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Partitioning of PM_{10}-$PM_{2.5}$-PM_1 at an urban site in the western Mediterranean: trends in PM levels and composition

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Real time PM level measurements have been carried out at an urban site in the Western Mediterranean (Barcelona, north-eastern Spain) from 1999 to 2007. PM data have been obtained by means of a laser spectrometer, being the measurements corrected with the factors obtained by comparison with the gravimetric data. Furthermore, 24-hour PM_{10}, $PM_{2.5}$ and PM_1 (only from 2005) samples have been collected (two per week during the whole period). These samples have been analyzed in order to determine the concentrations of about 60 inorganic species (mineral components, secondary inorganic compounds and trace metals), and also organic and elemental carbon.

Mean levels of PM_{10}, $PM_{2.5}$ and PM_1 reach 41, 28 and 20 $\mu g/m^3$ respectively, with slight variations from 1999-2007 (39-42, 25-29, 18-21 $\mu g/m^3$, respectively). When compared with other European urban areas, these levels can be considered as relatively high, with the exception of other Mediterranean cities. Inter-annual variations have been detected in the $PM_{2.5}$ and PM_1 fractions, with a clear increasing trend. No tendency was found in PM_{10}. The correlation between mean annual PM_1 levels and the diesel fleet allows us to attribute this increasing trend to the progressive increase and dieselization of the vehicle fleet.

PM composition varied substantially between PM_{10} and PM_1. The PM_{10} fraction is mainly composed by mineral matter (32%), secondary inorganic aerosols (26%) and carbonaceous compounds (22%), with little contribution of sea spray (5%) in spite of the coastal location of the city. The PM_1 fraction is mainly composed of carbonaceous

aerosols (45%) and secondary inorganic species (31%), with very low proportion of mineral matter (5%) and sea spray (<1%). The $PM_{2.5}$ fraction composition is similar to the PM_{10} composition. The unaccounted fraction varied from 15-18% in all the fractions. The temporal variability of the chemical components shows that the $PM_{2.5}$ and PM_1 increment is caused by the carbonaceous aerosols, which show a clear increasing trend.

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