あかつき搭載LIRを用いた金星雲頂の温度変動の周期解析

梶原 直也 [1]; 今村 剛 [1]; 田口 真 [2]; 福原 哲哉 [3]; 神山 徹 [4]
[1] 東京大学; [2] 立教大・理・物理; [3] 立教大・理; [4] 産総研

Periodic analysis of Venus' cloud-top temperature fluctuation using by LIR images

Naoya Kajiwara[1]; Takeshi Imamura[1]; Makoto Taguchi[2]; Tetsuya Fukuhara[3]; Toru Kouyama[4]
[1] The University of Tokyo; [2] Rikkyo Univ.; [3] Rikkyo Univ.; [4] AIST

The mechanism of Venus' strong zonal wind blowing at 60 times the speed of its rotation, called the super-rotation, is still unclear. Various waves of planetary scale have been proposed as the cause of the super-rotation, but it has not been elucidated yet.

Planetary-scale waves are known to exist in the atmosphere of Venus. For example, periodic fluctuations with periods of 4 to 5 days in UV brightness were discovered at the cloud top by Pioneer Venus orbiter (DelGenio and Rossow1990). Analyses of velocity fields obtained by cloud tracking revealed that zonal and meridional winds also fluctuate with periods of 4 to 5 days (Rossow et al. 1990; Kouyama et al. 2012, 2015). It has been clarified that various waves exist on Venus, but their spatial structures are not well understood. We focus on the periodical fluctuation of the cloud top temperature which has not been studied well.

We used images taken by the Long Infrared camera (LIR) onboard JAXA's Venus orbiter Akatsuki. LIR can capture the temperature of clouds around 65 km altitude. The image data taken by LIR has a systematic error of ˜3K and a relative error of ˜0.3K. Thanks to the small relative error of LIR, comparison of brightness temperatures in each image can be relatively accurate, and thus spatial inhomogeneities of the brightness temperature caused by waves are expected to be detectable. We focused on the longitudinal gradient of the brightness temperature. Considering the effect of limb-darkening, we focused on the same emission angles of the eastern and western side of the Venus disk in order to observe the brightness temperature coming from the same altitude. We calculated the averages of the brightness temperatures on the eastern and western side of the Venus disk (the range of the emission angle 40 degrees - 60 degrees) and the difference between the averages of the brightness temperatures. Longitudinal gradient of the brightness temperature is obtained by dividing the east-west temperature difference by the longitudinal distance between the two regions. The longitudinal gradient was arranged in time series and the periodicity was investigated by FFT analysis.

From FFT analysis, the brightness temperature fluctuation has several days periods. However, the influence of the change of the observed longitude due to spacecraft motion needs to be removed before exactly determining the wave periods. A preliminary result of this analysis will be presented.