Ground-based and balloon-borne cross comparisons with the aerosol counter LOAC

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Determining accurately the spatial and temporal distribution of atmospheric aerosols in terms of particle concentration, size and nature represents a serious instrumental challenge.

LOAC is a small optical particle counter of ~300 grams. The measurements are conducted at two scattering angles: 12° to determine the aerosol particle concentration in 19 size classes within a diameter range of ~0.2 - 100 µm and 60° to discriminate between the different types of particles dominating size classes called typology (droplets, mineral dust and carbonaceous particles). Data are post-processed and can be expressed in concentration (number, volume or even in mass concentration with the typology information) or in extinction in order to be compared to remote-sensing instruments.

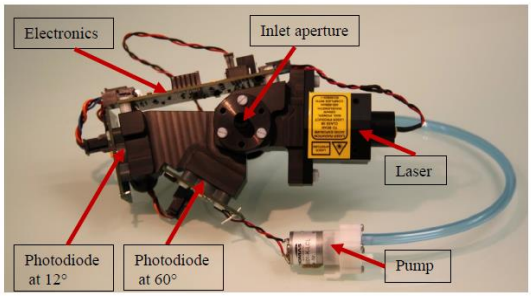

Figure 1. LOAC and the principle of measurement

LOAC has been tested in comparison with different instruments in several conditions. Two comparisons are presented here: with FIDAS and SMPS counters operated at Stockholm University in the sea spray chamber (Fig.2), and with a TEOM data under controlled environment in laboratory in LPC2E CNRS Orléans, France (Fig.3). Other outdoor atmosphere comparisons (Table 1) with different aerosol counters in peri-urban and urban conditions were also made. Balloon-borne LOAC vertical profiles from the ChArMEx campaign over the Mediterranean Sea has provided further comparisons with LIDAR and sunphotometer observations. Finally, the Voltaire campaign in Aire-sur-l'Adour (South of France) allows long term comparison with OSIRIS/ODIN satellite products on mid-latitude stratospheric aerosols.

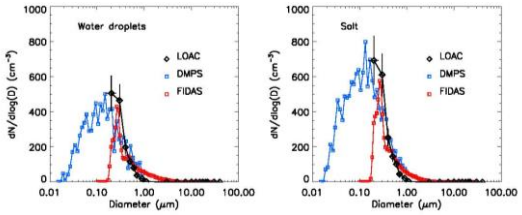

Figure 2. Size distribution comparison between LOAC, SMPS and FIDAS in case of water droplets and salt generated in laboratory under controlled conditions

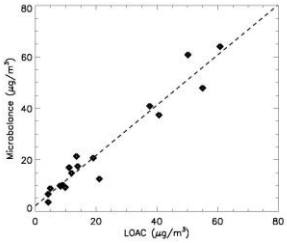

Figure 3. Comparison between LOAC and TEOM for different dust concentrations in laboratory

Table 1. List of cross comparisons presented with their respective conditions

Environment of comparison	Instrumentation	Parameter
Laboratory	SMPS FIDAS	Size distribution
	TEOM	Total mass
Ground – peri-urban	SMPS GRIMM HHPC6	Total number
Ground – urban	TEOM Airparif	PM_{10} $PM_{2.5}$
Low troposphere	LIDAR WALI	Extinction vertical profile
	AERONET	Size distribution
Stratosphere	OPC	Size distribution
	OSIRIS/ODIN	Extinction

LOAC is in good agreement with direct and indirect comparison. Uncertainties on total concentration in number and mass are about ±20 % and ±5 µg/m^3, respectively.

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