

Study of upper haze of Venus from Venus Express SPICAV-IR data

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The upper haze of Venus located at 70-90 km is composed of submicron aerosol particles of H₂SO₄ (Esposito et al., 1983). Three channels of SPICAV/SOIR instrument onboard the VEX orbiter provided the occultation profiles in three spectral ranges that resulted in the discovery of the bimodal nature of the size distribution in the upper haze comprising a mode with a radius of 0.1-0.3 μm , and a coarser mode of radius 0.4-1.0 μm ; while the presence of detached haze layers was also reported (Montmessin et al., 2008; Wilquet et al., 2009).

Recently, results from 222 SPICAV-IR solar occultations observed from May 2006 to November 2014 were reported (Luginin et al., 2016). Microphysical properties of the mesospheric haze were derived from the vertical profiles of atmospheric extinction obtained at 10 near-IR wavelengths. Bimodal distribution of particles was found to be consistent with data for some orbits with mean radius for mode 1 $\text{reff1}=0.12\pm 0.03 \mu\text{m}$ and $\text{reff2}=0.84\pm 0.16 \mu\text{m}$ for mode 2. The radius for the single mode case was found to be $\text{Reff}=0.54\pm 0.25 \mu\text{m}$, being 1.5 to 2 times smaller at polar region (60°N-90°N). In the bimodal case the number density profiles decreased smoothly for both modes, from $\sim 500 \text{ cm}^{-3}$ at 75 km to $\sim 50 \text{ cm}^{-3}$ at 90 km for mode 1, and from $\sim 1 \text{ cm}^{-3}$ at 75 km to $\sim 0.1 \text{ cm}^{-3}$ at 90 km for mode 2.

In this paper, we pursue the study of the aerosols in the Venus' upper haze. Scale heights were retrieved from 43 number density profiles in unimodal case. The mean scale height is found to be $3.6 \pm 0.7 \text{ km}$. Scale height is larger at polar region than at middle latitudes both on morning and evening terminators ($\sim 5 \text{ km}$ at 85°N vs $\sim 2 \text{ km}$ at 70°N). Retrieved scale heights is consistent with a mean upward motion of $\sim 1 \text{ mm/s}$ at 80 km and $\sim 1 \text{ cm/s}$ at 90 km.

In several occultations, detached haze layers at altitudes between 70 and 90 km were observed. The structures sometimes can be observed over consecutive orbits. In some instances, detached haze layers are shifted in altitude, but the form of the layers remains the same. In other cases, the altitude of the layers remains constant.

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