



Observed correlation of Venus topography with the zonal wind and albedo at cloud top level: the role of stationary gravity waves.

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Based on the analysis of UV images (at 365 nm) of Venus cloud top (altitude 67 ± 2 km) collected with VMC (Venus Monitoring Camera) on board Venus Express (VEX), it is found that the zonal wind speed south of the equator (from 5°S to 15°S) shows a conspicuous variation (from -101 to -83 m/s) with geographic longitude of Venus, correlated with the underlying relief of Aphrodite Terra. We interpret this pattern as the result of stationary gravity waves produced at ground level by the up lift of air when the horizontal wind encounters a mountain slope. These waves can propagate up to cloud top level, break there and transfer their momentum to the zonal flow. Such upward propagation of gravity waves and influence on the wind speed vertical profile was shown to play an important role in the middle atmosphere of the Earth by Lindzen [1981], but is not reproduced in a current GCM of Venus atmosphere.

Consistent with present findings, the two VEGA mission balloons experienced a small, but significant, difference of westward velocity, at their 53 km floating altitude.

The albedo at 365 nm varies also with longitude and latitude in a pattern strikingly similar in the low latitude regions to a recent map of cloud top H_2O [Fedorova et al., 2015], in which a lower UV albedo is correlated with increased H_2O . We argue that H_2O enhancement is the sign of upwelling, suggesting that the UV absorber is also brought to cloud top by upwelling.