Impact of wood burning on local scale pollution in a rural residential area

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Keywords: wood burning, Aethalometer, levoglucosan, PAH, aldehydes
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Wood burning can have a large impact on air quality and health as it is related to emissions of PM, BC, organic compounds and more specific also carcinogens such as PAHs. In addition, wood burning is sometimes related to nuisance in residential areas such as complaints about odor, irritated eyes. Irritation reactions caused by wood burning are often linked to aldehyde emissions.
Wood burning is very popular in wintertime, when weather is often characterized by stable atmospheric conditions. As a result, small local emissions can result in significant contributions to local BC and PM concentrations. In this study we will assess the impact of wood burning on local scale pollution.

The monitoring campaign was performed in a village residential area (Dessel) from 3/12/15 until 1/2/16. The sampling took place at three sites in the study area (located within a distance of 300m) and at one background location. The background site is located at our institute (rural background without known wood burning sources nearby) and situated about 2 km south-east of the study area.

PM_{10} mass concentration measurements were performed using sequential filter samplers (2,3 L/h, Leckel). Daily samples were collected on quartz fibre filters (Tissuequartz, Pall). Selected filters are subsequently analyzed for EC/OC, levoglucosan (mannosan and galactosan) and PAH's.

BC was measured using a dual spot seven wavelength Aethalometer (Magee Scientific AE33, λ=370, 470, 520, 590, 660, 880 and 950 nm) at 1 min time resolution. The Aethalometer method was used to estimate the contribution of wood burning to PM, based on difference in absorption characteristics between fossil fuel and wood burning (Sandradewi et al., 2008). We used Angström exponents $\alpha_{FF = 1}$ and α_{WB} = 2 for fossil fuel (traffic) and wood burning respectively.

Aldehydes (acroleïne and formaldehyde) are measured with diffusive samplers (UMEx1000) using 1 week integrated sampling time. SIFT-MS (Selected Ion Flow Tube-Mass Spectrometry) is used to study the temporal profile of aldehydes.

In addition to the environmental monitoring, a short questionnaire was performed in the area to assess the amount of wood burning, type of stoves and type of wood that is used.

The response rate of the questionnaire was 67%. Of all respondents, 42% uses wood as secondary heating. In most cases they have cassette or stoves and use wood logs as fuel. Most people (58%) observe wood burning in the cold season. However, only 9 % describe the odor as annoying.

Some preliminary results are given below. Table 1 shows average PM_{10} and BC concentrations at different locations in the study area (A, B, C) and background (E). It also shows average biomass contribution to BC (%BB) as calculated by the instrument (based on absorption at 470 and 950 nm).

Table 1. Average PM_{10} and BC concentrations (µg/m^3) and % biomass burning (%BB) at different locations in the study area (A, B, C) and background (E).

	A	B	C	E
PM_{10}	17,5	18,6	18,7	15,7
BC (880)	1,51	2,15	1,64	1,21
%BB	27	24	28	29

Average concentrations of PM_{10} and BC were relatively low due to favorable meteorological conditions. However, a few days with higher concentrations (>50 µg/m^3) were observed. Lowest concentrations were measured at background location (E) and spatial differences are observed in the study area. The calculated % BB was higher at the background location. However, the resulting absolute amount of BC from wood burning is lower (0,35 µg/m^3) at background location compared to the study area (0,42 – 0,53 µg/m^3).

This paper will further discuss the temporal and spatial variation of biomass burning and related pollutants (EC/OC, PAH, aldehydes, BC, PM). The two methodologies to assess the contribution of wood burning (tracer method and Aethalometer approach) will be compared.

Acknowledgement: This work was supported by the Flemish Environment Agency.

Sandradewi et al. (2008). *Environ. Sci. Technol.*, **42**, 3316–3323.