Geophysical Research Abstracts
Vol. 12, EGU2010-2876-1, 2010
EGU General Assembly 2010

A long term source apportionment study of wood burning and traffic aerosols for three measurement sites in Switzerland

Hanna Herich, Christoph Hüglin, and Brigitte Buchmann
EMPA, Laboratory for Air Pollution and Environmental Technology, Duebendorf, Switzerland (hanna.herich@empa.ch)

Besides their effects on radiative forcing soot aerosols have been found to cause health effects as they are carcinogenic. Diesel engines and incomplete biomass burning are the major emission sources of soot particles. Especially during winter, the wood burning (WB) emissions from residential heating have been found to contribute significantly to the total carbonaceous material (CM). To investigate the contribution of fossil fuel (FF) and WB emissions seven-wavelength aethalometers have been deployed in previous studies (Sandradewi et al. 2008, Favez et al. 2009). In these studies, the stronger light absorption of WB aerosols in the blue and ultraviolet compared to the light absorption of aerosols from FF combustion was used. Linear regression modelling of CM against the light absorption coefficient of FF combustion aerosols in the infrared (950 nm) and the light absorption coefficient of WB aerosols in the blue (470 nm) was proposed for source apportionment.
In this study we present long term aethalometer measurements at two rural and one urban background measurement stations in Switzerland from 2008 - 2010. At these stations organic (OC) and elemental carbon (EC) were also measured by thermochemical analysis providing estimates for total CM. Above described linear regession modelling was applied for determination of the contribution of FF and WB emissions to total CM. Sensitivity tests for different regression models and for varying light absorption exponents were performed. It was found that the regression modelling approach is only limited suitable for long term datasets because of significant fractions of CM resulting from sources and processes other than FF and WB. Thus in a different approach we focused on black carbon (BC). The contribution of WB and FF to BC was directly determined from the absorption coefficients of FF and WB aerosols which were calculated with the use of absorption exponents taken from literature. First results show that in winter the contribution of wood smoke emissions to BC is ca. 23% at rural stations, during summer, the contribution of WB aerosols to BC is negligible. The obtained WB contributions to BC correlate well with measured concentrations of levoglucosan, a finding that supports this approach.

References

J. Sandradewi, A.S.H. Prevot, S. Szidat, N. Perron, R. M. Alfarra, V. Lanz, E. Weingartner and U. Baltensperger. Using aerosol light absorption measurements for the quantitative determination of wood burning and traffic emission contributions to particulate matter. Environmental Science & Technology, 42, 2008.

O. Favez, H. Cachier, J. Sciare, R. Sarda-Estève, and L. Martinon. Evidence for a significant contribution of wood burning aerosols to PM2.5 during the winter season in Paris, France. Atmospheric Environment, 43(22-23):3640-3644, 2009.