Air quality in a Mediterranean city-port: Particulate matter source apportionment using the WRF-CAMx modeling system

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During the last decades, there has been an increasing urbanization pressure on the Mediterranean port-cities with impacts not only on the economic growth but also on the environment. The main objective of this study is the quantification of the contribution of pollutant emission sources to the air pollution in the city-port of Patras in Greece. More emphasis is given on the contribution of the maritime transport and the activities within the harbor area.

A modeling system is used that consists of the mesoscale meteorological model WRF and the photochemical model CAMx. Source apportionment is performed for the particulate matter (PM). Observational data are also used in order to identify the meteorological conditions that favor the increased PM concentrations.

The modeling system is applied over a 10km resolution grid that covers the Balkan Peninsula and a 2km grid that spans over Patras. Summer and winter simulation periods are examined in order to account for different meteorological conditions in the study area. The chemical boundary conditions are taken from the IFS-MOZART global modeling system.

The emission model MOSESS (Markakis *et al* 2009) has been applied in order to compile a spatially (2km resolution) and temporally resolved inventory for CO, NOx, SO2, NH3, NMVOCs, PM10 and PM2.5 emissions from anthropogenic sources (central heating, industries, road and non-road vehicles etc.) on the basis of the European scale emission inventory for the year 2007 of The Netherlands Organisation (Kuenen *et al* 2011). Emphasis is given on the estimation of pollutant emissions from the various activities inside the area of the harbor (stockpiles, unloading processes, harbor machineries etc) as well as from the maritime transport (cargo, passenger ships etc) on the basis of activity data provided by the Patras Port Authority (Figure 1).

Natural emissions of PM10, PM2.5 and biogenic NMVOCs are calculated employing the NEMO model (Poupkou *et al* 2010). NEMO can quantify hourly emission rates for sea salt, windblown dust and biogenic NMVOCs driven by the meteorology of WRF.

The CAMx model is extended to include the tool Particulate Source Apportioning Technology (PSAT) in order to provide PM source apportionment among specific source categories. The emission sources to be apportioned for Patras are the following:
1) Maritime and Harbor activities, 2) Road traffic, 3) Central heating, 4) Industries, 5) Soil (windblown dust) and 6) Vegetation (biogenic NMVOCs).

PM is a key pollutant in the urban atmosphere of Patras. The work presented will try, with the aid of a high resolution pollutant emission inventory and modeling system, to provide some insight on the issue of PM pollution in Patras (in relation also with the presence of the port) in order to allow the policy makers to develop effective control strategies for the atmospheric pollution.

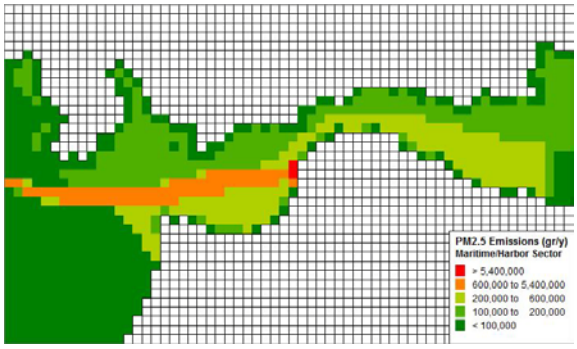

Figure 1. Annual PM2.5 maritime/harbor emissions in the Patras modeling domain.

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