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Geochemical perspectives from a new aerosol chemical mass closure

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Abstract. The aerosol chemical mass closure is revisited and a simple and inexpensive methodology is proposed. This methodology relies on data obtained for aerosol mass, and concentration of the major ions and the two main carbon components, the organic carbon (OC) and the black carbon (BC). Atmospheric particles are separated into coarse (AD>2 μm) and fine (AD<2 μm) fractions and are treated separately. For the coarse fraction the carbonaceous component is minor and assumption is made for the conversion factor *k* of OC-to-POM (Particulate Organic Matter) which is fixed to the value of 1.8 accounting for secondary species. The coarse soluble calcium is shown to display a correlation (regression coefficient *f*, y axis intercept *b*) with the missing mass. Conversely, the fine fraction is dominated by organic species and assumption is made for dust which is assumed to have the same *f* factor as the coarse mode dust. The fine mode mass obtained from chemical analyses is then adjusted to the actual weighed mass by tuning the *k* conversion factor. The *k* coefficient is kept different in the two modes due to the expected different origins of the organic particles. Using the f and k coefficient obtained from the data set, the mass closure is reached for each individual sample with an undetermined fraction less than 10%. The procedure has been applied to different urban and peri-urban environments in Europe and in Beijing and its efficiency and uncertainties on *f* and *k* values are discussed. The *f* and *k* coefficients are shown to offer consistent geochemical indications on aerosol origin and transformations. *f* allows to retrieve dust mass and its value accounting for Ca abundance in dust at the site of investigation may serve as an indicator of dust origin and aerosol interactions with anthropogenic acids. *f* values were found to vary in the 0.08–0.12 range in European urban areas, and a broader range in Beijing (0.01–0.16). As expected, *k* appears to be a relevant proxy for particle origin and ageing and varies in the 1.4–1.8 range. For Beijing, *k* exhibits high values of about 1.7 in winter and summer. Winter values suggest that fresh coal aerosol might be responsible for such a high *k* value, which was not taken into account in previous works.

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