EPSC Abstracts
Vol. 10, EPSC2015-858, 2015
European Planetary Science Congress 2015

Context images for Venus Express radio occultations: a search for a dynamical-convective origin of cloud-top UV contrasts

C. Wilson (1), M. Roos-Serote (1), R. MacDonald (1), S. Tellmann (2), B. Häusler (3)
(1) AOPP, Univ. of Oxford, UK (wilson@atm.ox.ac.uk), (2) Rheinisches Institut für Umweltforschung, Universität zu Köln, Germany, (3) Institut für Raumfahrttechnik, Universität der Bundeswehr München, Germany

Abstract

In this paper, we present a comparative analysis between data from the Venus Express Radio Science experiment (VeRa) and the Venus Monitoring Camera (VMC) UV channel. We compare the temperature structure derived from VeRa measurements with VMC-UV brightness at that same location, in search for any correlation. In the data analysed to date – which were all obtained at high Southern latitudes – we find no strong correlations, implying that we can find no evidence for a dynamical-convective origin of the UV contrasts at these latitudes. We suggest that the contrasts are formed at lower latitudes, a hypothesis which will be examined by looking at lower-latitude observations.

1. Introduction

It has been known for many decades that Venus shows strong contrasts when observed at UV wavelengths, as opposed to longer wavelengths in the visible and NIR, where Venus looks very homogeneous. This has been explained by the presence of a so-called UV absorber, which chemical identity is still unclear. Two hypothesis concerning the source and distribution of the UV-absorber have been put forward. For one of them the argument is that the absorbing substance is being transported from below the clouds up to the cloud top level by means of convection. This implies that in regions with more convection the absorber would be more abundant at the cloud-tops, thus resulting in lower brightness when observed in the UV. In the other scenario, it is haze-forming material which is brought to the cloud-tops by convection; in this case regions with stronger convection produce higher cloud tops would therefore show brighter in the UV.

The premise behind the current analysis is to combine data from the Venus Express Radio Science experiment (VeRa) and from the Venus Monitoring Camera (VMC), to search for any correlation between the temperature structure (T_z, $[dT/dz]_z$, static stability, S_z) as sounded on one specific location and the UV brightness of that same location.

2. Data

Between 25 November and 31 December 2013 a special observing "South Polar Dynamics" campaign was performed with Venus Express (Figure 1). On

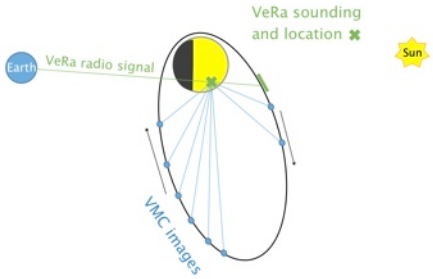

Figure 1: Geometry for the late 2013 South Polar campaign

each orbit one VeRa atmosphere sounding was acquired shortly after the pericentre passage, as well as a series of VMC-UV images capturing the very VeRa sounding location on that orbit before and after the sounding as it moves across the planet pushed by the zonal and meridional winds. The sounded latitudes varied between -83° and -48°. An example is shown in Figure 2.

We used the average wind field data from [1] to correct for wind motion in the interval between the VeRa sounding and each VMC image. An example of a selection of images from one orbit is shown in Figure 3. We did attempt to use wind tracking data specifically obtained from images on each orbit, but we found the dispersion in these data was too large to provide meaningful results.

