

LOCAL TIME SAMPLING WITH FORMOSAT-3/COSMIC

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The radio occultation (RO) method, which provides accurate profiles of atmospheric parameters, is known for its potential to be long-term stable and suitable for climate monitoring.

We investigated the local time sampling of the Formosat-3/COSMIC (Constellation Observing System for Meteorology Ionosphere and Climate) constellation, which performs Global Positioning System (GPS) RO measurements. The satellite constellation, consisting of six non Sun-synchronous satellite platforms, was launched in April 2006 into a low Earth orbit. All satellites together acquire up to 2500 RO events per day.

The satellites, in planes with 72° inclination and different local times of equator crossing, will be separated in ascending node by 30° by the end of 2007 when the final orbital constellation will be achieved; until then some of the satellites will be closer to each other. Each single Formosat-3/COSMIC satellite (in final orbit) has a drifting rate of about $-2^\circ/\text{day}$. Relative to the Earth's mean motion of about $+1^\circ/\text{day}$, the six satellites hence sample one full diurnal cycle within 10 days at low and mid latitudes. This homogeneous local time sampling allows the calculation of monthly climatologies with negligible (<0.01 K) sampling error local time component. Furthermore, a diurnal temperature cycle typical at these latitudes can be determined at monthly sampling, i.e., including seasonal variations.

Due to the asymmetry of ascending and descending branch at higher latitudes, local time is not ideally sampled in these regions within one month. Insufficient or irregular local time sampling leads to a small but systematic impact in monthly climatologies, which was estimated to be well below 0.1 K within one month. The reconstruction of the diurnal cycle is limited but should be possible up to 60° latitude based on the final satellite constellation. Since the orbital inclination of 72° prohibits an adequate number of measurements at highest latitudes (beyond about 75° to 80°), sampling—including local time sampling—is insufficient.

We compared the local time sampling in December 2006, July 2007, and—by means of simulation studies—in final constellation. We will discuss the local time influence in RO climatologies and will show preliminary results of the diurnal temperature cycle at tropopause region and lower stratosphere altitudes.