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Vertical structure of the Venus cloud top from the VeRa and VIRTIS observations onboard Venus Express

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Vertical structure of the Venus clouds is important for understanding of the radiative energy balance and the atmospheric dynamics. The structure of the cloud tops (75-65 km) is especially poorly investigated since it falls between the altitude ranges sounded by solar/ stellar occultation and that studied by descent probes. In this work we analyse the data from the radio science experiment VeRa and Visible and Infrared Thermal Imaging Spectrometer (VIRTIS) onboard Venus Express. Radio sounding is insensitive to the clouds and provides "true" temperature structure, while thermal IR spectra depend on both temperature and aerosol distribution. Thus the joint analysis allows one to constrain vertical structure of aerosol at the cloud tops and its latitudinal variations. Using VeRa temperature profiles we fit VIRTIS spectra in the wavelength range of 4.5 - 5 μm by tuning two parameters in the exponential model of aerosol vertical distribution: cloud top altitude of a unity optical thickness and scale height. We found that the cloud top altitude decreased from $\sim$66 km in the middle and low latitudes to 62-64 km in the polar regions. The scale height showed correlated changes from 3-4 km to less than 1 km. Radiative transfer modelling showed that thermal IR spectrum is more sensitive to the cloud top altitude than to the aerosol scale height.