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Study of aerosol properties in the upper haze of Venus from SPICAV IR data

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Upper haze of Venus lies above cloud layer and extends from 70 to 90 km. According to previous missions results the upper haze consists of submicron particles that are considered to be droplets of concentrated sulfuric acid (75%) [Kawabata et al., 1980; Lane and Opstbaum, 1983; Sato et al., 1996]. Recently, from the observations of Venus Express spacecraft a bimodal particle distribution was discovered as well as presence of detached haze layers at 80-90 km. This may be due to abundance of different kinds of particles [Montmessin et al., 2008; Wilquet et al., 2009]. Moreover, study of aerosol particles at altitudes above 90 km could be the key to solution of the sulfur oxides problem recently discovered in this altitude range [Belyaev et al., 2012].

SPICAV IR spectrometer is a part of SPICAV/SOIR experiment on board the Venus Express orbiter [Korablev et al., 2012]. It measures a vertical structure of Venus atmosphere using solar occultation method at altitudes 70-100 km in spectral range of 0.65 1.7 μm. The spectrometer is sensitive to abundance of submicron (mode 1) and micron (mode 2) particles in the Venus' upper haze. Using sulfuric acid refractive indices, Mie scattering theory, and spectral dependence of aerosol extinction, one can derive vertical distribution of particles size and number density assuming bimodal as well as unimodal cases.

In this paper we present vertical profiles of extinction, number density and size distribution from more than 200 occultations obtained between May 2006 and September 2014. Aerosol scale height is found to be equal to $\sim$4 km in the upper haze. At the equator, upper haze top lies at higher altitudes than near the North Pole. A detached haze layers were observed in $\sim$50% of all observations in latitude range from 60°N to 90°N where the best spatial resolution is achieved. According to our statistics bimodal distribution is typical for altitudes from 75 to 85 km, while unimodal distribution dominates at altitudes 70-75 km and above 85 km. For bimodal size distribution effective radii of particles and ratio of density are fitted and effective variances are held fixed, effective radii vary between 0.05-0.4 μm (mode 1) and 0.4-1.1 μm (mode 2). For unimodal size distribution effective radius is fitted and effective variance is held fixed, effective radius varies between 0.2-0.8 μm. Diurnal variations have been analysed.

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