

Interactive comment on “Contribution of residential wood combustion to hourly winter aerosol in Northern Sweden determined by positive matrix factorization” by P. Krecl et al.

P. Krecl et al.

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We thank anonymous referee # 1 for all comments and suggestions that helped to improve the quality of this article. A detailed response to the comments of reviewer # 1 follows below.

1. Introduction/methodology, page 5729, line 5. This is the third paper in a series of 4 papers presenting results from the measurement campaign carried out in Lycksele in winter 2005/2006. The description of the household wood-burning appliances in the residential area where the sampling took place was already presented in Krecl et al. (2007a). In Krecl et al. (2007b), we reported that evening aerosol concentrations were statistically significantly higher during weekends than on weekdays probably caused by

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the use of wood burning for recreational purposes and/or higher space heat demand when inhabitants spend longer time at home.

2. Page 5729, line 18. Term "MLAC". In our study, MLAC stands for light-absorbing carbon (LAC) mass concentrations. The reviewer is right pointing out that the term "black carbon" has been widely used in the literature. However, some recent works (e.g. Kirchstetter et al., 2004; Hoffer et al., 2006) show that certain organic compounds in addition to black carbon could also contribute to light absorption. As suggested by Andreae and Gelencsér (2006), we adopted the term LAC to also include the so-called "brown carbon" which could contribute significantly to light absorption in the ultraviolet and visible spectral regions especially in areas strongly polluted by biomass burning.

3. Page 5729, line 19. References to Krecl et al. 2007a,b. The references to Krecl et al. (2007a) and Krecl et al. (2007b) are already included in the reference list. The first work is already published in Atmos. Environ. and the second one is in press and the corrected proof is available online on the Atmos. Environ. website since 20 January 2008.

4. Page 5739, line 5. Assumption of spherical particles. The differential mobility particle sizer (DMPS) is a powerful tool to carry out on-line measurements of submicron particle number size distributions. A DMPS system consists of a particle charger, a differential mobility analyzer (DMA) followed by a condensation particle counter (CPC). The DMA classifies the aerosol particles according to their electrical mobility. In our study, we assumed that the particles are spherical in relation to the DMPS measurements in two occasions. First, aerosol particles are assumed to behave like if they were spherical to calculate their size as a function of the electrical mobility. If one knows that the sampled aerosol contains only certain substance with a defined structure (e.g. ammonium sulphate), a particle shape factor can be applied to correct for the assumption of all particles being spheres. However, in an atmospheric sample, particles are coming from different emission sources and could also have undergone different physical

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and chemical transformations. As a result, a variety of particle shapes can be found and largely differ from being spheres. This particle spherical assumption is very seldom reported in the experimental methods but largely applied by the scientific community measuring particle number size distributions with DMPS. Particle volume size distributions can be derived from particle number size distributions by assuming a certain shape for the particles in order to calculate the volume. Then we assumed again that the particles are spheres to estimate the particle volume size distributions from the DMPS particle number size distributions, which is a frequent assumption in this research field (e.g., Kim et al., 2004; Zhou et al., 2004; Glasius et al., 2006). Since the particle shapes were not determined in our case we cannot estimate the error magnitude and not even the sign of the error (i.e. positive or negative).

5. Conclusions: generalization. The topography in the Lycksele area is smooth with a minimum height of ~210 m a.s.l and a maximum height of ~300 m a.s.l. Certainly this topography is not comparable with the Alpine valleys in Switzerland where high emissions (mainly from RWC) are trapped in the narrow valleys during winter as reported by Szidat et al. (2007). In the case of Lycksele, high concentrations of atmospheric pollutants are observed during the winter associated with low wind speeds (mean of 1.7 m s⁻¹) and stable atmosphere (76% of the campaign period) close to the ground which prevents the vertical dispersion of the pollutants (Krecl et al., 2007b). The methodology we applied in Lycksele to obtain the atmospheric aerosol source apportionment (i.e. PMF on particle number size distributions) could be applied to other cities/towns where since particle number size distribution emissions of vehicle exhaust and RWC are well separated and have distinctive characteristics. The text has been modified in the conclusions section accordingly: Hence, this methodology could be applied to other urban sites where RWC is a substantial source of aerosol particles and particle size distribution emissions of vehicle exhaust and RWC present characteristic modes and shapes that can be separated and identified by PMF.

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