Geophysical Research Abstracts
Vol. 19, EGU2017-7111, 2017
EGU General Assembly 2017

Dependence of wind speed and UV albedo at Venus top cloud layer on topography and local time revealed from VMC images

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A set of UV (365 nm) and IR (965 nm) images obtained by the Venus Monitoring Camera (VMC) was used to study the circulation of the mesosphere at two altitude levels. Displacement vectors were obtained by wind tracking in automated mode for observation period from 2006 to 2014 for UV images [1,2] and from 2006 to 2012 for IR images. The long observation period and good longitude-latitude coverage by single measurements allowed us to focus on the study of the slow-periodic component. The influence of the underlying surface topography on the change of speed of the average zonal wind at UV level at low latitudes, discovered by visual methods has been described in [3]. Analysis of the longitude-latitude distribution of the zonal and meridional components for ∼172000 (257 orbits) digital individual wind measurements at UV level and for ∼32,000 (150 orbits) digital individual wind measurements at IR level allows us to compare the influence of Venus topography on the change of the zonal and meridional components at both cloud levels.

At the UV level (67±2 km) longitudinal profiles of the zonal speed for different latitude bins in low latitudes correlate with surface profiles. These correlations are most noticeable in the region of Aphrodite Terra. The correlation shift depends on the surface height. Albedo profiles correlate with surface profiles also at high latitudes.

Zonal speed profiles at low latitude (5-15°S) depend not only on altitude, but also on local time. Minimum of the zonal speed is observed over Aphrodite Terra (90-100°E) at about 12 LT. A diurnal harmonic with an extremum over Aphrodite Terra was found. It can be considered as a superposition of a solar-synchronous tide and a stationary wave caused by interaction of the windstream with the surface.

At the IR level (55±4 km) a correlation between surface topography and meridional speed was found in the region 10-30°S. The average meridional flow is equatorward at the IR level, but in the region Aphrodite Terra it is poleward.

Acknowledgements:

M.V. Patsaeva, I.V. Khatuntsev and J.-L. Bertaux were supported by the Ministry of Education and Science of Russian Federation grant 14.W03.31.0017.

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