Characterisation of the aerosol sources in Brindisi (Italy) harbour area within the CESAPO project: an overview of the experimental results

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The harbour areas are economic centres and transport hubs, that bring together different transport modes (sea, road, railway transport) and, often, include relevant industrial activities. Emissions of ships and of harbour-related activities could have potential negative impact on air quality especially for fine and ultrafine atmospheric particles (Contini at al., 2011; Healy et al., 2010).

At the beginning of 2012 it was started the research project CESAPO (Contribution of Emission Sources on the Air quality of the POrt-cities in Greece and Italy), within the framework of Interreg Greece-Italy 2007/2013, having among its objectives the quantification of the contribution to atmospheric particles of emission sources in two important Mediterranean port-cities: Patra (Greece) and Brindisi (Italy) using state-of-the-art modelling and experimental approaches. Here, an overview of the experimental results obtained in Brindisi will be presented. The area studied is influenced by several emissions: an industrial area, three power plants, an airport and an harbour with a freight traffic and total goods movement that accounted for more than 9.5 million tons and over 520,000 passengers in 2011. Experimental activities in CESAPO were based on an intensive observation period (IOP) of 5 months (June-October 2012). During the IOP the data of 10 fixed monitoring stations (the regional network managed by ARPA Puglia) and those from two additional stations specifically installed during the project inside the harbour area were collected. A station was used to characterize the chemical composition of PM2.5 (metals, major water soluble ions and carbon content) and PAHs (in the gaseous and aerosol phases) and the other was devoted to high temporal resolution (1 second) measurements of PM2.5 mass, number concentrations of submicron particles and diurnal spatially integrated gaseous concentrations using a remote sensing DOAS system (Premuda et al., 2011).

Results of source apportionment based on PM2.5 composition, using the Positive Matrix Factorization (EPA PMF3.0), and on high temporal resolution measurements will be presented and compared with other harbour areas in Italy and Europe. Preliminary results indicate that average PM10 and PM2.5 concentrations in the harbour area are smaller than those observed in the urban area but SO_2 concentrations associated to oil combustion and shipping emissions were larger. The secondary non-sea-salt-sulphate was essentially ammonium sulphate and accounted for about 32% of PM2.5. The detailed contributions of ship traffic and of harbour activities (loading/unloading of ships) were analysed using high temporal resolution measurements. The two contributions appear to be of the same order of magnitude and sporadic in nature being due to numerous short concentrations peaks (durations variable between 10 and 100 minutes) in PM2.5 and in the number of sub-micron particles. An example of peaks to due ships is reported in Figure 1. These peaks were analysed using a statistical methodology that takes into account the wind direction and the actual ships traffic to quantitatively characterize the contribution of vessels traffic and of harbour activities.

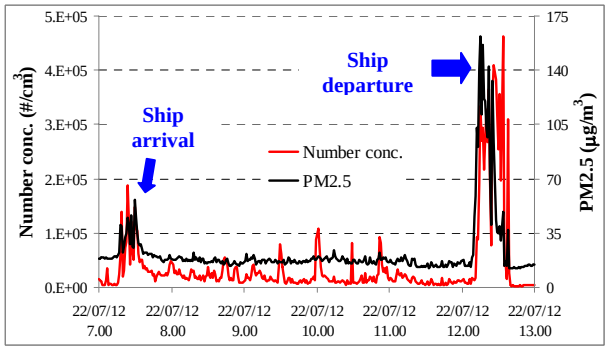

Figure 1. Example of ship emissions contribution to PM2.5 and number particle concentrations.

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