CLIMATE CALIBRATION OBSERVATORY IN ORBIT: CALIBRATION AND VALIDATION OF MEASUREMENTS OF AMSU AND AIRS USING GLOBAL POSITIONING SYSTEM RADIO OCCULTATION OBSERVATIONS

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The purpose of this study is to demonstrate the usefulness of Global Positioning System (GPS) Radio Occultation (RO) data to serve as a climate calibration observatory in orbit to calibrate and validate two widely used satellite sounders, the Advanced Microwave Sounding Unit (AMSU) and the hyper-spectral infrared sounding from Atmospheric Infrared Sounder (AIRS). Combined with AMSU measurements, the AIRS is the first of a new generation of operational remote sensors for upwelling atmospheric emission that provide excellent temperature and water vapor retrievals at middle atmosphere, which has significant impacts on short-term numerical weather forecasts. However, both AIRS and AMSU also exhibit biases in retrieving atmospheric temperatures and moistures when compared with in situ measurements. These retrieval biases have diverse and complex dependencies on the temperature/moisture being measured, the season and geographical location, surface conditions, and sensor temperature, which is difficult to quantify. In this study, we use COSMIC RO data to simulate AMSU and AIRS brightness temperatures for the lower stratosphere (TLS) and compare them to AMSU TLS and those of AIRS brightness temperatures at the same height. Our analysis shows that because RO data do not contain mission-dependent biases and orbit drift errors, and are not affected by on-orbit heating and cooling of the satellite component, they are very useful to identify the AMSU time/location dependent biases for different NOAA missions and long term drift of the AIRS retrieved temperatures. The derived TLS record is compared with the newly available TLS datasets provided by Remote Sensing Systems (RSS) and University of Alabama in Huntsville (UAH). The causes of the TLS differences among these datasets are discussed.