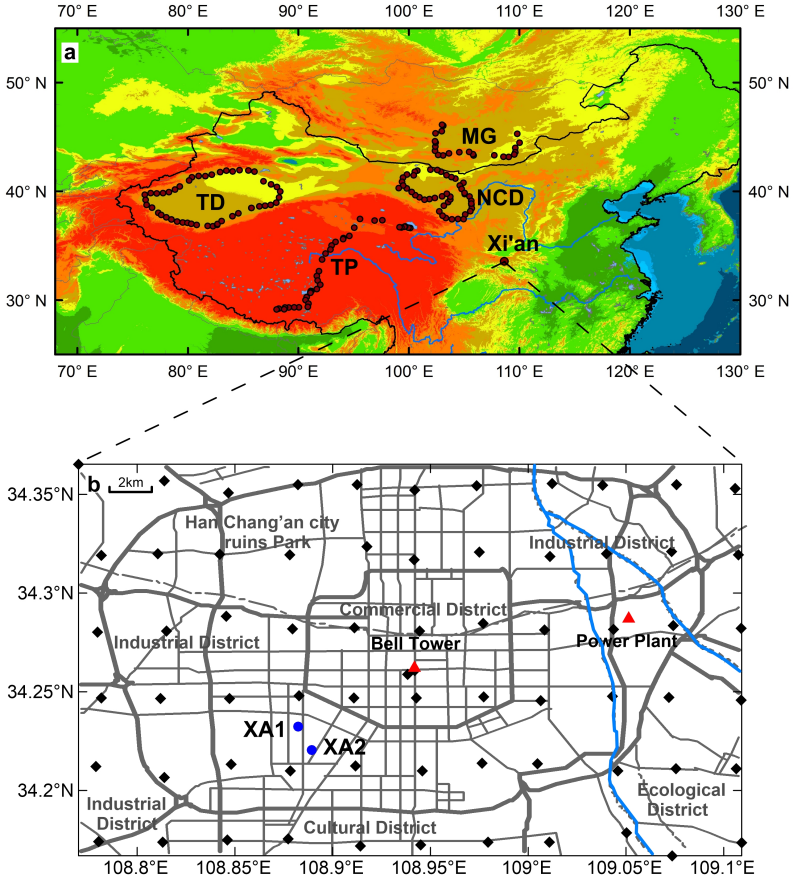

Fig. 3. Locations of natural surface sediments (NSS) in the East Asian sources (a) and urban dust samples in Xi'an (b).