APPLICATIONS OF COSMIC RADIO OCCULTATION DATA TO CLIMATE MONITORING: EARLY RESULTS

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The accurate, consistent, and stable observations from different satellite missions are crucial for climate change detection. However, it is not an easy task to construct a consistent temperature record using measurements from different instruments where the characteristics of the instrument may be changed due to its changing environment. The Global Positioning System (GPS) radio occultation (RO) can provide all-weather, high vertical resolution (from $\sim$60 m near the surface to $\sim$1.5 km at 40 km) measurements that have great potential for climate monitoring. Because the basis of the GPS RO measurement is a time measurement against absolute timed and calibrated atomic clocks on the ground, this data type is ideal for use as a climate benchmark. Recently, the six-satellite Constellation Observing System for Meteorology, Ionosphere, and Climate (COSMIC) mission was successfully launched in April 2006. With very high vertical resolution and accuracy, and about an order of magnitude of more soundings ($\sim$2500 profiles) than previously available, with uniform distribution in time and space, COSMIC presents a unique opportunity for validating and inter-calibrating the vertical structure of atmospheric temperatures obtained from other satellite instruments. The objective of this study is to demonstrate the usefulness of COSMIC RO data for climate monitoring. First, we quantify the precision of COSMIC RO data in the early phase of the mission, which is critical for climate monitoring. To demonstrate the long-term stability of GPS RO data, we compare COSMIC dry temperature profiles to that from collocated Challenging Mini-satellite Payload (CHAMP) profiles, which was launched in 2001. To illustrate the usefulness of GPS RO data to inter-calibrate measurements from Advanced Microwave Sounding Unit (AMSU) instruments to potentially improve atmospheric temperature trend analysis, we compare synthetic COSMIC AMSU Ch9 brightness temperatures (Tbs) to AMSU Tbs from NOAA15, NOAA16 and NOAA18. Excellent correlation is found between synthetic COSMIC Tbs and AMSU Tbs from NOAA15, NOAA16 and NOAA18, respectively. The slopes of offsets for each COSMIC-NOAA pairs are derived. Although we have only one year of COSMIC RO data, because the CHAMP RO profiles are highly consistent with that from COSMIC, we can use CHAMP data to demonstrate the usefulness of GPS RO data as independent data for comparison against other satellite observations in climate studies. Finally, we present results from the comparison of the microwave Tb for the Lower Stratosphere (TLS) datasets provided by Remote Sensing Systems (RSS) and University of Alabama in Huntsville (UAH) with the GPS radio occultation (RO) data from CHAMP over 49 months from June 2001 to June 2005.