IAF EARTH OBSERVATION SYMPOSIUM (B1)
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CUTTING-EDGE SPACEBORNE SYNTHETIC APERTURE RADAR TECHNOLOGIES FOR THE CHALLENGES OF NEXT DECADES

Abstract

Spaceborne synthetic aperture radar (SAR) represents a fundamental means to address the challenges of the next decades in the domains of Earth monitoring, as well as intelligence, surveillance and reconnaissance (ISR). Novel ambiguous SAR acquisition modes, recently demonstrated with TerraSAR-X, can circumvent the swath/resolution constraint without the need for digital beamforming. These modes are effective for dedicated applications, such as maritime surveillance and ground deformation monitoring, leading to a coverage increase by a factor of 20 with the same technology. SwitchSAR is a recently-developed SAR concept that enables a multi-fold increase of the sensitivity of a SAR system for the same average transmit power and is particularly attractive for Ka-band systems and topographic interferometric applications. Besides the generation of accurate digital elevation models, the coherent combination of SAR images, taken from different angles, helps unveil the three-dimensional structure of vegetation, ice, and dry soil through high-resolution tomograms that can be better interpreted if acquired using multiple-input multiple-output systems, as demonstrated using a ground-based radar. Distributed systems, based on clusters of small satellites flying in formation, enable simultaneous collection of such multi-angular images with a significant impact on numerous applications. An affordable and versatile approach for their demonstration is based on swarms of drones equipped with lightweight radar sensors, which DLR is implementing by building up a distributed drone-based SAR infrastructure. Bistatic and multistatic geometries with spaceborne transmitters and airborne receivers also play a fundamental role in ISR applications, where broadband communication satellites can be exploited as illuminators of opportunity. These advances are forerunners for the development of novel full-fledged and NewSpace spaceborne Earth

observation missions that will offer remarkable societal benefits.