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Contribution of Diurnal Tide to Venus Cloud-Top Superrotation

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Venus's cloud-top superrotation, characterized by equatorial zonal winds of ~100 m/s, is sustained by the atmospheric angular momentum (AM) induced by atmospheric waves, especially thermal tides, and meridional circulation. However, the overall patterns of thermal tides and their individual components' contribution to superrotation remain poorly understood. Recent Akatsuki observations and semispectral model simulations suggest that the semidiurnal tide is the dominant driving force behind cloud-top superrotation. Using a 16-year radio occultation dataset observed by Venus Express and Akatsuki, we have, for the first time, revealed the thermal tide structure from the cloud base to mesopause (50-90 km) in the southern hemisphere and validated the tidal patterns simulated by the Venus Planetary Climate Model. The simulation indicates that diurnal tide-induced AM flux divergence is the primary driving force for the equatorial cloud-top superrotation, contrary to the previously held belief that the semidiurnal tide was dominant.