Cloud top structure of Venus retrieved from the Akatsuki IR2 dayside observations

*Takao M. Sato[1], Takehiko Satoh[2], Hideo Sagawa[3], Naohiro Manago[2], Yeon Joo Lee, Shin-ya Murakami[2], Kazunori Ogohara[4], George HASHIMOTO[5], Yasumasa Kasaba[6], Atsushi Yamazaki[2], Manabu Yamada[7], Shigeto Watanabe[1], Takeshi Imamura[8], Masato Nakamura[2]

1. Hokkaido Information University, 2. ISAS/JAXA, 3. Kyoto Sangyo University, 4. University of Shiga Prefecture, 5. Okayama University, 6. Tohoku University, 7. Chiba Institute of Technology, 8. The University of Tokyo

We present the cloud top structure of Venus retrieved from a total of 93 dayside images acquired at a wide variety of solar phase angles (0-120 deg) by the 2.02-μm channel of the 2-μm Camera (IR2) onboard Japanese Venus orbiter, Akatsuki, during the period from April 4 to May 25, 2016. Since the 2.02-μm channel locates in a CO_2 absorption band, the sunlight reflected from Venus allows us to determine the cloud top altitude corresponding to unit aerosol optical depth at 2.02 μm with radiative transfer calculation. Firstly, the observed solar phase angle dependence and zonal variation of the reflected sunlight in the equatorial region were used to construct a baseline model characterized by cloud top altitude , Mode 2 radius , and cloud scale height which are 70.287 km, 1.26 μm and 5.1 km, respectively. Secondly, individual cloud top altitudes were retrieved with the assumption that the last two values are valid for the entire planet. The latitudinal structure of cloud top altitude is symmetrical with respect to the equator: the averaged cloud top locates at a constant altitude of 68-70 km equatorward of ±45 deg but rapidly drops in latitudes of 50-60 deg and reaches 61 km poleward of ±70 deg. The averaged cloud top in the equatorial region indicates the tendency to increase from early morning (~7 h) and reach a maximum near early afternoon (~14 h) and decrease toward late afternoon (~17 h). The magnitude of the change is in the order of 1 km. After high-pass filtering of the cloud top altitude maps, small-amplitude features including stationary structures occur within several hundred meters and typically show less contrast than those at two channels (283 and 365 nm) of the Ultraviolet Imager (UVI). Although the long, zonal or tilted streaky features poleward of ~45 deg are clearly identifiable, the features in low and middle latitudes are usually faint and do not necessarily appear as the local variation in cloud top altitude where mottled and patchy patterns are seen in the UV channels, suggesting the existence of convection and turbulence at the cloud top level.

Keywords: Venus, atmosphere, clouds, Akatsuki, near-infrared, radiative transfer

