



Measuring the vertical distributions of the upper tropospheric and stratospheric dust with a LOAC aerosol counter under meteorological balloons

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The aerosol issue is in a constant growing. At ground, the airborne particles in boundary layer represent a real risk for population and must be control. In the middle troposphere, aerosols play an important role in the micro-physics and meteorology, the heterogeneous chemistry is not well understood. In the stratosphere, several teams of researchers have shown that solid aerosols might exist, the question of the dynamic of these solid aerosol in the stratosphere is open.

The aim was to develop an instrument that it can make measurements from the ground to the middle stratosphere. This instrument must be able to be put under meteorological balloons, which represent the worst conditions for the development of such instruments in terms of weight, resistance under large variations of temperature and pressure, autonomy and cost if we consider that something throw under a meteorological balloon can be lost after the fly. In the consideration of these conditions, we have developed a new instrument able to make such kind of measurements. This instrument is call LOAC for Light Optical Aerosol Counter.

LOAC provides the concentration and size distribution of aerosols on 19 channels from 0.2 μm to 50.0 μm every ten seconds, and determine the main nature of particles (carbonaceous aerosol, mineral, droplets of water or sulfuric acid) in relation with a large range of samples in laboratory. The physical technique is based on the observation of the scattered light by particles at two angles. LOAC is light enough (1 kilogram) to be placed under a meteorological balloon that is very easy to launch such balloons. The goal is to perform a large number of flights to gather information about the dust distribution in stratosphere and to understand the various mechanisms controlling their spatial and temporal variability.

About 25 flights with have been performed in the stratosphere with the LOAC above the Mediterranean Sea, from south of Paris, from Aire-Sur-l'Adour (South-West of France) and form Iceland. For this period of observation, the stratosphere is characterized by a "background" aerosol content, i.e. free of any volcanic influence. In this context, we show that both liquid and solid particles are present, depending on the altitude and on the aerosol sizes. A series of one year of flight will be presented to highlight the trend in the aerosol content. Also, the analysis of individual profiles exhibits a strong variability in terms of concentration and composition both in the upper troposphere and in the stratosphere. Such variations are often linked with the aerosol composition. The reasons of such variability are investigated, in particular in terms of air mass origins and transport.