

Venusian cloud structure in the northern high-latitude region estimated from VEX/VIRTIS-H data

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This paper presents the characteristics of northern high-latitude cloud, i.e., its opacity, cloud top temperature and altitude, and these relationships estimated from Venus Express (VEX) observations.

Venusian clouds mainly consist of sulphuric acid droplets in the altitude of 40-70 km. Recent long-term observations by Venus Monitoring Camera (VMC) and Visible and Infrared Thermal Imaging Spectrometer - M channel (VIRTIS-M) aboard VEX has investigated the south polar vortex [e.g., Luz et al., 2011]. For an example, the lower cloud top altitude at southern polar region is reported [Ignatiev et al., 2008]. We investigated the cloud structure in these regions by the data observed by VIRTIS - High spectral resolution channel (VIRTIS-H), which can get information of northern hemisphere that has not been well reported by VMC and VIRTIS-M. We compared these characteristics with previous reports for the Southern hemisphere, and investigate the opacity, cloud top temperature and altitude, and these relationships between them.

(1) In the 2.3 μ m thermal radiation from the night side, we could not find enough flux from the region more than 70degN in latitude. In the study combined to a radiation transfer analysis, the cloud optical thickness in high latitude region is constantly about twice of that in lower latitudes. It suggests that the clouds in polar region are thicker or has different aerosol characteristics.

(2) We retrieved the cloud top temperature from 5 μ m radiation and the cloud top altitude by 2.2 μ m CO₂ absorption band. The averaged cloud top temperature increased from 75degN to North Pole. On the other hand, the averaged cloud top altitude at 80degN (65.4 \pm 0.7 km) was lower than that at 50 degN (69.3 \pm 0.5km). This is consistent with the characteristics in the southern hemisphere [Ignatiev et al., 2008]. In an event study, it was also shown that the cloud top altitude in the cold collar regions surrounding the hot polar vortex is \sim 1km higher.

(3) We retrieved the averaged latitudinal distributions of cloud opacity, cloud top temperature and altitude in the northern hemisphere from 15 orbits nadir observations, with the resolution of 1 deg. in latitude. There was a negative correlation between the cloud top temperature and its altitude. No other correlations were not clear.

In the paper, we will report the results with the discussion on their interpretations.

Keywords: venusian atmosphere, polar vortex, cloud top altitude, cloud top temperature, cloud optical depth