

Dependence of longitudinal distribution of zonal wind and UV albedo at cloud top level on Venus topography from VMC camera onboard Venus Express

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Abstract

A set of UV images obtained by the Venus Monitoring Camera (VMC) [3] was processed by manual and digital methods [2]. Analysis of longitude-latitude distribution of the zonal wind for 49,700 (139 orbit) visual and 457,850 (722 orbit) digital individual wind measurements allowed us to find an influence of Venus topography on change of the average zonal wind in latitude range from 5°S to 15°S from -100.9 m/s in the longitude range 200-300° to -83.4 m/s in the range 60-100° [1].

Investigation of other latitude ranges by using a correlation method demonstrates that correlation shift depends on height of the obstacle streamlined by a flow. Dependence was found for both the average zonal stream and UV albedo averaged for the entire period of observations.

Introduction

An unprecedented number of UV images of upper clouds of Venus, obtained by VMC on the Venus Express spacecraft was used to study the circulation of the mesosphere [2, 4]. The long observation period (from 2006 to 2014) and good longitude-latitude coverage by single measurements allowed us to eliminate short-periodic changes in the velocity component in the zonal flow and to focus on the study of the slow-periodic component. We managed to trace the influence of topography of the underlying surface on the behavior of the mean zonal flow and the average UV albedo for a set of latitude intervals of 10°.

Results

Longitudinal profiles of surface altimetry, average zonal wind speed and average UV albedo were constructed for each latitudinal range. Then correlations between altimetry profiles and profiles of speed and albedo were considered. Shifts between correlated profiles were defined for the maximum correlation coefficient. Dependence was found between the shift and the maximum height difference of the surface relief in a given latitudinal range.

Figure 1 shows dependence between the maximum height difference and the shift for average zonal stream (visual and digital methods) and albedo at low south latitudes. The shift between the correlated profiles increases when the maximum height difference decreases (to the south of *Aphrodite Terra*) and therefore the influence of the surface relief is delayed. Due to peculiarities in Venus atmosphere circulation, the influence of the meridional component becomes noticeable at 30 °S. It can be seen on Fig. 1 as cease in growth of correlation shift when the height decreases.

In the middle latitudes, circulation becomes more complex, which is reflected in values of correlation coefficients. The coefficients have low values that don't allow us to track the influence of relief.

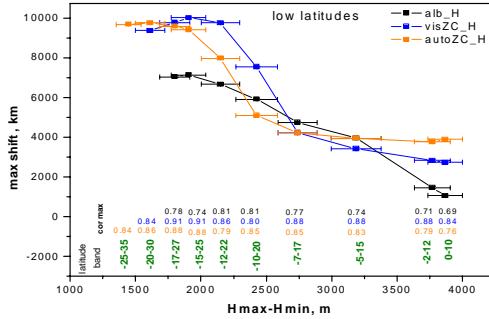


Figure 1. Dependence between the correlation shift and the maximum height difference of the surface relief for a set of latitude intervals 10° wide. The dependence for the average zonal wind by visual method is shown in blue, by digital one in orange, and for albedo in black. This is for **low south latitudes**. Blue, orange and black numbers correspond to correlation coefficients. Green ones – to the latitudinal bands.

In the high south latitudes (Figure 2), due to bad coverage with data, it is only possible to track the dependence between topography and albedo. The latitudinal interval of 60°S - 70°S is a rather stable area of transition between the middle-latitude circulation (jet region) and polar circulation where influence of a polar vortex is significant [4]. There is the same height in this area called *Erzulie Mons*. We observe here the same dependence of correlation shift on height, as in latitudes of *Aphrodita Terra*.

Summary and Conclusions

The analysis confirms the influence of the underlying surface topography on the change of speed of the average zonal wind and UV albedo, and also establishes dependence of this influence on the maximum difference of heights in the chosen width interval.

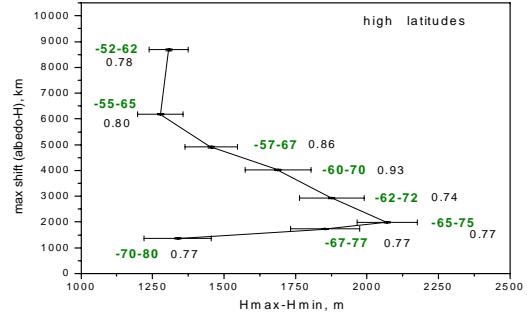


Figure 2. The same as Fig.1, but for **high south latitudes**. Only for albedo.

Acknowledgements

M. Patsaeva, I. Khatuntsev, A. Turin were supported by the Program 9 of the RAS Presidium.

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