Comparison of Akatsuki radio occultation experiments with thermal infrared image obtained by LIR

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Venus climate orbiter called Akatsuki which failed to be inserted into Venus orbit in 2010 has been successfully re-orbited on December 2015, and instruments onboard the spacecraft has finally started observation of Venus. The longwave infrared camera (LIR) detects thermal emission with wavelengths of 8 - 12 micron from Venus disk regardless of day or night side, and represents horizontal distribution of the brightness temperature at the cloud top. LIR has continuously archived more than eight thousands images without serious fault for two Venusian years. The radio occultation experiment termed Radio Science (RS) retrieves the atmospheric pressure, the temperature, the sulfuric acid vapor mixing ratio, and the electron density. Akatsuki mainly probes the low and middle latitude regions with the near-equatorial orbit in contrast to the previous radio occultation experiments such as Venus Express in a polar orbit. Vertical temperature profiles by RS observation were successfully obtained at altitude of 38 - 85 km by July 2017. On the other hand, the cloud-top altitude observed by LIR would be roughly ˜65 km in accordance with the contribution function of Venus atmosphere simulated under situation of typical cloud distribution. However, it is difficult to retrieve an actual cloud-top altitude except for the comparing with the vertical temperature profile synchronously observed. LIR images have been synchronously acquired with most of RS observations as a basic strategy for Akatsuki observation. Thus, we could acquire several data sets in which LIR and the radio occultation experiments observed same region. The data set covered low latitude in the morning and southern mid latitude in the midnight. Since LIR image included background bias depending on baffle temperature at observation, it was canceled by using deep-space images acquired on orbit with different baffle temperature. Furthermore, limb-darkening effect which is generally seen in the thermal infrared images is considered when absolute brightness temperature is estimated from LIR observation. Thus, the cloud-top altitudes in the LIR images were deduced by the comparison with the RS observations. It showed some atmospheric features depending on the local time and latitude. A variability which is caused by thermal tides at the cloud top layer may be included. We are carefully considering the result obtained by our observation.