

Three years of balloon-borne and ground-based measurements of urban pollution by the light aerosol counter LOAC: assessment and perspective

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Keywords: Pollution, aerosol counter, urban, balloon

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LOAC is a light aerosol counter that can be used at ground and under all kind of balloons, to determine the aerosol concentrations in 19 size classes between 0.2 and 100 μm , and to estimate their typology (Renard et al., 2016a). The counting can be converted in PM_{2.5} and PM₁₀ mass concentrations, with an accuracy of about 5 $\mu\text{g}/\text{m}^3$.

LOAC has been operated since 2013 at the Observatoire Atmosphérique Général (OAG) touristic balloon in Paris, France (Figure 1); measurements are continually performed at ground, and during the balloon flights, up to an altitude of 270 m. The measurements are presented in real time to the public.



Figure 1 : LOAC on the gondola of the OAG balloon

Another LOAC is operated at ground, also since 2013, at the SIRTA observatory in the south of Paris suburb, for the study of pollution events and fog formation. Finally, a third LOAC has been operated since end of 2015 at ground in the south of Orleans (France) at the Labex VOLTAIRE site. Table 1 provides the location of the measurements.

Table 1. Locations of LOAC measurements.

Project	Location	Coordinates
Balloon OAG	Paris	48.841°N, 2.274°W
SIRTA	Palaiseau	48.713°N, 2.208°E
VOLTAIRE	Orléans	47.838°N, 1.944°E

The retrieved LOAC mass concentrations in the Paris region are in good agreement with those of the air quality network Airparif. Several episodes of pollution has been recorded since 2013 (Renard et al., 2016b). The

size distribution and the nature of the particles are depending on the origin of the pollution (agricultural activities, industrial activities, transport, wood burning heating). Such measurements provide complementary information to the normative PM₁₀ mass concentrations. In particular, during the December 2013 episode the mass concentrations was dominated by the sub-micronic carbonaceous particles, while the March 2014 episode is dominated by the micronic particles of different origins.

The balloon measurements allows us to determine the vertical evolution of the particles' concentrations. Figure 2 presents an example for the December 2013 event, which is characterized by an accumulation layer of fine carbonaceous particles at an altitude of about 200 m.

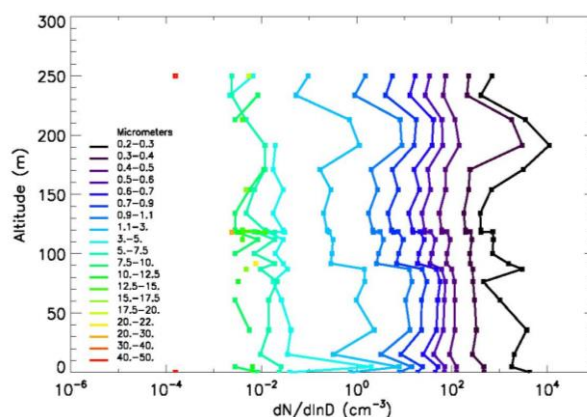


Figure 2 : Evolution of particles concentrations with altitude during the 11 Decemebe 2013 pollution event

The characteristics of the main pollution episodes recorded during the last 3 years will be discussed. Then, the perspective for a 'LOAC network' will be presented, including a fourth LOAC instrument that will be mounted on a touristic balloon in a French small city. Number and mass concentrations, and typologies obtained by the instruments will be available on line.

Renard, J.-B., Léger, K., Bernard, J.-F., Sciare, J., and Giacomoni, J. (2016a), *La météorologie*, **92**, 39-45.

Renard, J.-B. et al. (2016b) *Atmos. Phys. Measur.*, submitted.