Geophysical Research Abstracts
Vol. 15, EGU2013-2620-2, 2013
EGU General Assembly 2013

The Contribution of Local and Regional Sources to Particulate Matter in European Megacities

Ksakousti Skyllakou (1,2), Athanasios Megaritis (1,2), Christos Fountoukis (2), Benjamin Murphy (3), Spyros Pandis (1,2,3)

(1) University of Patras, Chemical Engineering, Patra, Greece (ksakousti@chemeng.upatras.gr), (2) Institute of Chemical Engineering Sciences (FORTH/ICE-HT), 26504, Patras, Greece, (3) Department of Chemical Engineering, Carnegie Mellon University, Pittsburgh, PA 15213, USA

The ongoing urbanization over the past decade has led to an increasing number of Megacities around the world, now hosting more than half of the world's population (UN 2007). These large urban centers are substantial sources of anthropogenic pollutants having adverse effects on human health, visibility and ecosystems (Seinfeld and Pandis, 2006). In order to improve air quality in those urban areas we need to quantify the fraction of the pollution originating from local and regional sources and to determine the response of the system to emission controls. Three-dimensional chemical transport models (CTMs) are well suited to help address these source receptor questions since they model all the necessary processes that impact air pollution concentrations and transport in the domain.

In this study we applied PMCAMx (Fountoukis et al., 2011) a three dimensional CTM over Europe to study the influence that emissions in large European urban areas (eg. Paris, London, etc.) might have on the concentration of the major PM2.5 components during a summer and a winter period. We combined PMCAMx with the Particulate Source Apportionment Technology (PSAT) (Wagstrom et al., 2011) which directly computes the contribution of different emission areas or source types. The contributions of local, short, medium, and long range transport and different source categories (e.g., transport, fires, etc.) were quantified. Local emission sources are predicted to have a significant effect on primary pollutant levels, like black carbon (BC) while secondary pollutants concentrations are dominated by sources outside the major urban areas.

The PSAT results were compared with those of an "annihilation" scenario zeroing out all anthropogenic emissions over an urban area. The results of these simulations suggest that the two methods show a good agreement with each other, but PSAT is a lot more computationally efficient.

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