EARTH OBSERVATION SYMPOSIUM (B1)
Future Earth Observation Systems (2)

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TOPMEX-9: DISTRIBUTED SAR MISSION EMPLOYING NANOSATELLITE CLUSTER

Abstract

Collaboration between Mexican and German organizations has been set up to develop a new mission using a Synthetic Aperture Radar (SAR) based on nanosatellite Earth observation clusters. TOPMEX-9 is a cluster of nanosatellites proposed to fly around a micro satellite in a cluster arrangement in SAR Multistatic mode. This is an analogy with the sun providing illumination to passive optical receivers or cameras. The microsatellite containing the transmission radar acts as a speaker while the nanosatellites around behave as listeners.

The nanosatellite cluster can be arranged in different experimental configurations, such as the formation of a synthetic aperture in height (e.g. at different orbits). Thus, performing Interferometry SAR (InSAR), Differential Interferometry SAR (DInSAR) or SAR Tomography. Due to severe volume, weight and power availability constraints found in the cubesat standard (2U and 3U), each TOPMEX-9 nanosatellite includes a single receiver antenna at X-Band, either with HH or VV polarization.

Three issues are crucial for this mission to succeed: an accurate positioning system, attitude control and laser intercommunication for small satellites. The last two were already developed by UNAM and

CICESE respectively and are currently under validation phase.

The SAR system distributed architecture (transmission, detection of the radar signal, TM/TC of data acquisition, link to ground station) based on satellites with different sizes has the advantages of routing more energy to the radar antenna to achieve powerful signals, better signal-to clutter ratio and on the other hand the distributed SAR architecture reduces the heat produced as compared to that generated by a single satellite SAR solution.

TOPMex-9 will have a great impact in Earth observation missions. Monitoring oceanographic processes is one of the future applications that has been identified. This includes waves and wind over the ocean as well as surface features associated with fronts and currents.

For México one of the strengths in space industry in the short term resides in the mass production of small satellites. For this reason the collaboration between the Mexican Space Agency (AEM) and other Agencies is being promoted. In addition, production points have been already identified in México to start the development of this technology.

The apparent limited lifetime of a nanosatellite is compensated with the facts that new radar cluster configurations can be launched based on lessons learned, contributions in the acceleration of technology development and proving innovating data acquisition schemes.