Detection of aerosols in planetary atmospheres using the new light aerosol counter LOAC

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Aerosols can be found in different planetary atmospheres at different altitudes. Assessing the distribution with altitude of aerosol particle concentration, size and nature (liquid, solid, main composition) is a major step to study their physical and chemical properties.

This can be done with a new generation of aerosol counter, called LOAC (Light Optical Aerosol Counter). LOAC will be a light particle counter/sizer of few hundreds of grams, having low electric consumption, first designed to be mounted on the various kinds of Earth tropospheric and stratospheric balloons. The main difference with already existing aerosol optical counters is its geometry of observation. The measurements are conducted at 2 scattering angles: the first one, at 10°, is used to determine the aerosol particle concentrations in several size classes within a diameter range of typically 0.3-20 µm. At such a low scattering angle close to forward scattering, the signal is much more intense and the measurements are not strongly sensitive to the nature of the particles. 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 2 angles is used to determine the nature of the aerosol particles in the different size classes.

The tests already conducted with a laboratory prototype have shown that the concept works well for the identification of the aerosol natures using this 2-angles method. The first test flight of LOAC under a sounding balloon is expected to be performed at the end of 2010. LOAC is planned to be flown in future projects for the determination of the nature of aerosol layers in different parts of the atmosphere.

The design of LOAC is simple, without any lens in front of the detection system. The instrument could be well adapted for spatial probes as well as for landers and rovers for long term monitoring of surface aerosols in planetary atmospheres.