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Spatial and temporal variability of UV albedo and its relation to the wind field revealed by Akatsuki UVI

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Venus is entirely covered by optically thick clouds that play essential roles in the Venus' climate system. The cloud consists of H_2SO_4 aerosols, and H_2SO_4 is produced from SO_2 photochemically at the cloud top. SO_2 is abundant in the lower part of the cloud layer and the subcloud region (Bertaux, 1996), and is thought to be transported to the cloud top in the sulfur cycle (Mills et al., 2007), although the dynamical processes responsible for the transport are not understood. The purpose of our study is to confirm that SO_2 is supplied from the lower atmosphere to the cloud top where it is lost via photochemical reactions and to determine how the stationary planetary-scale circulation and time-varying disturbances contribute to the SO_2 transport. The horizontal divergence calculated from the cloud-tracked wind (Ikegawa and Horinouchi, 2016; Horinouchi et al., 2018) is considered as an index of the vertical flow in the cloud: a horizontally divergent (convergent) flow will tend to correspond to an upward (downward) wind for convection-like motions, while the divergence is out of phase with the vertical wind by 90 degrees for gravity waves including thermal tides. The 283-nm radiance, which is subject to SO_2 absorption, measured by Akatsuki UVI (Yamazaki et al., 2018) was converted to UV albedo following the method of Lee et al. (2015, 2017), and low (high) albedo regions are considered to be regions of high (low) SO_2 density. By comparing the Lagrangian derivative of UV albedo with the horizontal divergence, the relation between the change of the cloud-top SO_2 and the vertical flow was obtained for independent air parcels and the mean field. The result shows that the solar-fixed structure of the UV albedo is consistent with the supply of SO_2 by the updraft phase of the thermal tides and that transient and localized UV albedo variations are consistent with the supply of SO_2 by ascending flows coincident with horizontal divergences.