# ATMOSPHERIC AEROSOLS PROPERTIES VIA SOLAR INFRARED OCCULTATION OBSERVATIONS BY SPICAM IR

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**Introduction:** Solar occultation measurements by the SPICAM on Mars-Express in the IR spectral range (wavelengths of 1–1.7 μm) allow to study the vertical distribution of aerosol particles in the Martian atmosphere [1]. The considered dataset includes over 1200 occultations (January 2005 – May 2017, MY 27–34), the profiles for opacity, extinction coefficient, particle size and number density were obtained. It allows characterization of the seasonal evolution and inter-annual comparisons of aerosol particles. The 28 Mars Year (MY) global dust storm is also covered by the dataset.

**Data retrieval:** We measured the transmission of solar radiance and then calculated the slant optical depth for each altitude layer. Retrieval of the extinction coefficient profiles was done using "onion peeling" method for 10 reference wavelengths outside the absorbtion bands of atmospheric gases. Radiative properties of the aerosol may be described in Mie theory for the visible-to-infrared opacity ratio and depend on the particle size distribution. For each altitude we assume lognormal size distribution specified by first two moments of this function: effective radius ($r_{eff}$) and effective variance ($v_{eff}$) [2]. With the retrieved size distribution and knowing the vertical profile of extinction coefficient we calculated the aerosol number density. Also we made a decision about water ice cloud presence for each altitude based on extinction and opacity profiles and model predictions.

**Results:** The seasonal, latitudinal and altitudinal map of extinction coefficient was plotted. We observe the increase of extinction during the dusty season in the second half of the year. Also the higher values are at low and equatorial latitudes. Some profiles exhibit detached layers, where extinction locally increases, and such layers may be considered as clouds of water ice. Usually there are altitudes between 40 and 60 km. The spectral range of SPICAM IR alone allows to detect particles with sizes in the range 0.2–1.2 μm and to put constrains on particles with $r_{eff}$ > 2 μm. The retrieved effective radius ranges within 0.2–1.3 μm for mineral dust and 0.6–1.5 μm for water ice. Smaller particles were observed at high latitudes (70–90°) in both hemispheres. Particles about 1 μm and larger were located commonly at low and middle latitudes. In the period of the MY28 global dust storm the clear increase of $r_{eff}$ value was detected almost for all latitudes and for altitudes 40–80 km. it may be interpreted as lifting of large dust particles (~1 μm) up to 80 km during the Ls≈265–300°, MY 28.

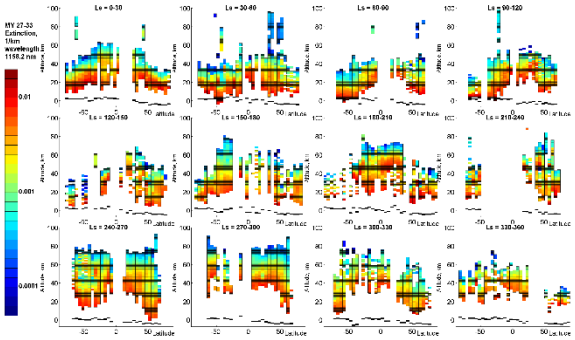

**Figure 1:** Distribution of aerosol extinction with season, altitude and latitude, the average map for 7 Martian years, at 1158.2 nm.

The results of SPICAM solar occultation observations may be useful for planning operations of ExoMars NIR spectrometer which will work at the same range, as well as for other solar occultation spectrometers on Exomars.

**References:**

[1] Korablev, O.I. et al. SPICAM IR acousto-optic spectrometer experiment on Mars Express // **J. Geophys. Res.** 2006. V. 111. p. E09S03.
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