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The inversion layer at the tropopause of the Venus atmosphere: new insights from the Radio Science Experiment (VeRa) onboard Venus Express

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Abstract

The inversion layer at the tropopause of the Venus atmosphere is a very common and prominent feature in the vertical temperature profile at higher latitudes. The inversion layer is of particular interest because it separates the stratified troposphere from the highly variable mesosphere. The altitude range of the inversion layer is therefore a likely location for the formation of gravity waves [1]. The Radio Science Experiment (VeRa) onboard Venus Express [2,3] is capable to sound the Venus atmosphere from 100 km downward to 40 km [4,5] and delivered more than 800 vertical profiles of temperature, pressure and neutral number density at almost all local times and latitudes. The tropopause is typically located at 60 km altitude. Spatial changes of the refractive index over a short altitude range lead to multi-path effects which cannot be fully retrieved with common closed-loop recording methods. The development of a new data processing tool based on VeRa open loop data sets provided the necessary frequency resolution to fully resolve multipath effects occurring along a short range of 2 km at the tropopause location.
The inversion layer presents itself up to 15K colder than commonly thought. The new results shall help to find a consistent picture of the Venus' thermal atmosphere structure and therefore help to improve atmospheric models.

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