

Study of BC sources in a closed alpine valley in France: seasonal variations and specificities of biomass burning impacts

B. Golly¹, C. Piot¹, J.-L. Besombes¹, J.-L. Jaffrezo² and G. Brulfert³

¹Université de Savoie-LCME, Le Bourget du Lac, France

²Université Grenoble 1-CNRS, LGGE, France

³Air-RA, Bron, France

Keywords: black carbon, seasonality, biomass burning, source apportionment, alpine valley

Presenting author email: benjamin.golly@univ-savoie.fr

Alpine valleys are exposed to high PM levels mainly in winter when specific topographic and meteorological conditions lead to pollutant accumulation. PM in alpine valleys is emitted to a large extent by residential heating, particularly biomass burning. Biomass burning was found to account for 42% of PM mass in Grenoble during winter (Favez et al., 2010) and for 41% of the organic aerosol (OA) mass in Zurich (Szidat et al., 2006). Vehicular emissions can also be an important source of aerosols in Alpine valleys that are important crossroads of traffic (Marchand et al., 2004). PM from these two sources contained a large part of carbonaceous matter like Black Carbon (BC) or carcinogenic compounds like Polycyclic Aromatic Hydrocarbons (PAH).

BC is emitted by incomplete combustion of organic matter such as fossil fuels and various types of biomass burning. BC has several optical properties like absorbing the sunlight, and it plays an important role in climate forcing by changing the Earth radiation budget. Several devices are used for measuring BC concentrations in atmosphere (MAAP, Aethalometer, PSAP...). One of the most common device used is the Aethalometer AE-31, which has the advantage of measuring the aerosol light absorption at 7 wavelengths allowing source apportionment of BC. This apportionment is based on the difference of absorption of BC according to its emission sources.

A monitoring program in Lanslebourg was proposed for 2 years (summer 2012 to summer 2014). Lanslebourg is a rural village located in a steep Alpine valley in France (Maurienne valley on the border with Italy). This site is known to be largely impacted by biomass burning emissions in winter (Piot, 2011) contributing to 58% of PM₁₀ on average. Aethalometer measurements are used for source apportionment of BC during the modernization of wood burning appliances in order to reduce the emissions of pollutants. In addition intensive field campaigns of 15 days are conducted at different seasons with off-line sampling of PM on quartz fiber filters. A detailed chemical characterization is conducted on these samples allowing the determination of the global composition of PM and a large organic speciation. Source apportionment models are applied on these data and results are compared to results from the Aethalometer model.

The first results show high concentrations of BC ranging from 0.2 to 0.5 $\mu\text{g}\cdot\text{m}^{-3}$ in summer and 0.5 to 10 $\mu\text{g}\cdot\text{m}^{-3}$ in winter, with contributions up to 63% from

biomass burning. Figure 1 represents the daily variations of BC concentrations in July and November 2012. Daily evolutions are very different with a peak of concentrations at the end of the day in winter due to the increase of residential heating emissions.

This comparison between the two seasons will assess the interest for long-term monitoring of BC in order to manage the air quality in Alpine sites strongly impacted by biomass burning.

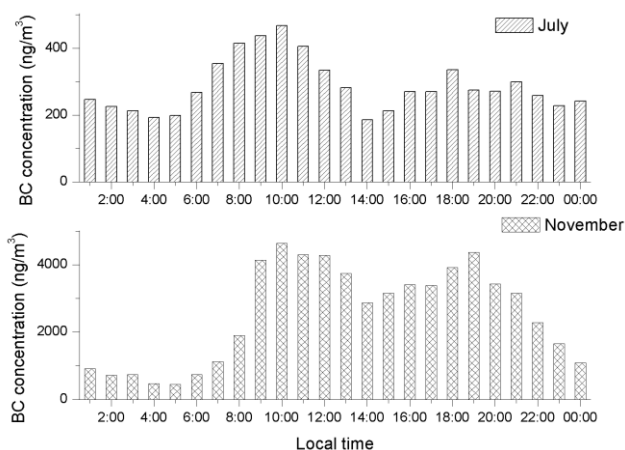


Figure 1. Average daily variations of BC concentrations in July and November 2012 in Lanslebourg (France).

Lanslebourg program was funded by ADEME. Authors thank staff from AIR-RA for their help during campaigns.

Favez, O., El Haddad, I., Piot, C., Boréave, A., Abidi, E., Marchand, N., Jaffrezo, J.-L., Besombes, J.-L., Personnaz, M.-B., Sciare, J., Wortham, H., George, C. and D'Anna, B. (2010) *Atmos. Chem. Phys.* **10**, 5295-5314.

Marchand, N., Besombes, J.-L., Chevron, N., Masclat, P., Aymoz, G. and Jaffrezo, J.-L. (2004) *Atmos. Chem. Phys.* **4**, 1167-1181.

Piot, C. (2011). Thesis of the University of Grenoble (France), 294 pp.

Szidat, S., Jenk, T.M., Synal, H.A., Kalberer, M., Wacker, L., Hajdas, I., Kasper-Giebl, A. and Baltensperger, U. (2006) *J. Geophys. Res.* **111**, D07206.