VALIDATION OF SPIRE RADIO OCCULTATION RETRIEVALS WITH SNPP ATMS MICROWAVE AND RADIOSONDE MEASUREMENTS

X. Shao (1), S.-P. Ho (2), Y. Chen (2), X. Zhou (3), and B. Zhang (1)

(1) CISESS/ESSIC, University of Maryland, College Park, USA
(2) NOAA/NESDIS/STAR, USA
(3) Global Science & Technology, Inc., USA

The Global Navigation Satellite System (GNSS) radio occultation (RO) data play an essential role in numerical weather prediction (NWP) and climate change monitoring. Spire RO data were provided to NOAA under the Commercial Weather Data for RO (CWD-RO) project to evaluate the commercial RO data quality. To ensure the data quality from Spire is consistent with other RO missions and is not significantly deviated from observations by NOAA's satellite, we need to quantify their accuracy and retrieval uncertainty carefully. In this work, the Spire Wet Profile (wet temperate and humidity profiles) data from 2021-09 to 2022-03 (Delivery Order-3) processed by the University Corporation for Atmospheric Research (UCAR) are evaluated through comparison with Suomi National Polar-orbiting Partnership (SNPP) Advanced Technology Microwave Sounder (ATMS) microwave sounder measurements and collocated radiosonde measurements. Observations from RO, microwave sounders such as ATMS, and radiosonde are all assimilated into NWP. The inter-consistency among Spire RO, SNPP ATMS, and radiosonde data is critical in improving the global weather forecasts and monitoring/predicting severe weather events, and still remains challenging to be quantitively characterized. Through the Community Radiative Transfer Model (CRTM) simulation, the microwave sounder SNPP ATMS and Spire RO measurements are compared over the ATMS sounding channels CH07 to CH14 (temperature channels) with weighting function peak height from 8 to 35 km and CH19 to CH22 (water vapor channels) with weighting function peak heights ranging from 3.2 to 6.7 km. Biases of the evaluated channels' brightness temperature (BT) are within ±0.6 K, indicating the consistency between CRTM-simulations using Spire data and ATMS data. For the ATMS moisture channels CH19-21, the Spire versus ATMS BT biases are consistent within 0.1 K. In the Spire retrievals versus RS41radiosonde observations (RAOB) inter-comparison study, the height-dependent mean temperature/humidity biases and their associated uncertainties are evaluated. In general, over the height region between 8 km and 26 km, the RS41 RAOBs match Spire temperature profiles very well with temperature biases < 0.04 K. Below 4 km, the Spire humidity retrievals deviate from RS41 RAOBs with increasing negative humidity biases approaching the surface, which can be attributed to the negative refractivity biases due to the super-refraction conditions. The RAOB data quality can be affected by the solar illumination correction. Spire data also provide an opportunity to serve as a reference.