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Temperature and Wind in the Venusian Upper Atmosphere Measured by Ground Based Infrared Spectroscopy

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The dynamical structure and the behavior of temperatures in the Venusian upper atmosphere is not yet fully understood. Especially short and long term variations indicate that waves might have a significant influence [1,2]. So far space based observations can only partially provide temperatures [3,4] and do not offer direct wind measurements [5,6]. Ground-based results still lack in time coverage and spatial resolution. Hence measurements on various time scales and on different locations with sufficient spatial resolution on the planet are important. Such observations were carried out with the Tunable Infrared Heterodyne Spectrometer (THIS) which was developed at the I.Physikalisches Institut, University of Cologne [8]. Beside high spectral resolution (R>10to7) this technique also guarantees high spatial resolution. Temperatures and winds in planetary atmospheres can be retrieved from detection and full resolution of narrow non-LTE emission lines of CO_2 at 10μm. These emission lines are induced by solar radiation and can only occur within a narrow pressure/altitude region around 110km [6]. Temperatures are retrieved from the Doppler-width of emission lines with a precision down to 5K [7]. Wind velocities can be determined from Doppler-shifts of the emission feature providing a precision down to 10 m/s [8,9].

Five observing runs between 2010 and 2013 at the McMath Pierce Solar Telescope on Kitt Peak and at the NASA IRTF on Mauna Kea were dedicated to collect day-side temperatures and wind information in the Venusian upper atmosphere at an altitude around 110 km. The primary focus of these campaigns was the tracking of the short and long term temporal behavior and information about the spatial variation.

Data analysis is still ongoing. First investigations confirm the dominance of the sub solar to anti solar flow in the order of 140m/s. Nevertheless we do see an additional wind component and short term temporal variations which need further investigations. E.g. measurements in the northern and southern hemisphere close to the equator revealed a systematic difference between the southern and the northern hemisphere even though the observed positions are very close to each other. Detailed analysis of all observations and interpretations will be accomplished and results including conclusions will be presented at the conference.

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