

Venus orbiter Akatsuki and a new era of atmospheric science

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Akatsuki spacecraft of Japan became a Venus orbiter on December 7, 2015. Venus is one of the most attractive targets in the solar system when we seek to understand how terrestrial planets differentiate into various types. The principal mode of the atmospheric circulation of Venus is a zonal westward rotation of the entire atmosphere called the super-rotation; the mechanism sustaining the circulation is still unclear, although various mechanisms explaining the super-rotation have been proposed. The main goal of Akatsuki is to understand the Venusian atmospheric dynamics and cloud physics. Onboard science instruments, five of which are imagers dedicated to meteorological studies and one of which is a reference radio source, sense multiple height levels of the atmosphere to model the three-dimensional structure and dynamics. The lower clouds, the lower atmosphere and the surface are imaged by utilizing near-infrared windows. The cloud top structure is mapped by using scattered ultraviolet radiation and thermal infrared radiation. Lightning discharge is searched by high-speed sampling of lightning flashes. Radio occultation complements the imaging observations by probing the vertical structure of the atmosphere. The principal observation mode is continuous global imaging at multiple wavelengths, which visualizes three-dimensional atmospheric motions at global scales. Identification and evaluation of key atmospheric processes from the time series would enable comprehensive understanding of Venus' climate system.

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