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High altitude Venus' upper haze from SOIR onboard Venus Express

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The Venus cloud consists of a main cloud deck at 47 – 70 km, with thinner hazes above and below. The upper haze on Venus lies above the main cloud surrounding the planet, ranging from the top of the cloud (70 km) up to as high as 90 km. The Solar Occultation in the InfraRed (SOIR) onboard Venus Express is designed to measure the atmospheric transmission at high altitudes (65 – 165 km) in the infrared (IR, 2.2 – 4.3 μm) with high spectral resolution by solar occultation.

We investigated haze optical properties of Venus at above 90 km by analyzing SOIR spectral data. Vertical and latitudinal profiles of haze extinction, optical thickness, and mixing ratio were retrieved. These profiles exhibit the following characteristics. It shows that haze is present at altitude above 90 km although it has been recognized that the top of haze layer is 90 km. Extinctions vary order of magnitude every occultation. Extinctions are appeared to be independent of wavelength. This makes it clear that haze particles are sufficiently-small in size in comparison with observation wavelength. We find that haze extinction and optical thickness at low latitude are two times thicker than those at high latitude. One of the notable results is that mixing ratio of haze increases at above 90 km at both high and low latitudes. It's the first time that haze is speculated to be produced at high altitude. In this paper, haze transport and increase processes will be discussed to explain the results from SOIR observation.