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# Contribution of local sources to Megacities air quality

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**Abstract**

The ongoing urbanization over the past decades has led to an increasing number of large urban agglomerations around the world, now hosting more than half of the world's population (UN 2007). These large urban areas with more than 10 million inhabitants, also known as Megacities (Gurjar and Lelieveld 2005) are substantial sources of anthropogenic pollutants having adverse effects on human health, visibility and ecosystems. Development of emissions control strategies to improve Megacities air quality requires quantification of the fraction of the pollution originating from local and regional sources and to determine to which extent Megacities emissions influence the air quality of surrounding areas.

PMCAMx-2008 (Murphy and Pandis, 2009; Fountoukis et al., 2011), a three dimensional chemical transport model (CTM) was applied in Europe, to quantify the influence of emissions in European Megacities (Paris, London, Rhine-Ruhr, PoValley) on the concentration of the major $PM_{2.5}$ components. Different emissions scenarios were applied (e.g. an "annihilation" scenario zeroing all anthropogenic emissions in Megacities), and the impact of Megacities emissions on air quality within Megacities and also their contribution on the air quality in the surrounding regions was investigated. Two simulation periods were used, summer 2009 and winter 2010, to study the seasonal effect of Megacities emissions.

The results show that the impact of the local emissions on the concentration of total $PM_{2.5}$within Megacities is quite variable in space and time. In Po Valley, total $PM_{2.5}$was found to be largely local in both periods (over 50% in summer and more than 60% during winter), while in Paris and Rhine-Ruhr the contribution of local sources is significant mainly during winter. On the contrary, London emissions have a much smaller effect on local $PM_{2.5}$ and long range transport of pollutants dominates.

Megacities emissions are important for local black carbon (BC) levels. In both periods BC is found to originate from local sources in all the Megacities (more than 40%), while in Po Valley local sources accounted for approximately 90% of BC. Sulfate and secondary organics concentrations on the other hand are dominated by sources outside the major urban areas. At the same time, Megacities do not only influence their own air quality, but they also impact areas several hundred kilometres away.

**References**

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