Analysis of the brightness temperature fluctuation at the cloud top of Venus using image data taken by the Long Infrared camera

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Venus is sometimes called Earth’ s twin because the size and mass of Venus and Earth are almost the same. However, the movement of the atmosphere is greatly different. Venus rotates very slowly. Its rotational period is 243 days. The atmospheric circulation of Earth is much slower than its rotation, but on Venus there is a zonal wind blowing at 60 times the speed of its rotation. The wind is called the super-rotation. Various waves of planetary scale are thought to be the cause of the super-rotation, but it has not been elucidated yet.

It has been revealed that various waves exist in the atmosphere of Venus. For example, it was confirmed that there are periodic fluctuations of 4 to 5 days in UV brightness at the cloud top by Pioneer Venus mission (DelGenio&Rossow1990). Furthermore, observations by Venus Express revealed that zonal and meridional winds fluctuate with periods of 4 to 5 days (Kouyama et al. 2015). It has been clarified that various waves exist on Venus, but their spatial structures are not well understood. We focus on the fluctuation of temperature which has not been clarified yet.

We used image data 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. In other words, the relative error of LIR is small and the comparison within the same image is relatively accurate.

In order to suppress the influence of systematic error, we calculate the differences of the brightness temperatures between areas near the Venus disk center and the edge, and we analyzed how the brightness temperature fluctuates with time. It is considered that the cause of the brightness temperature difference is mainly the limb darkening due to the temperature gradient in the vertical direction. We carried out this analysis for different latitudes from the equator to the high latitude, and found that there exist periodic fluctuations with periods of 4 to 5 days at all latitudes.

Several waves are thought to affect the periodic fluctuation detected this analysis. We will analyze the data for a longer period of time and try to separate the wave components by spectral analysis.

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