

The impact of harbour activities on the air quality of the city of Genoa: source apportionment and simulation by dispersion models

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In the framework of local and international projects, the Department of Physics of the University of Genoa is involved in the evaluation of the impact of on the urban air quality. Among the others, the Programme MED APICE project (<http://www.apice-project.eu/>) aims at the evaluation of the impact of harbor activities on urban air quality and the definition of strategies to reduce air pollution in port cities. In this frame, the year 2011 was devoted to monitoring campaigns, in particular addressing the Particulate Matter (PM) levels, composition and sources, in the five cities joining the project (Barcelona, Genoa, Marseille, Thessaloniki and Venice).

The monitoring activities were addressed to the source apportionment in each study area and to the set-up of numerical tools able to reproduce the experimental results. In Genoa, this turned out in a PM2.5 sampling campaign with daily samples collected in three sites for a 6-month period (May-October 2011). Subsequent compositional analyses (anions, cations, metals, EC/OC) produced a large database for a receptor model analysis through Positive Matrix Factorization (Paatero, 1994) and the comparison with numerical dispersion models. PM2.5 samples were collected on daily basis and in the same period in three sites in the urban area of Genoa (namely: Bolzaneto, C.so Firenze and Multedo) selected considering the direction of prevailing wind. Also, a meteorological and air quality modelling system was implemented, based on the mesoscale NWP model WRF (Skamarock 2008) and the Eulerian CTM CAMx (ENVIRON 2010) Through subsequent nestings, meteorological and pollutant concentration fields are obtained up to resolutions of order of 1 km.

A large amount of data has been collected and is now under analysis while simulations are running in order to get results over the whole monitoring period. Some discussion can be already done about what has been preliminary observed.

Despite of a distance of several kilometers and of the quite complex topography of the area, the time trends of PM2.5 daily concentration values measured in the three sites are very well correlated and have the same mean value over the six month period of sampling (see Figure 1). Interesting results has been obtained by analysing the correlation between the concentration values of V and Ni, typical tracers of heavy oil combustion and therefore of ship emissions, which have shown the same average ratio in the three monitoring sites, consistent with values previously observed in the

urban area of Genoa (Mazzei *et al.*, 2008 and references therein).

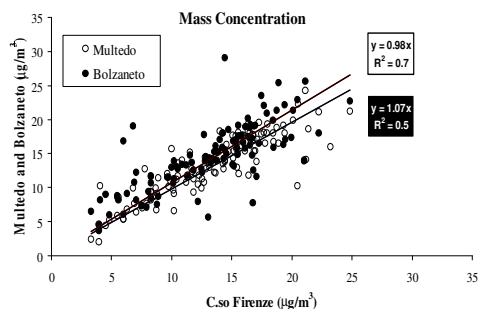


Figure 1. Correlation study among the PM2.5 data sets for the three sites in Genoa

The effect of transport phenomenon has been clearly evidenced by the comparison of concentration values observed in the two near-harbour sites (Multedo and C.so Firenze) with respect to Bolzaneto, a few km inland. Furthermore, a strong correlation has been observed with wind directions while no correlation turns out between the time series of the concentration of one of the two elements measured in two different sites this suggesting that the dispersion of ships emission from the harbour is driven by meteorological conditions.

The full results of the source apportionment performed with PMF and with the Eulerian models will be given.

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