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Comparing Stratospheric Temperature Records from GPS Radio Occultation, MSU/AMSU, and Radiosondes

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The upper troposphere-lower stratosphere (UTLS) region reacts sensitively to climate change. Detecting the anthropogenic climate change there requires high quality observations. Upper air temperature time series exist primarily from radiosondes (since 1958) and from satellite measurements, the latter provided by the (Advanced) Microwave Sounding Unit (A)MSU (since 1979). Neither of the instruments was originally intended for climate monitoring. Thus, demanding intercalibration and homogenization procedures are required to establish a climate record. Though improved agreement in UTLS trends of these records was achieved recently, uncertainties concerning the magnitude of upper air temperature trends still remain.

The relatively new radio occultation (RO) technique is well suited to overcome these problems. It uses Global Positioning System (GPS) radio signals in limb sounding geometry to deliver observations in the UTLS region with high accuracy, global coverage, and high vertical resolution. Additionally it is self-calibrating, avoiding the need of error-prone intercalibration routines. These properties qualify RO data as climate benchmark data.

A first comparison of RO data with (A)MSU and radiosonde data showed basically good agreement, but significant trend differences to (A)MSU in the tropical lower stratosphere. In this follow-on study, the most recent RO temperature records are used to calculate synthetic MSU layer-average brightness temperatures for the lower stratosphere (TLS). The equivalent MSU temperatures for individual RO profiles are derived using the state-of-the-art radiative transfer model RTTOV (Met Office, UK). Monthly-mean zonal-mean synthetic temperatures are then compared to recent (A)MSU data provided by the University of Alabama in Huntsville (UAH, USA) and Remote Sensing Systems (RSS, USA), and to recent radiosonde data sets (RAOBCOREv1.4 and RICH) provided by the University of Vienna (UOV, Austria). First results are presented.