Detecting anthropogenic climate change in the upper troposphere-lower stratosphere (UTLS) region requires high quality observations. Upper air temperature time series exist primarily from radiosondes (since 1958) and from satellite measurements, the latter is provided by the (Advanced) Microwave Sounding Unit (A)MSU (since 1979). None of these instruments was originally intended to be used for climate monitoring. Thus, demanding intercalibration and homogenization procedures are required to establish a climate record, and uncertainties concerning the magnitude of upper air temperature trends still remain.

The relatively new radio occultation (RO) technique is qualified 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, thus avoiding the need of error-prone intercalibration routines. In this comparative study, the most recent RO records are used to calculate synthetic MSU layer-average brightness temperature anomalies for the lower stratosphere. Monthly-mean zonal-mean synthetic temperature anomalies are then compared to three recent (A)MSU records provided by the University of Alabama in Huntsville (UAH, USA), Remote Sensing Systems (RSS, USA), NESDIS Center for Satellite Applications and Research (STAR, USA), and to two recent radiosonde data sets (RAOBv1.4 and RICH) provided by the University of Vienna (UOV, Austria), respectively. Error characteristics resulting from uneven or sparse spatial and temporal sampling of the various datasets are taken into account to estimate the influence of sparse sampling on differences between the anomaly sets.