Comparison of horizontal distributions of temperature and UV absorbers at the Venus cloud-tops

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Venus is the nearest neighbor planet, which has a size similar to that of the earth. However, unlike the earth, Venus is covered with thick H_2SO_4-H_2O clouds floating at 45-70 km altitudes [Nakamura et al., 2011]. It is considered that the clouds are photochemically generated by oxidation of SO_2 and H_2O. In the visible region, light reflected by the clouds are poorly absorbed and few structures are noticeable. On the other hand, in the ultraviolet (UV) region, inhomogeneity of albedo has been identified to be inhomogeneous distribution of UV absorbers above the layer of UV scattering. It has been identified that SO_2 in the Venusian atmosphere absorbs light in the wavelength region between 200 nm and 320 nm, but chemical species responsible for the absorption in the wavelength region longer than 320 nm is still unidentified. S_2O and OSSO are candidates. The UV absorbers play an important role in the atmospheric dynamics, controlling vertical thermal stability by heating at the top of convection layer. The dynamics may feedback the distribution of the UV absorbers by transport of them from the lower atmosphere. Details of the chemical and dynamical coupling are still unknown.

Images obtained by the Longwave Infrared Camera (LIR) and Ultraviolet Imager (UVI) onboard the Venus orbiter Akatsuki were analyzed. LIR takes images of thermal radiation in the wavelength range of 8-12 um emitted from the cloud-tops [Fukuhara et al., 2011]. Temperature distributions are derived from the images. Disturbances seen in the temperature distributions are thought to be caused by atmospheric waves and tides, changes in the cloud-top altitude and adiabatic heating and cooling due to convection, direct heating by the UV absorbers, and so on.

UVI takes images of the solar radiation reflected by the clouds with narrow bandpass filters centered at the 283 and 365 nm wavelengths, which correspond to the absorption bands of SO_2 and unknown absorbers [Yamazaki et al., 2018].

We compared horizontal distributions of the temperature and UV absorbers, and examine correlation between them. Examples are shown in Figure. Correlation coefficients were calculated for square regions of 1.2 degree by 1.2 degree. In the temperature distribution, a bright (high temperature) pattern is seen around 50 degree south. It is found that there are strong positive correlations in this region. However, there are positive correlations up to around 60 degree south. It is considered that the UV absorbers do not change in concentration and are along the cloud tops despite the fact that the temperature (altitude) of the cloud tops change in this region.