Tropical temperature and tropopause trends from vertically high-resolved observations

Florian LADSTÄDTER[1,2], Hallgeir WILHELMSEN[1,3], and Andrea K. STEINER[1,2,3]

[1] *Wegener Center for Climate and Global Change (WEGC), University of Graz, Graz, Austria*
[2] *Institute for Geophysics, Astrophysics, and Meteorology/Institute of Physics, University of Graz, Austria*
[3] *Doctoral Programme Climate Change, University of Graz, Graz, Austria*

Observations capable of detecting vertically resolved changes in the thermodynamical state of the tropical atmosphere are sparse. The radiosonde record, while going back several decades, has relatively few measurements available in the tropics, and suffers from homogenization problems due to instrument changes. The only other observational system for highly-resolved measurements of thermodynamical variables is GNSS radio occultation (RO), providing a global record with high accuracy since 2001.

In this study we use the potential of RO to investigate vertically resolved climate change signals in the tropical upper troposphere/lower stratosphere region. We examine the various contributions to atmospheric variability including the Quasi-Biennial Oscillation, El Niño–Southern Oscillation, volcanic eruptions, and solar variability, and discuss the challenges in the detection of short-term trends. We then use RO to study differences in the observed vertically resolved trends between radiosondes and RO.

The quality of the RO measurements is notably accurate in the tropopause region, where data of high vertical resolution is of particular value. We study the variability and trends of the tropopause based on RO. We investigate in detail various tropopause parameters, such as the lapse rate tropopause temperature and height, the cold point tropopause temperature and height, and the tropical tropopause layer. We compare these results with tropopause parameters based on radiosonde data and reanalysis data.

Key words: GPS radio occultation, climate monitoring, atmospheric trends, tropopause