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Temperature trends and variability in the troposphere and stratosphere from GPS radio occultation

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Radio occultation (RO) based on Global Positioning System (GPS) signals provides satellite observations of atmospheric thermodynamic variables for more than 16 years now. From a climate perspective this is still a short record, however, RO measurements are of high quality and deliver a long term stable and consistent global climate record in the troposphere and the lower stratosphere.

Here we use the latest Wegener Center OPSv5.6 record from 2001 to 2017 to investigate vertically resolved temperature change signals in the atmosphere. We analyze the different contributions to atmospheric variability, including the seasonal cycle, the Quasi-Biennial Oscillation, El Niño–Southern Oscillation, volcanic eruptions, and solar variability. We discuss challenges and uncertainties regarding the detection of vertically resolved short-term trends.

We find that RO observations very well capture atmospheric variability. Vertically resolved trends of the RO record agree with trends in radiosondes and reanalyses. The RO record is found well suited for monitoring atmospheric climate variability and change and as a reference record for the validation of upper-air observations.