Interaction between the thermosphere and the cloud-level atmosphere of Venus inferred from simultaneous observations by Hisaki and Akatsuki

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Recent studies on the Venus' upper atmosphere suggest that atmospheric waves may propagate from the middle atmosphere to the thermosphere (e.g., Masunaga et al., 2017). To understand the role of vertically propagating waves, simultaneous observations of the cloud-level atmosphere and the thermosphere of Venus are necessary.
Hisaki and Akatsuki observed Venus simultaneously in June 2017 and we analyzed the EUV OI (130.4 nm and 135.6 nm) dayglow obtained by the Extreme Ultraviolet Spectroscope for Exospheric Dynamics (EXCEED) on Hisaki and the UV contrast (365 nm) obtained by the Ultraviolet Imager (UVI) on Akatsuki. The OI emissions reflect the column density of the oxygen and the electron in the thermosphere, and the UV images reflect the spatial distributions of unidentified absorbers at the cloud top.
Analyzing the time series of the OI dayglow emissions and the UV contrast obtained by UVI, we identified periodicities of 3.5 days in both data. The wind velocity deduced with cloud tracking from UV images suggests that the 3.5-day periodicity can be associated with Kelvin waves at the cloud top; however, Kelvin waves should decay with height through radiative damping and will not reach the thermosphere. We propose an indirect process in which the Kelvin waves change the wind field periodically and this oscillating wind influences the vertical propagation of small-scale gravity waves.

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