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LOAC (Light Optical Particle Counter): a new small aerosol counter with particle characterization capabilities for surface and airborne measurements

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The determination of the size distribution of tropospheric and stratospheric aerosols with conventional optical counters is difficult when different natures of particles are present (droplets, soot, mineral dust, secondary organic or mineral particles...). Also, a light and cheap aerosol counter that can be used at ground, onboard drones or launched under all kinds of atmospheric balloons can be very useful during specific events as volcanic plumes, desert dust transport or local pollution episodes.

These goals can be achieved thanks to a new generation of aerosol counter, called LOAC (Light Optical Aerosol Counter). The instrument was developed in the frame of a cooperation between French scientific laboratories (CNRS), the Environnement-SA and MeteoModem companies and the French Space Agency (CNES). LOAC is a small optical particle counter/sizer of ~250 grams, having a low electrical power consumption. The measurements are conducted at two scattering angles. The first one, at 12° , is used to determine the aerosol particle concentrations in 19 size classes within a diameter range of 0.3-100 micrometers. At such an angle close to forward scattering, the signal is much more intense and the measurements are the least sensitive to the particle nature. The second angle is at 60° , where the scattered light is strongly dependent on the particle refractive index and thus on the nature of the aerosols. The ratio of the measurements at the two angles is used to discriminate between the different types of particles dominating the nature of the aerosol particles in the different size classes. The sensor particularly discriminates wet or liquid particles, soil dust and soot.

Since 2011, we have operated LOAC in various environments (Arctic, Mediterranean, urban and peri-urban...) under different kinds of balloons including zero pressure stratospheric, tethered, drifting tropospheric, and meteorological sounding balloons. For the last case, the total weight of the gondola including the PTU sonde, transmission and batteries is below 1 kg.

The results obtained during these flights and related campaigns such as the ground-based winter campaign Paris-Fog in Ile de France (fog life circle) and the Pre-ChArMEx/TRAQA summer campaign on the French Mediterranean coast will be presented, as well as future campaigns in which LOAC is involved, especially ChArMEx, (flights in the lower troposphere above the Mediterranean Sea), and Strateole (long duration flights in the tropical stratosphere). Balloon operation of LOAC will tentatively be shown during EGU.