

Meteorology of Venus and Venus Climate Orbiter of Japan

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Venus Climate Orbiter (VCO) is the first Venus spacecraft of JAXA and is also called the PLANET-C project. The phase B study of VCO has started in 2004, and the spacecraft will be launched around 2009–2010.

VCO focuses on the meteorology of Venus. The wind system of Venus is characterized by the super-rotation: the wind speed increases with height and the atmosphere at the cloud top rotates around the planet within 4 Earth days, although the planetary rotation period is as long as 243 Earth days. To maintain the vertical shear associated with the super-rotation, there must be a mechanism transporting angular momentum upward. Various mechanisms have been proposed so far: combination of meridional circulation and some eddies that provide horizontal viscosity; vertically-propagating thermal tides excited in the cloud layer; and vertically-propagating gravity or Kelvin waves excited in the lower atmosphere.

To observe the key processes driving the atmospheric circulation, VCO will have 5 cameras dedicated to meteorological study: IR1 (1.01 micrometer); IR2 (1.735/2.02/2.26/2.32 micrometer and H-band), LIR (8–12 micrometer), UVI (280/365 nm), and LAC (551/558/777 nm). IR1 and IR2 observe the clouds and minor constituents in the deep atmosphere through the near-IR window, while LIR and UVI observe the cloud top temperature and albedo feature, respectively. LAC will detect lightning flashes and airglow features.

The angular velocity of the spacecraft around the apoapsis of the elliptical orbit (30 hours period) is synchronized with the westward rotation of the cloudlevel atmosphere for 20 hours. From the successive global images obtained from this portion of the orbit, we will derive the three-dimensional global structure of atmospheric motions. Close-up images of meso-scale features and limb images will also be obtained near the periapsis, and the shadow of Venus is utilized for observing lightning and airglow. Radio occultation will also be performed to observe the vertical profiles of temperature and sulfuric acid vapor.

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