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Radiosonde temperature observations have been available since 1958. Despite different senor types and various radiative bias correction were used during different time periods, radiosonde temperature data from multiple sensor types have been used to construct long-term temperature trends in the troposphere and lower stratosphere.

In this study, we use consistently reprocessed Global Positioning System (GPS) radio occultation (RO) temperature data derived from the COSMIC and Metop-A/GRAS missions from 2006 to 2014 to characterize the inter-seasonal and interannual variability of temperature biases in the upper troposphere and lower stratosphere for different radiosonde sensor types. The results show that the temperature biases for different sensor types are mainly due to (i) uncorrected solar zenith-angle-dependent errors and (ii) change of radiation correction. The mean radiosonde–RO global daytime temperature difference in the layer from 200 to 20 hPa for Vaisala RS92 is equal to 0.20 K. The corresponding difference is equal to 0.06K for Sippican, 0.71K for VIZ-B2, 0.66K for Russian AVK-MRZ, and 0.18K for Shanghai. The global daytime trend of differences for Vaisala RS92 and RO temperature at 50 hPa is equal to 0.07 K/5 yr. Although there still exist uncertainties for Vaisala RS92 temperature measurement over different geographical locations, the global trend of temperature differences between Vaisala RS92 and RO from June 2006 to April 2014 is within 0.09 K/5 yr. Compared with Vaisala RS80, Vaisala RS90, and sondes from other manufacturers, the Vaisala RS92 seems to provide the most accurate RAOB temperature measurements, and these can potentially be used to construct long-term temperature climate data records (CDRs). Results from this study also demonstrate the feasibility of using RO data to correct RAOB temperature biases for different sensor types. We also demonstrate the initial results for using GPS RO temperature data to quantify the temperature biases in the upper troposphere and lower stratosphere obtained from GRUAN RS92 and RS41 sondes.
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