COMPARING GPS RADIO OCCULTATION TEMPERATURE RECORDS WITH MSU/AMSU AND RADIOSONDES FOR THE LOWER STRATOSPHERE

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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, delivering 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 study (Steiner et al., JGR, 2007) comparing RO with (A)MSU data showed significant differences between the data sets in the tropical lower stratosphere. In this follow-on study, the most recent RO records from CHAMP, GRACE and COSMIC are used to calculate synthetic MSU layer-average brightness temperatures for the lower stratosphere (TLS). The synthetic 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). In this comparison, the sampling error (resulting from uneven or sparse spatial and temporal sampling) for RO as well as for radiosondes is also taken into account.