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Seasons on Venus - cloud cover signatures

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With the smallest obliquity and orbital eccentricity of any planet around the Sun, Venus is not generally expected to show any seasonal variations in its atmosphere. Careful analysis of the global images obtained by the Venus Monitoring Camera (VMC) on board European Space Agency's Venus Express orbiter from 12 June 2006 orbit 24) till 15 September 2014 (orbit 3043) reveal short term variations and a detectable periodic variation in the normalized intensity (reflectance) as well as in unit optical depth at a fixed local time at low latitudes as well as at high latitudes.

VMC ultraviolet images were brightness normalized using Minnaert Law and the brightness at the sub-solar meridian at different latitudes in the southern hemisphere. The unit optical dept was inferred by precision location of the limb location in images acquired during the apoapsis portion of the orbit at range greater than $\sim$ 30,000 km from Venus center. The temporal changes of the unit optical depth was monitored at fixed solar zenith angles and latitude.

The seasonal signature is more pronounced at high latitudes compared to low latitudes. The data suggest that the variations in insolation due to heliocentric range and the small obliquity are responsible for the periodic changes in the Venus cloud cover. Concurrent changes in the cloud changes are also observed at other three wavelengths (550, 950 and 1050 nm) at which VMC obtained images, but the number of images at these wavelengths is much smaller. A secular decrease in the image brightness is observed over the life of the Venus Express mission, most likely due to the degradation of the some of the optical/sensor elements.