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

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The most extensive observations of Venusian mesosphere have been performed by Venus Express (VEX) up to 2014 (e.g., Patzold et al., 2007; Mahieux et al., 2015). These observations have found the highly spatial and temporal variations in the thermal structure. The temperature discrepancies between observations by VEX/SOIR and general circulation models in the altitude of 80 - 100 km have not been properly interpreted (Bougher et al., 2015; Gilli et al., 2017). In addition, the mesospheric dynamics located between retrograde superrotational zonal wind (cloud deck) and subsolar-to-antisolar flow (above 120 km altitude) have not been well understood due to lack of observations. On the other hand, the lower thermosphere has been observed by mid-infrared heterodyne spectrometer (MIR-HS). Temperature in this region varied extensively between 140 K and 240 K, and wind velocity changed intensely from 130 m/s to 190 m/s for a terrestrial day (Sornig et al., 2013; Krause et al., 2018). Temperature and wind variations such as periodicity and locality in Venusian mesosphere and lower thermosphere have not been comprehended. The purpose of our observations is to solve it with continuous observations by MIR-HS.
Our Mid-Infrared Laser Heterodyne Instrument (MILAHI) have been inserted to Tohoku 60 cm telescope located the summit of Mt. Haleakala in Maui, Hawaii (Nakagawa et al., 2016). MILAHI has 10 um CO_2 laser as local oscillator. The field of view is 4 arcsec with 60 cm telescope and in the wavelength of 10 um. MIR-HS can retrieve temperature and wind in different altitude between dayside observations and nightside observations. CO_2 emerge non-local thermodynamic equilibrium emission from 100 –120 km altitude in dayside (Lopez-Valverde et al., 2011). Temperature and wind are derived from Doppler width and Doppler shift of the emission spectra, respectively. In nightside, CO_2 in the mesosphere absorbs background radiation from the cloud deck. Temperature profile and wind are retrieved from this absorption spectra with radiative transfer equation and inverse method of AMATERASU developed in National Institute of Information and Communications Technology.
Dayside observations were conducted between 24th and 27th in June, 2018. Apparent diameter was 15 arcsec and apparent dayside was half of the disk in this term. Observed points were North, South, disk center, and equator with integration times of 30 - 55 minutes. Each observed point gave different temperature variation feature. Temperature variation range was 170 - 220 K in agreement with Sonnabend et al. (2010). Temperature distribution showed both latitudinal dependence in 25th and convergence at 200 K in 26th.
Nightside observations were conducted from 11th to 13th, 19th, and 20th in November, 2018. Apparent diameter of Venus changed between 55.4 and 49.4 arcsec after inferior conjunction. We observed equator with three days, north 33 degree and south 33 degree for diurnal and latitudinal variations with integration times of 80 - 130 minutes. The observed spectra in the unit of relative intensity are under conversion because the retrieval with AMATERASU is necessary to use absolute radiation. We will show retrieved temperature profile and wind velocity at this presentation.

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