EPSC Abstracts,
Vol. 4, EPSC2009-541, 2009
European Planetary Science Congress,

Lower clouds dynamics study of Venus as seen by VIRTIS on Venus-Express

O. Lanciano (1), G. Piccioni (1), R. Hueso (2), A. Sánchez-Lavega (2), S. Pérez-Hoyos (2), J. Peralta (3).

(1) IASF-INAF Rome, Italy, (2) Universidad del País Vasco, Bilbao, Spain, (3) Instituto de Astrofísica de Andalucía, Granada, Spain
(orietta.lanciano@iasf-roma.inaf.it)

Abstract

The hyperspectral imager VIRTIS onboard the Venus-Express spacecraft gives us images of Venus with a typical projected field of view covering 40° in latitude and 50° in longitude across the Venus South hemisphere when observed from the apocenter, at a distance of about 65000 km. Observations at a wavelength of 1.7 μm are effectively used to map the lower clouds placed at an altitude of about 48 km over the surface. This cloud layer presents a mixture of cloud textures, in the range from bland regions with a few structures to chaotic regions highly contrasted [1]. The dynamical recurrent patterns in this layer are here investigated through a Fast Fourier Transform analysis (FFT) method able to differentiate automatically, in each single image, the regions with laminar and turbulent dynamical regimes.

The calibrated radiance signal is selected in longitudinal cuts at a fixed latitude with longitudinal extension of 1000 km. Then the FFT is calculated and a power spectrum for each radiance scan is retrieved. The fixed sample extension ensures that we can actually compare results from different latitudes and different images. The power spectrum is then fitted by a bilinear function with two characteristic slopes for two different ranges of wavenumbers. The slope of the power spectrum serves as an indicator of the dynamical regime and it can be used to investigate the energy transfer in the atmosphere between different scales of motions, as explained by the classical turbulence theory for the kinetic energy spectra [2]. The two slopes are calculated in correspondence of two intervals: from 1000 km to 200 km (medium scale) and from 200 km to 40 km (local scale). The values of these slopes change with the cloud dynamical structures and we use the values of these spectral slopes to identify the laminar and turbulent regions in the images automatically. Another parameter well correlated to the cloud turbulent-laminar aspect is the difference between the first wavenumber (1000 km) and the mean value of the power spectrum in the interval from 40 km to 20 km. This gap of power spectrum is able to highlight the different dynamical conditions. In particular, it removes the ambiguity present in the value distribution of the slopes in the case of transverse laminar fluxes respect to the zonal motion.

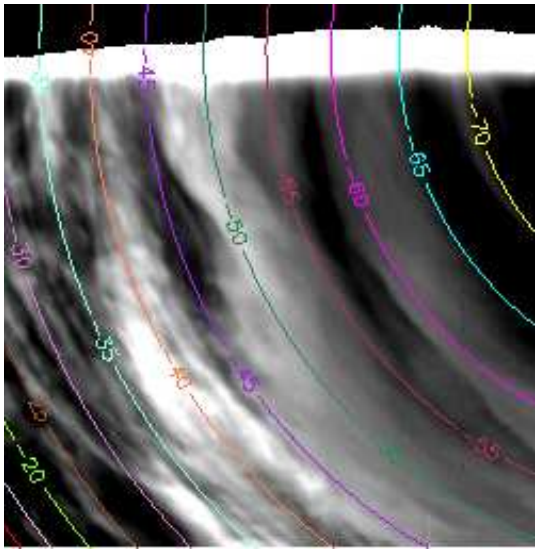

Figure 1: a typical VIRTIS image at 1.7 μm showing the Venus clouds on the night side at about 48 km of altitude from the surface. The colored curved lines indicate the latitude in degrees.

EPSC Abstracts,
Vol. 4, EPSC2009-541, 2009
European Planetary Science Congress,

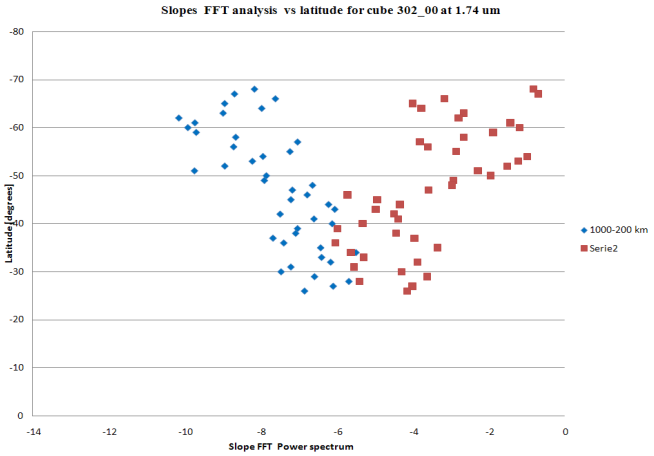

Figure 2: the FFT Power spectrum slope values versus latitude for the samples from Fig. 1.

References

[1] Peralta, J., Hueso, R. and Sánchez-Lavega, A. (2007) *Icarus*, 188, 305-314.

[2] Vallis, G.K., (2006) *Atmospheric and Oceanic Fluid Dynamics: Fundamentals and large scale Circulation*, 234-387.