



Vertical distribution of the particulate pollution in Paris (France) obtained with the light aerosol counter LOAC on-board the tethered touristic balloon “Ballon Generali”

Jérôme Giacomoni (1), Jean-Baptiste Renard (2), Karine Léger (3), Véronique Gherzi (3), Benoit Couté (2), Vincent Duverger (2), and Matthieu Jeannot (4)

(1) Aerophile, Paris, France, (2) LPC2E-CNRS, Orléans cedex 2, France, (3) Airparif, Paris, France, (4) MeteoModem, Ury, France

LOAC is a light aerosol counter/sizer operated at ground and under all kinds of balloons, to determine the aerosol concentrations in 19 size classes between 0.2 and 100 micrometers, and to estimate their main typology (carbonaceous particles, minerals particles, salts, droplets). The counting concentrations can be converted in PM_{2.5} and PM₁₀ mass concentrations, with an accuracy of about 20%.

LOAC has been operated continuously since 2013 at the tethered touristic balloon “Ballon Generali” in the south-west of Paris, France (latitude 48.841°N, longitude 2.274°W). The measurements are continually performed at ground, and during the daytime balloon flights up to an altitude of 300 m when the wind conditions are favorable. The balloon is in a park, relatively far from the conventional local source of pollutions; thus, we access mainly to the background urban pollution.

The Paris region has recently encounter 4 strong pollution episodes, in December 2013, in March 2014, in March 2015, and in December 2016-Januray2017. The retrieved LOAC mass concentrations at the OAG balloon are in good agreement with those of the air quality network Airparif. The size distribution and the nature of the particles depend on the origin of the pollution (agricultural activates, industrials activities, transport, wood burning heating, Saharan dust plume). The winter episodes ae usually dominated by the sub-micronic carbonaceous particles, while the Spring episodes are usually dominated by the micronic particles of different origins. Such measurements provide complementary information to the normative PM₁₀ mass concentrations for ambient air.

The balloon measurements allow us to determine the vertical evolution of the particles’ concentrations and thus the vertical transport of the pollution. Fortunately, the balloon can flight during the anticyclonic conditions that prevail during urban pollution events. The vertical evolution strongly depends on the meteorological conditions, with sometimes an inversion layer, and on the origin of the pollution (local sources vs. imported pollution or dust plume). Also, the respective contribution of particles in the 0.2-1 micrometers range, 1-3 micrometers range and 3-10 micrometers range is strongly dependent on the origin of the pollution; typically, the highest concentrations of sub-micronic particles were obtained during winter with primary carbonaceous particles.

The characteristics of the various pollution episodes are compared and discussed. We present also the interest of performing such kind of tethered balloon measurements in other cities.