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Monitoring of Short Term Wind and Temperature Variations in Venus Upper Atmosphere Derived from Ground-based Infrared Spectroscopy

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Abstract

The atmosphere of Venus is unique in our solar system. The dynamical structure as well as the temperature distribution are under ongoing investigations and a stable sub solar to anti solar flow has been detected [1]. Recently, advanced ground-based and space-based observing methods have shown that the atmosphere is much more active than formerly believed. The temperature gradient shows significant deviation from a simple sub solar to anti solar distribution. Also the wind velocities show more variability than predicted before. Wave mechanisms may cause variability in wind velocities as well as in temperatures.

Hoshino et al 2012 [2] implemented wave mechanisms in a global circulation model and predicted variations in the wind velocity with a maximum of ±4m/s in the equatorial regions at an altitude of 110km due to Kelvin waves with periods of four days. Nagakawa et al (2012) [3] predicted gravity waves with amplitudes up to 15m/s in this altitude.

In March 2012 the Tuneable Heterodyne Infrared Spectrometer (THIS) of the University of Cologne was installed at the McMath Pierce Telescope on Kitt Peak, Arizona to observe the Non-LTE emission line of CO_2 at 10 microns in the atmosphere of Venus. This feature occurs only in a low pressure environment, about 0.001mbar corresponding to an altitude region of about 110km. From the Doppler shift of the line it is possible to calculate the movement of the molecules in the atmosphere. The line width contains information about the temperature of the molecules. THIS features the possibility for ground-based measurements of wind velocities with high precision down to 10m/s [4]. The observing geometry was especially chosen to search for variability in the equatorial region where the Kelvin waves are expected. We are going to present unique data covering measurements of the same positions over twelve days in order to retrieve detailed information over temporal variability.

References

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