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Polycyclic aromatic hydrocarbons (PAHs) in the atmospheres of two French alpine valleys: sources and temporal patterns

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Abstract. Alpine valleys represent some of the most important crossroads for international heavy-duty traffic in Europe, but the full impact of this traffic on air quality is not known due to a lack of data concerning these complex systems. As part of the program "Pollution des Vallées Alpines" (POVA), we performed two sampling surveys of polycyclic aromatic hydrocarbons (PAHs) in two sensitive valleys: the Chamonix and Maurienne Valleys, between France and Italy. Sampling campaigns were performed during the summer of 2000 and the winter of 2001, with both periods taking place during the closure of the "Tunnel du Mont-Blanc". The first objective of this paper is to describe the relations between PAH concentrations, external parameters (sampling site localization, meteorological parameters, sources), and aerosol characteristics, including its carbonaceous fraction (OC and EC). The second objective is to study the capacity of PAH profiles to accurately distinguish the different emission sources. Temporal evolution of the relative concentration of an individual PAH (CHR) and the PAH groups BghiP+COR and BbF+BkF is studied in order to differentiate wood combustion, gasoline, and diesel emissions, respectively. The results show that the total particulate PAH concentrations were higher in the Chamonix valley during both seasons, despite the cessation of international traffic. Seasonal cycles, with higher concentrations in winter, are also stronger in this valley. During winter, particulate PAH concentration can reach very high levels (up to 155 ng.m^{-3}) in this valley during cold anticyclonic periods. The examination of sources shows the impact during summer of heavy-duty traffic in the Maurienne valley and of gasoline vehicles in the Chamonix valley. During winter, Chamonix is characterized by the strong influence of wood combustion in residential fireplaces, even if the temporal evolution of specific PAH ratios are difficult to interpret. Information on sources given by PAH profiles can only be considered in qualitative terms.

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