3-D Thermal Structure of the Venus Atmosphere Obtained by Akatsuki/LIR

*Masahiro Akiba[1], Makoto Taguchi[2], Tetsuya Fukuhara[2], Takeshi Imamura[3], Toru Kouyama[4], Takao M. Sato[5]

1. Rikkyo graduate School, 2. Rikkyo University, 3. The University of Tokyo, 4. National Institute of Advanced Industrial Science and Technology, 5. Hokkaido Information University

To maintain the fast circulation of the Venus atmosphere, thermal tides have been considered a very important candidate of a driving engine, because they can transfer eastward momentum from the accelerating region of the upper atmosphere to the ground [Kouyama et al., 2019]. We investigated the vertical structure of brightness temperature distribution above the cloud-tops based on the emission angle dependence of the sensing altitude of LIR onboard Akatsuki. We used LIR data obtained when Akatsuki was in the altitude range from 60,000 to 100,000 km during the period from October 19, 2016 to October 2, 2018. Each brightness temperature image with 328x248 pixels was divided into 3280x2480 sub-pixels, and 32 successive images were accumulated after precise adjustment of the Venus disk position. Emission angles are converted to sensing altitudes by a radiative transfer calculation with nominal temperature and cloud particle distributions [Sato et al., 2014]. Thus, we derived a local time-altitude cross section of the brightness temperature deviation above the cloud-tops in the latitude ranges of 0-30, 40-50, 55-65, 70-80, and 80-90. Sensing altitudes change slightly with latitude but range vertically about 7 km depending on the emission angles. A Fourier analysis shows the vertical distribution of temperature in the equator region is dominated by a semidiurnal tide with a tilt of the phase with increasing altitude. The maximum positive temperature deviation appears around 10 and 21 LT at the bottom of the sensing altitudes. It is suggested that the thermal tide is generated deep in the cloud deck by solar heating and propagates upward. On the other hand, a diurnal tide dominates in the higher latitudes. Latitudinal dependence of the observed amplitudes, phases and their tilt angles of diurnal and semidiurnal tides will be discussed by comparing with those from a numerical simulation.

Keywords: dynamics, atmosphere