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A photochemical study with a focus on O3/NOY/HOX observations during MEGAPOLI summer campaign in the Greater Paris Area

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At present, a large part of the world's population is living in urban areas. These cities are growing considerably. Human activities in these megacities lead to serious challenges in terms of environmental management such as air quality and its effect on human health.

Within the FP7 MEGAPOLI project, two intensive field campaigns have been conducted in the Greater Paris region during summer 2009 and winter 2010 to evaluate the impact of Megacities on local and regional air quality. The objectives of these campaigns were namely: i) to quantify sources of trace gases and primary and secondary aerosol, in and around the large agglomeration and ii) to document their evolution in the megacity plume. To do so, it has been necessary to perform particulate phase measurements as well as gas phase species but also more generally to carefully describe the photochemical processes in this environment.

Here we focus on the summer campaign results from the SIRTA site, located in the suburb area at 15km south west of Paris. A large set of instruments measuring gas phase species (NO, NO2, PAN, CO, NMHC (C3-C10), HCHO, HONO, O3, OH, RO2) was deployed to investigate photochemistry on this site. In addition, measurements of photolysis frequencies and usual meteorological parameters were carried out.

In this contribution, a study of the oxidative capacity of Great Paris atmosphere is presented. First an assessment of ozone photostationary state (Leighton ratio) is discussed. Values of this ratio significantly greater than unity at low NOX (NO + NO2) indicate that species such as peroxy radicals (RO2) or halogen monoxides convert NO to NO2 in excess of the reaction between NO and O3. Moreover, the fact that Leighton ratio has to be near unity at high NOX can be used as a validation test for our data.
In addition, photostationary state calculations for nitrous acid (HONO) are compared to measurements. From the divergence between measured and calculated HONO a hypothetical unknown source of HONO is postulated. This unknown source is correlated to NO2 photolysis frequency (JNO2) and to the product of JNO2 with Relative Humidity (RH). Finally, a comparison between measured and calculated hydroxyl radical (OH) is presented.