Wind field at the cloud top of Venus covering all local time obtained from thermal infrared images

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Knowledge of the structures of the mean meridional circulation and the thermal tides is important for understanding the dynamics of the Venus atmosphere. Measurements of the wind field at a specific altitude covering all local time are essential to such studies. However, cloud tracking has been possible only for the dayside cloud top or the nightside middle/lower cloud region depending on the wavelength, except the southern polar region observed by Venus Express (Peralta et al., 2012).

Venus' cloud-top temperature distribution is now continuously mapped by LIR (Long-wave Infrared camera) mounted on the Venus orbiter Akatsuki, which can potentially be used for studying the dynamics in all local time regions. LIR images have not been used for cloud tracking because of the relatively low S/N ratio and the existence of stationary features induced by topographic gravity waves that obscure passive tracers.

Here we conduct cloud tracking using LIR data with a new method. Multiple images taken in ˜4 hours sliding windows are averaged successively in the coordinate system that rotates with the background superrotation. In the resultant images, random noises were suppressed and stationary features were smoothed out, enabling detection of detailed cloud morphologies. By the combination of this method and the cross-correlation method (Ikegawa and Horinouchi 2016), we derived the wind field both on the dayside and the nightside for the first time. As a result, the structures of the thermal tides and the mean meridional circulation at the cloud top were revealed. Predominant equatorward flows on the nightside and an equatorial convergence of the mean meridional flow were discovered.