

## The contribution of biomass burning to PM: a comparison between an Alpine valley and the Po Valley

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Levels of PM<sub>10</sub> exceed limit values not only in the densely populated and industrialized Po Valley but also in the nearby Alpine valleys. In addition, annual means of benzo(a)pyrene in the valley floor in the southern Alps are higher than those observed in the adjacent Po Valley and exceed the target value set by EU Directive 2004/107/EC.

In a recent study, it has been observed that despite the very small differences in winter concentrations of PM from different sites of the valley floor (kerbside, urban background and rural background), levels of this pollutant decrease significantly with height (Belis et al., 2008). These authors indicated that the orography and the meteorology of the cited Alpine area strongly contribute to the accumulation of local emissions in the air layer influenced by the winter ground level thermal inversion.

According to the emission inventory of the Lombardy Region the main sources of primary PM<sub>10</sub> in the Alpine city of Sondrio are biomass burning (42%) and transport (36%) compared to 10% and 64% respectively of primary PM<sub>10</sub> in the city of Milan.

In order to check these estimations source apportionment has been carried out with the receptor model CMB 8.2 using the concentration of 20 elements in PM<sub>10</sub> measured in a three years survey (2004 – 2007). In addition to the source profiles available in literature, local source profiles were obtained for soil, biomass burning, brakes, tyres, etc. (Colombi et al., 2008). The results indicate that in the Alpine city 25% of PM<sub>10</sub> derives on average from biomass burning while the contribution of this source in the city of Milan is <10%. The contribution from biomass burning is relevant also in areas where carpentry is the main economic activity.

The concentrations of levoglucosan, a chemical marker for biomass burning (Simoneit et al., 1999), measured between 2005 and 2007 in 4 sites distributed across the Po Valley and the Alpine area strongly support the hypothesis of a higher contribution of this source to the PM in the Alpine valley floors. In Sondrio, biomass burning contributes to 20-45% of EC and to 40-55% of OC (Piazzalunga et al., 2008).

Similar indications come from the comparison of K levels in 11 sites from different areas (rural, urban and suburban) between the Po Valley, and the southern slope of the Alps. However, interpretation of K as tracer of wood smoke is not straightforward since its emission factor varies with the temperature of combustion and since the uptake from the soils into roots is also subject to variability (Hays et al., 2005).

In the Alpine valley floor the winter concentration of 6 PAH with 5 - 6 rings (benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, benzo(g,h,i)perylene, indeno(1,2,3-c,d)pyrene, and dibenzo(a,h)anthracene) in a kerbside site is 25% lower than that in the background sites (rural and urban) while levels of these compounds above the inversion layer fall to 20% of those observed in the valley floor.

Moreover, it has been observed in three short term winter campaigns carried out between 2005 and 2007 contemporaneously in Sondrio and Milan that concentrations of benzo(a)pyrene presented a significant correlation with those of levoglucosan ( $R^2=0.89$ ) in both sites.

These results point to biomass burning as an important source of PAH to the urban PM in both the Alpine and the Po Valley areas.

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