ATMOSPHERIC DYNAMICS OF VENUS USING AKATSUKI'S SPACE-BASED OBSERVATIONS AND CLOUD TRACKING TECHNIQUES

Daniela Espadinha [1], Pedro Machado [2], Javier Peralta [3], Gabriella Gilli [2], José Silva [2], Ruben Gonçalves [2], Miguel Silva [2], Francisco Brasil [2]

(1) Instituto de Astrofísica e Ciências do Espaço. (Portugal) despadinha@oal.ul.pt
(2) Instituto de Astrofísica e Ciências do Espaço. (Portugal)
(3) Japan Aerospace Exploration Agency. (Japan)

Abstract

1. Introduction

General circulation models for planetary atmospheres are a standout amongst the most significant bases and tools of atmosphere dynamics in planetary sciences. Such models are regularly the result of the analysis of great amounts of observations so they can be sufficiently accurate to properly describe and portray circulation on our target planets. There is additionally the possibility of application of these models to other celestial bodies outside of our solar system. In order to increase this accuracy, we analyzed Akatsuki's (Venus Climate Orbiter) Ultraviolet Imager (UVI) data so that we could model wind velocities at two different cloud levels.

2. Cloud Tracking Method

The cloud tracking method gets its results from the analysis of image sequences that follow cloud patterns on Venus's atmosphere. Considering two images, one taken of a certain cloud area with all its features and shapes and another of the same area taken some time after the first.

Manually, one point is selected in each image which corresponds to the same feature and a correlation vector is then determined. You know the time and you know displacement, therefore, you know the velocity of the wind at that point.

This method is applied after the images are processed in terms of brightness and contrast so that its features can be seen more clearly making the manual process less complicated.

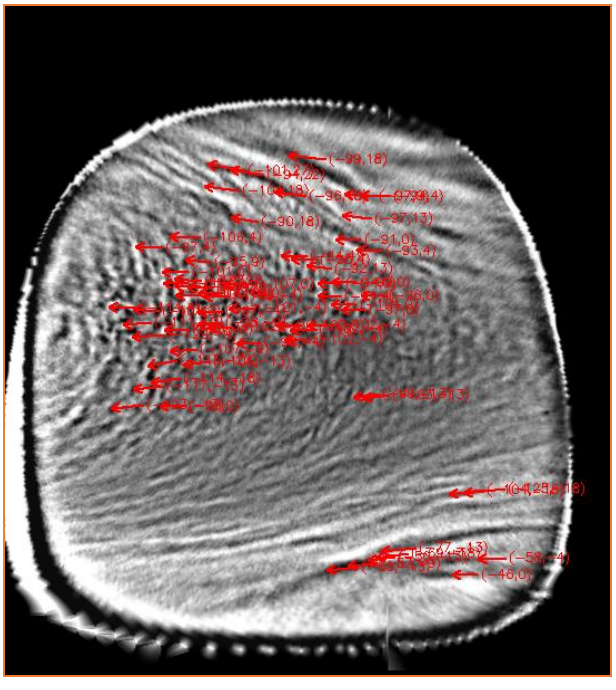

Figure 1. *Processed UVI image with correlation vectors(red).*

3. Results

Data from six mission days (from 26 of January 2017 to 31 of January 2017) was processed and analysed using the two UVI bandpass filters centred at the 283 and 365nm wavelengths (both in ultraviolet). These filters sound the atmosphere at about 70km of altitude, the 283nm filter sounds about 2 to 3km above the 365nm filter.

Zonal wind (wind component measured parallel to the latitude of the planet) profiles were retrieved for each of the days and each filter. It is observed that each day shows a steady wind velocity profile with a quick drop in velocity when reaching the poles.

The steady profile part is centred at about 102km/s for the 365nm cloud level. The analysis of winds on the 283nm level shows velocities of 10 to 15km/s higher than the previous filter following the same tendency (steady profile with a quick drop when reaching the poles).

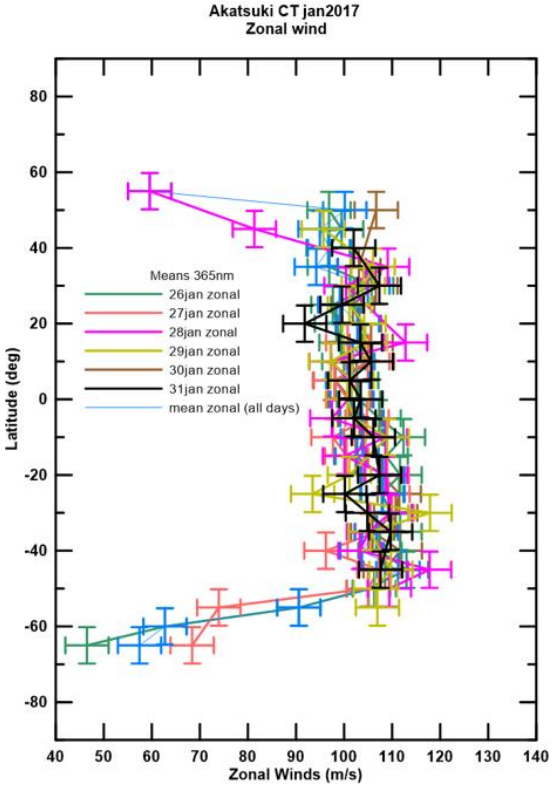

Figure 2. *Zonal wind profiles in the 365nm filter (the graph shows the module of the velocity since winds on Venus blow westward) with a 5-degree binning.*

4. References

[1] Sánchez-Lavega, A., et al. "Variable winds on Venus mapped in three dimensions", GEOPHYSICAL RESEARCH LETTERS, VOL. 35, 2008.

[2] R. Hueso, J. Peralta, I. Garate-Lopez, T. V. Bandos, and A. Sanchez-Lavega. “Six years of Venus winds at the upper cloud level from UV, visible and near infrared observations from VIRTIS on Venus Express.”, August 2015.