# Variability of Venusian Polar Tropopause Studied by Radio Occultation and Venus SCALE-GM

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In the Venusian atmosphere, a cloud layer composed mainly of sulfuric acid exists at altitudes of 50–70 km. Near the cloud base, infrared radiation emitted from the lower atmosphere is absorbed, driving convection in the lower and middle clouds (approximately 50–55 km) and forming the troposphere. In addition, a large-scale meridional circulation is thought to exist, in which air rises at low latitudes, flows poleward near the cloud top, and descends at high latitudes to return to the troposphere, producing adiabatic heating above the troposphere. As a result, the high-latitude tropopause is formed as a boundary between subsidence-induced heating and convective control of temperature, and its structure plays an important role in material and energy transport between the troposphere and the stratosphere. Based on temperature data from radio occultation observations by the Venus Express spacecraft, Ando et al. (2017) identified temperature variations on timescales of several days in the polar region and attributed them to planetary-scale waves. By analyzing a larger data set, we further showed that the tropopause height also varies on similar timescales and that there is a strong positive correlation between the temperature below the tropopause and the tropopause height. These features suggest meridional advection of the background atmospheric structure associated with planetary-scale waves, but direct verification has been difficult because meridional wind cannot be obtained from radio occultation observations. In this study, we investigate this mechanism using numerical simulations with the global non-hydrostatic Venus atmospheric model, Venus SCALE-GM. The model reproduces a positive correlation between temperature anomalies and tropopause height. Moreover, the meridional wind and temperature fields around 55 km altitude exhibit a prominent wavenumber-1 structure at high latitudes. Wavenumber–frequency analysis indicates a period of about 6 Earth days and westward propagation relative to the background flow, consistent with a Rossby wave.

 