Comparison of Three Retrievals of COSMIC GPS Radio Occultation Results in the Tropical Upper Troposphere and Lower Stratosphere

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Combining Geometrical Optics (GO) and Wave Optics (WO), COSMIC Data Analysis and Archive Center (CDAAC) retrieved two sets of the dry atmosphere temperature (*T*) from COSMIC GPS radio occultation (GPS-RO), which are named as atmPrf2010 and atmPrf2013. The sewing height between WO and GO varied at 10-20 km for atmPrf2010, and it was fixed at 20 km for atmPrf2013. We also derived *T* by applying WO throughout the troposphere and the stratosphere up to 30 km altitude, which is named as rishfsi2013. The height resolution of the atmPrf2010 varied depending on the sewing height, while rishfsi2013 provides high-resolution *T* profiles up to 30 km. The *T* profiles by atmPrf2013 are smoothed over 500 m. Among the three datasets, we compared the *T* variations in the upper troposphere and lower stratosphere (UTLS) over the tropics from October 1, 2011, to March 31, 2012, when radiosonde soundings were conducted as the CINDY-DYNAMO 2011 campaign. The mean *T* profiles were consistent between atmPrf2010 and atmPrf2013. In the other hand, the rishfsi2013 results were colder/warmer than the CDAAC retrievals below/above the tropopause. The mean *T* difference between atmPrf2013 and atmPrf2010 was 0.17 K at the cold point tropopause (CPT), and −0.38 K at the lapse rate tropopause (LRT), respectively. The rishfsi2013 showed the colder *T* at CPT by −0.77 K and −0.59 K relative to atmPrf2013 and atmPrf2010, respectively, and the warmer *T* by 0.60 K and 0.20 K at LRT. During CINDY-DYNAMO we found 134 radiosonde soundings which coincided with GPS-RO within ±3 hours and collocated within 200 km from GPS-RO. The mean *T* difference at CPT from radiosondes was 0.32 K, 0.49 K and −0.24 K for atmPrf2010, atmPrf2013 and rishfsi2013, respectively. That is, both atmPrf2013 and atmPrf2010 had a positive bias at CPT, while rishfsi2013 had a negative bias. Similar comparisons at LRT were −0.45 K, −0.69 K, and −0.41 K, respectively, showing a positive bias for all GPS-RO retrievals. The rishfsi2013 is consistent with the retrievals at CDAAC and radiosondes, and it is useful for the studies of mesoscale *T* perturbations in the UTLS because of the good height resolution.

Keywords: COSMIC GPS Radio Occultation, Full Spectrum Inversion, Retrieval Algorithm, UTLS

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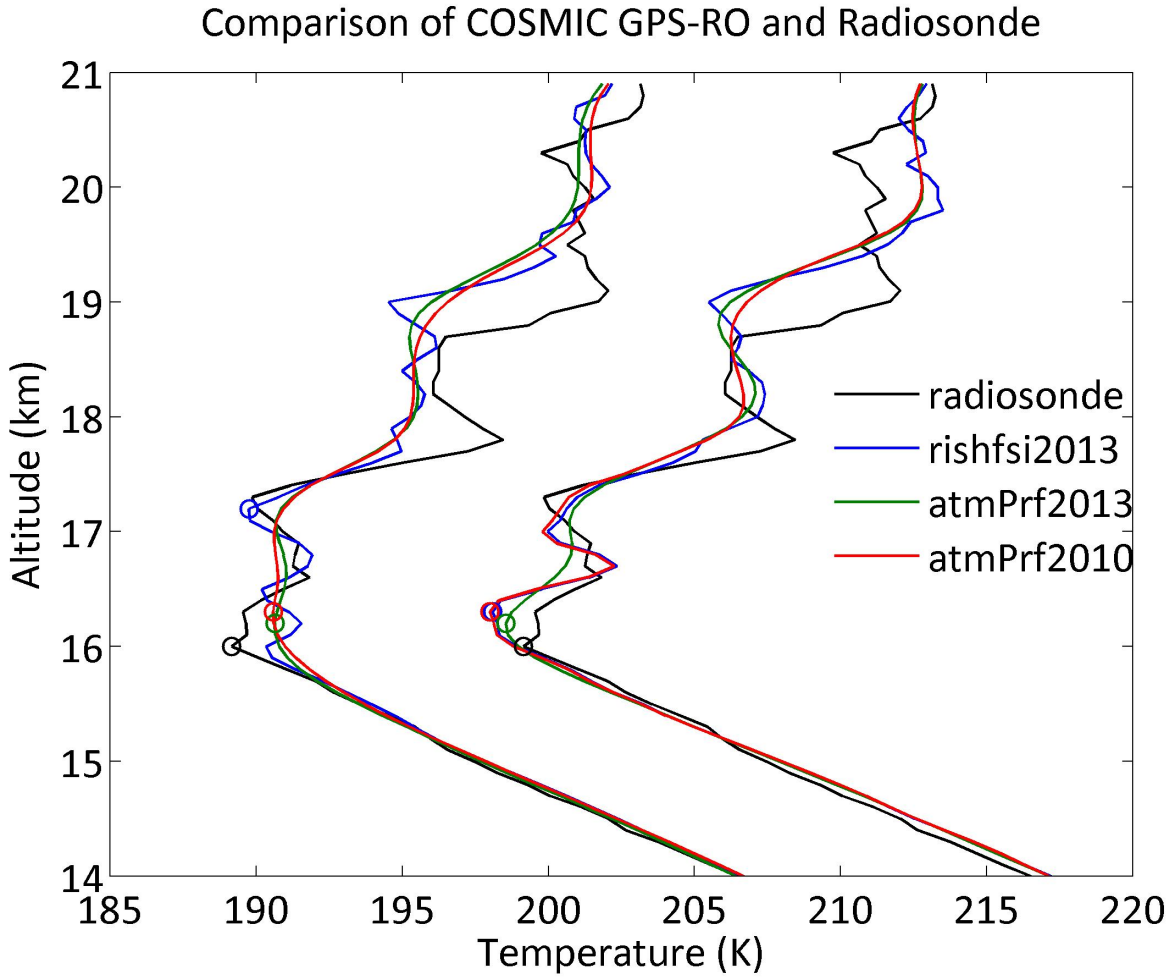

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