

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 χ_{lf} and χ_{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).

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2. Such a qualitative result may be estimated only by dustflux ratio without χ_{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 (M_s) of representative samples (Fig.1 h-m) were measured to identify concentration of ferrimagnetic minerals. We found that the averaged values of M_s 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 χ_{lf} in different sources. This indicates that the high χ_{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 χ_{lf} (25×10^{-8} m³ kg⁻¹) of the surface sediments and local street dust (550×10^{-8} m³ kg⁻¹). On this basis, we calculated the LC χ (see Fig. 2b, Lines 3-12 in 11 Page in the revised version).

The result showed that LCflux and LC χ 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 χ 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 χ_{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

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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? Filtering? 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 χ_{fd} indicates different mineralogy?

Reply: We corrected this sentence to “The different distribution patterns of χ_{fd} indicate that the assemblage of magnetic minerals in the NCD and TD may differ 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 χ_{fd} values of 6.9%, 5.1%, 4.6%, and 2.5% have any scientific meaning?

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

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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>

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

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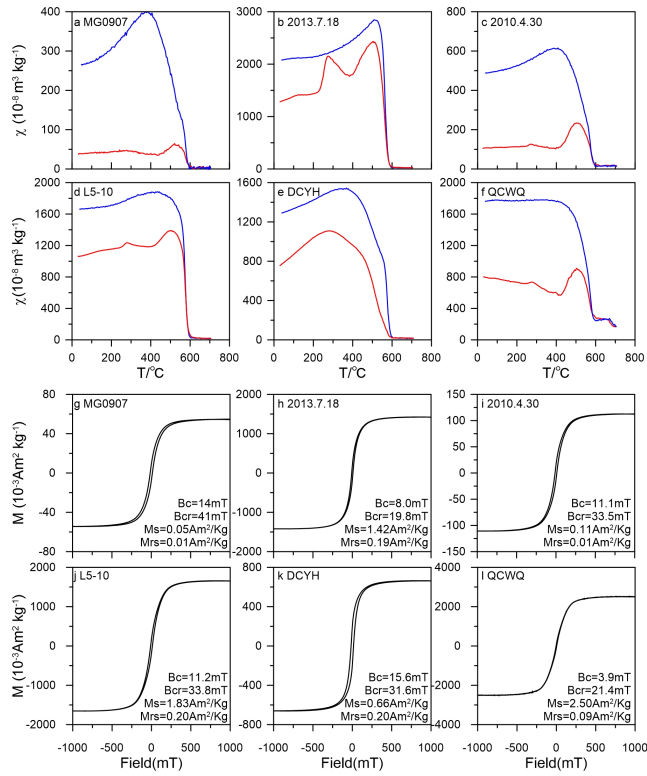


Fig. 1. χ -T heating (red line) and cooling (blue line) curves (a-f) and magnetic hysteresis loops (g-l) of representative samples.

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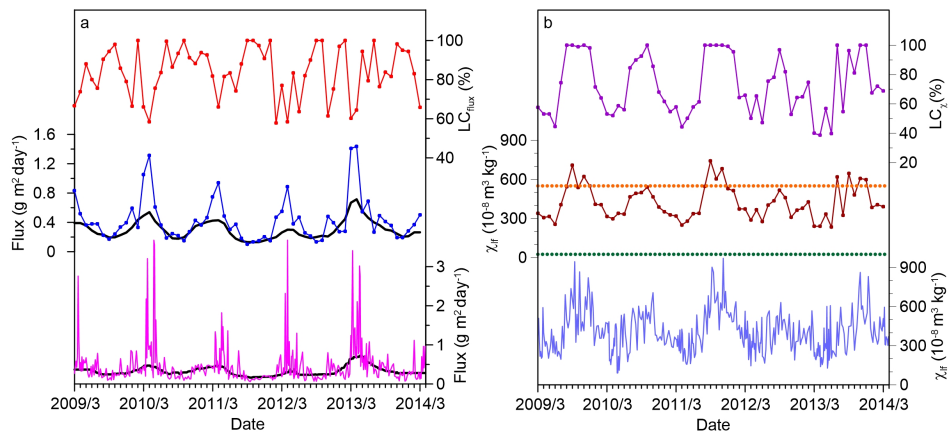


Fig. 2. The estimated local anthropogenic contributions by dust flux (a) and χ_{lf} (b).

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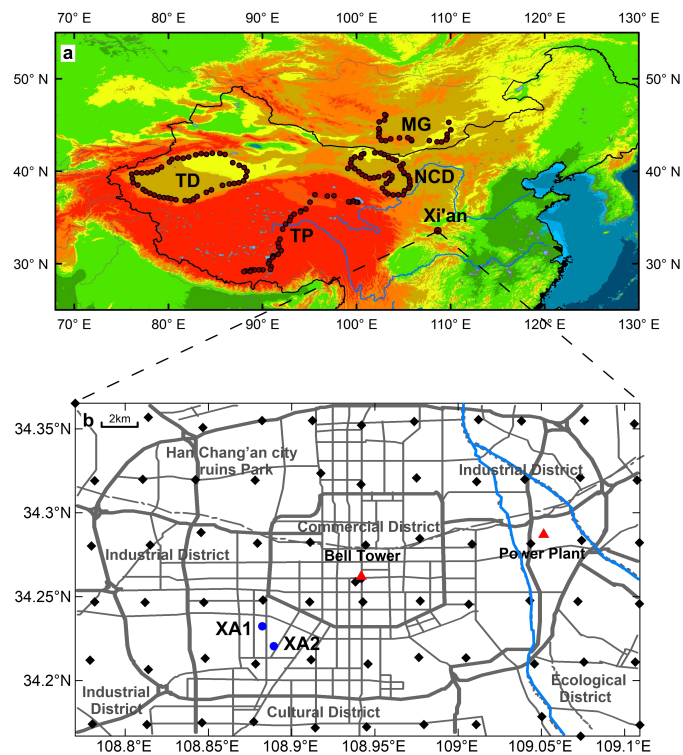


Fig. 3. Locations of natural surface sediments (NSS) in the East Asian sources (a) and urban dust samples in Xi'an (b).