EPSC Abstracts
Vol. 8, EPSC2013-675-1, 2013
European Planetary Science Congress 2013

Atmospheric waves on Venus as seen by the Venus Express Radio Science Experiment VeRa

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Abstract

Next to quasi-horizontal waves and eddies on near planetary scales, diurnally forced eddies and thermal tides, small-scale gravity waves and turbulence play a significant role in the development and maintenance of atmospheric super rotation.

1. The VeRa Radio Science Experiment

The Venus Express Radio Science Experiment VeRa has analysed more than 700 atmospheric profiles in the mesosphere and troposphere of Venus in the approximate altitude range of 40-90 km [1,2]. These profiles cover a wide range of latitudes and local times, enabling us to study atmospheric wave phenomena at different spatial scales in the mesosphere and troposphere [3].

2. Atmospheric Waves

Small-scale temperature variations with vertical wavelengths of 4 km or less have significant wave amplitudes in the stable atmosphere above the tropopause as compared with the only shallow temperature perturbations in the adjacent middle cloud layer.

We find evidence for a local time dependence of gravity wave activity in the low latitude range: gravity wave amplitudes are at their maximum in the early afternoon, strongly suggesting that convection is a possible wave source. We also find that the gravity wave activity has a strong latitudinal relationship with increases in wave activity with increasing latitude in both hemispheres.

These results suggest that convection (at low latitudes) as well as topographical forcing (at high northern latitudes), possibly in combination with convection and/or Kelvin-Helmholtz instabilities, are possible key processes for the generation of gravity waves [4].

References

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