

# **EXPLORING THE ATMOSPHERE WITH RADIO OCCULTATION—CONTRIBUTIONS TO WEATHER, CLIMATE, AND SPACE WEATHER SCIENCE AND FORECASTING**

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A revolution in atmospheric sounding from space is taking place. The radio occultation (RO) technique, which makes use of radio signals transmitted by the global positioning system (GPS) satellites, has emerged as a powerful and relatively inexpensive approach for sounding the global atmosphere with high precision, accuracy, and vertical resolution in all weather and over both land and ocean. On 15 April 2006, the joint Taiwan-U.S. Constellation Observing System for Meteorology, Ionosphere, and Climate (COSMIC)/Formosa Satellite Mission 3 (FORMOSAT-3; hereafter COSMIC), a constellation of six microsattellites, was launched into a 512-km orbit. After launch the satellites were gradually deployed to their final orbits at 800 km, a process that took about 17 months. During the early weeks of the deployment, the satellites were spaced closely, offering a unique opportunity to verify the high precision of RO measurements. As of June 2010, COSMIC is providing about 1600 RO soundings per day to support the research and operational atmospheric sciences communities. COSMIC data are of better quality than those from the previous RO missions and penetrate much farther down into the troposphere; 75% of the soundings reach to within 1 km of the surface over the oceans. The data are having a large positive impact on operational global weather forecast models. With the ability to penetrate deep into the lower troposphere using an advanced open-loop tracking technique, the COSMIC RO instruments can observe the structure of the tropical atmospheric boundary layer. The value of RO for climate monitoring and research is demonstrated by the precise and consistent observations between different instruments, platforms, and missions. COSMIC observations are capable of intercalibrating microwave and infrared measurements from different satellites and are able to distinguish the quality of different types of radiosondes.