

## Temperature and Wind variations in Venusian mesosphere and lower thermosphere by mid-infrared heterodyne spectrometer in 2018

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Venusian upper atmosphere is mainly classified into the mesosphere (70 - 100 km) and the thermosphere (100 km -). Large spatial and temporal variation of temperature profile in this region which had been believed stable was found by Venus Express (Tellmann et al., 2009). On the other hand, Venus has global circulations over 100 m/s which are a retrograde superrotational zonal wind at the cloud top and a subsolar-to-antisolar circulation in the lower thermosphere. General Circulation Model (GCM) expected a wind shear by global circulations to complicate atmospheric profile in this region by generating the gravity waves (Rodin et al., 2013). The previous studies by mid-infrared (MIR) heterodyne spectrometer showed discrepancies with GCM and intense temporal variations of temperature (40 K) and wind velocity (30 m/s) (Sornig et al., 2013; Krause et al., 2018). These nature in the Venusian upper atmosphere are not understood comprehensively due to lack of continuous monitoring because the previous observations were conducted by competitive large telescopes.

Mid-Infrared Laser Heterodyne Instrument (MILAHI) is MIR heterodyne spectrometer developed by Tohoku University (Nakagawa et al., 2016). This instrument is attached to Tohoku University 60 cm telescope located at the summit of Mt. Haleakala. The advantage of this instrument is to conduct continuous observation by using the dedicated telescope. Sensitive altitude ranges of MIR heterodyne observation are different between a dayside observation and a nightside observation. A dayside observation is to obtain CO<sub>2</sub> 10  $\mu$ m non-local thermodynamic equilibrium (non-LTE) emission generated from 100 - 120 km altitude in the lower thermosphere (Lopez et al., 2011). Kinetic temperature and wind velocity along line of sight are derived from line width and doppler shift, respectively (Sonnabend et al., 2008; Sornig et al., 2008). The CO<sub>2</sub> 10  $\mu$ m absorption of the atmosphere upon the cloud top is observed in the nightside. We can retrieve temperature profile and wind velocity along line of sight between 70 km and 100 km in the nightside mesosphere by AMATERASU include a clear sky radiative transfer model, a receiver simulator and an inversion code (Takami et al., in preparation).

We conducted continuous observation of 8 days in June 2018. This observation campaign was dayside observation, so observed altitude was 100 - 120 km. Venusian evening terminator was coming to disk center in June 2018. We could divide Venusian dayside into 4 regions: disk center, equator limb, north high latitude and south high latitude due to field of view of 4 arcsec (MILAHI) and the apparent diameter of 13 arcsec (Venus). A latitude dependence was not found in this observation campaign and the results of temperature showed different variation features among observed regions. The average temperature decreased by 30 K from June 20th and increased by 40 K up to 220 K from 23th. The retrieval of wind velocity is under evaluation process.

We plan observation for nightside in October 2018 at just before inferior conjunction. This observation results will be shown. This study is the first time for derivation of wind velocity in Venusian mesosphere by remote sensing from ground-based observation.