Once the wind-corrected VeRa-sounded location was

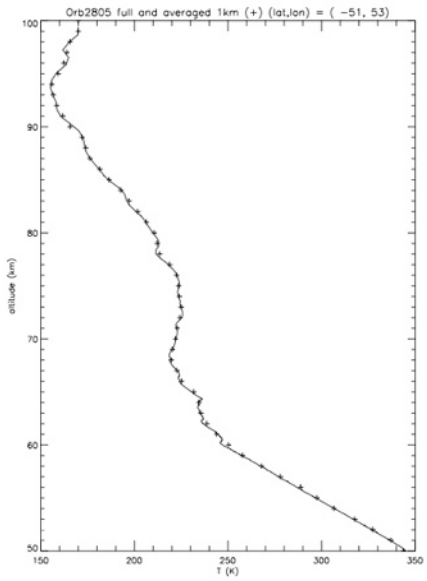

Figure 2: Example of a resulting T(z) from VeRa sounding (25 Dec. 2015).

identified in each VMC-UV image, the relative UV-brightness was determined from the whole series of images at the locations of the VeRa sounding for each orbit, taking into account the changing viewing geometry (phase angle, incidence angle and emergence angle).

3. Analysis

The question is whether or not we can identify any statistically significant correlations between the temperature structure at a given location and the relative UV-brightness (Br) at that same location. We compare T_z and $[dT/dz]_z$ and S_z for levels between 50 and 80km altitude to the relative UV brightness for 30 orbits. No significant correlations have been found at the time of submission of this abstract. At the moment, we are extending our analysis to a wider dataset, including an another ~ 60 orbits with VeRa sounded latitudes closer to the equator.

References

[1] Khatuntsev, I.V. et al.: Cloud level winds from Venus Express Monitoring Camera imaging, Icarus, Vol. 226, pp. 140-158, 2013.

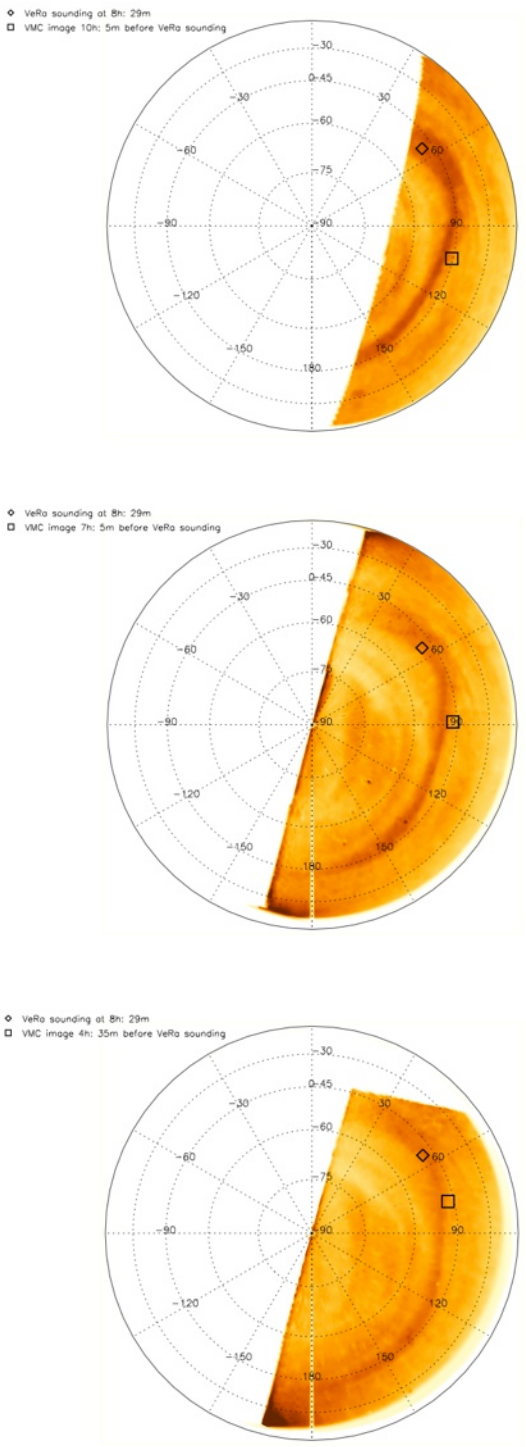

Figure 3: VMC UV 25 Dec. 2015. Diamond is the Vera sounded location, square is that same location at the time of the image at 10h, 7h and 4.5h before the VeRa sounding.