Mean winds at the cloud top of Venus obtained from two-wavelength UV imaging by Akatsuki

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Venus is covered with thick clouds. Ultraviolet (UV) images at 0.3-0.4 microns show detailed cloud features at the cloud-top level at about 70 km, which are created by an unknown UV-absorbing substance. Images acquired in this wavelength range have traditionally been used to measure winds at the cloud top. In this study, we report low-latitude winds obtained from the images taken by the UV imager, UVI, onboard the Akatsuki orbiter from December 2015 to March 2017. UVI provides images with two filters centered at 365 and 283 nm. While the 365-nm images enable continuation of traditional Venus observations, the 283-nm images visualize cloud features at an SO2 absorption band, which is novel. We used a sophisticated automated cloud-tracking method and thorough quality control to estimate winds with high precision. Horizontal winds obtained from the 283-nm images are generally similar to those from the 365-nm images, but in many cases, westward winds from the former are faster than the latter by a few m/s. From previous studies, one can argue that the 283-nm images likely reflect cloud features at higher altitude than the 365-nm images. If this is the case, the superrotation of the Venusian atmosphere generally increases with height at the cloud-top level, where it has been thought to roughly peak. The mean winds obtained from the 365-nm images exhibit local-time dependence consistent with known tidal features. Mean zonal winds exhibit asymmetry with respect to the equator in the latter half of the analysis period, significantly at 365 nm and weakly at 283 nm. This contrast indicates that the relative altitude may vary with time and latitude, and so are the observed altitudes. In contrast, mean meridional winds do not exhibit much long-term variability.

A previous study suggested that the geographic distribution of temporal mean zonal winds obtained from UV images from the Venus Express orbiter during 2006–2012 can be interpreted as forced by topographically induced stationary gravity waves. However, the geographic distribution of temporal mean zonal winds we obtained is not consistent with that distribution, which suggests that the distribution may not be persistent.

Keywords: Venus, Superrotation, Akatsuki, Cloud top

