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# Differences in composition of above and below legal limit PM10 at two contrasting sites in the city of Oporto, Portugal.

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Particulate matter, either with aerodynamical diameter below 10 $\mu$m ($PM_{10}$) or the fine (aerodynamical diameter below 2.5 $\mu$m, $PM_{2.5}$) or coarse (aerodynamical diameter between 2.5 and 10 $\mu$m, $PM_{2.5-10}$) modes only, are presently regarded as one of the main threats to public health instigated by air pollution. The levels of ambient air particulates are regulated but the limits are frequently surpassed. It is therefore necessary to identify and quantify PM sources and their variability, as well as the biogenic processes that to some extent control their ambient load, in order to effectively regulate on the anthropogenic activities which originate PM.

$PM_{2.5-10}$ and $PM_{2.5}$ were monitored in Oporto, NW Portugal, at two contrasting sites (directly impacted by traffic, roadside, and at the urban background) during two one-month campaigns (winter and summer). Sampling was conducted independently during daytime and night-time. Out of the 207 sampling periods analysed, 38 (18%) were above the European legal $PM_{10}$ limit of 50 $\mu$g m$^{-3}$. $PM_{2.5}$ concentrations above the limit of 25 $\mu$g m$^{-3}$ proposed by the EC occurred in 70 out of 202 sampling (35%). More exceedances occurred in winter than in summer and at roadside than at the urban background. Within the scope of this work, the relationship between PM concentrations, namely the occurrence of exceeding PM limit values, and meteorological variables or the sampling period (day/night, work day/weekend) and will be presented.

Besides PM mass, the soluble ionic composition ($Cl^-$, $SO_4^{2-}$, $NO_3^-$, $Na^+$, $NH_4^+$, $K^+$, $Ca^{2+}$ and $Mg^{2+}$) as well as the elemental composition (Al, Si, S, Cl, K, Ca, Ti, V, Cr, Mn, Fe, Ni, Cu, Zn, Ga, As, Se, Br, Rb, Sr, Zr, Sn, Ba and Pb) were also determined. This allowed the application of multivariate analysis (principal component analysis with multi-linear regression analysis, PCA-MLRA, and positive matrix factorisation, PMF). Five main sources were identified in the fine and coarse modes (direct road traffic emissions, industrial activities related with refuse incineration or metallurgy, soil dust emissions, sea salt and fuel oil combustion coupled to secondary formation). The contribution of the various sources or source types to the PM load was calculated. A comparison between the relative contribution of the various sources or source types during exceeding and non-exceeding periods is conducted in order to assess if the exceeding periods may be attributed to a particular origin. Also, the concentration and relative contribution to total PM mass of the various PM constituents measured during exceedance and non-exceedance episodes is compared in order to assess their variability between the two types of events.