Applications of COSMIC Radio Occultation for Climate Monitoring

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Global Positioning System (GPS) Radio Occultation (RO) is a powerful remote sensing technique to provide global all-weather vertical profiles of refractivity, which is a function of temperature, water vapor and pressure. The six-satellite COSMIC mission was successfully launched in April 2006. After the satellites were deployed to operational orbits, ~1,500-2,000 GPS RO soundings are available over the globe every 24 hours. The early phase of the COSMIC mission, when these six COSMIC receivers were closely located, provided a unique opportunity to test the precision of GPS RO measurements, because the independent RO signals travelled through nearly the same atmospheric paths. Comparisons from two COSMIC receivers show that the ranges of median values of dry temperature difference from surface to 30 km are within 0.05 K, and as small as 0.02 K from 3 km to 25 km. The precision of better than 0.05 K in the mean confirms that RO data are benchmark climate observations, and are ideally suited to monitoring climate variability and trends from the surface to 30 km. Applications of COSMIC RO data for climate monitoring are presented.

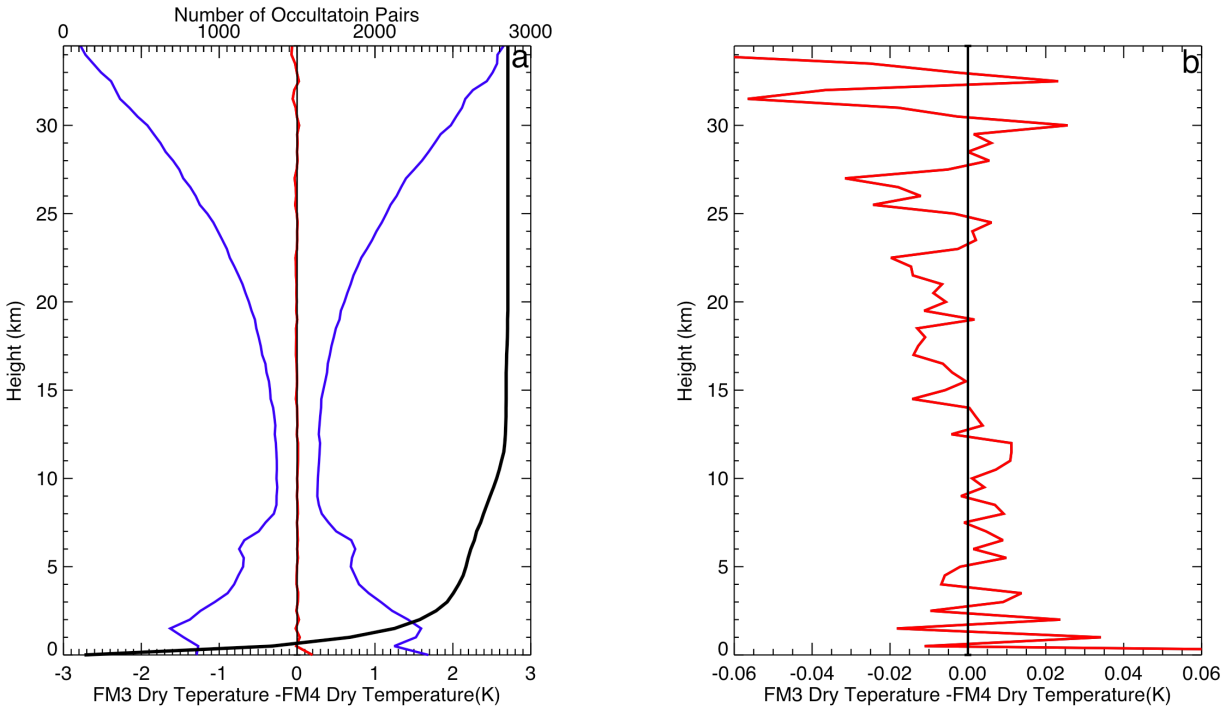

Figure 1. (a) The median and the median absolute deviation (MAD) of the dry temperature difference between two COSMIC satellites (FM3 and FM4) from 2006, day 111 through 300 where the distance between FM3-FM4 receivers is within 10 km. The red line is median, the blue line is MAD, and the black line is the number of the FM3-FM4 profile pairs used in the comparison at various vertical levels. (b) The median of the dry temperature difference between FM3-FM4 as in (a) but on a much smaller temperature scale in x-axis.