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PERFORMANCE ASSESSMENT OF AN INTERFEROMETRIC SAR NETWORK FOR THE EQUATORIAL REGION

Abstract

Interferometric Synthetic Aperture Radar (SAR) missions employing flying formations are already playing a major role in operational bi-static remote sensing applications; viz. the TerraSAR-X and Tandem-X formation. The user requirement for 3-D digital elevation model (DEM) imagery for application in cartography, rectification, geographic information system (GIS) and other application areas is on the rise. The equatorial region (ER) is vastly populated by developing nations that sparsely harness the benefits of space missions and are in need of affordable satellite data to assist in urban development, disaster monitoring and mitigation, mapping and various other application areas. The ER is defined as the boundary lines of latitude between 10 degrees North and 10 degrees South of the Equator. The design of a small SAR satellite network, positioned at an inclination of 10 degrees, with each satellite having different ascending nodes, thereby implementing a Pendulum configuration, offers a possible solution for providing rapid SAR data to developing nations. A bi/multistatic configuration based on a "master" satellite (transmitter/receiver) and several "slave" (receiver-only) satellites is proposed. The "slave" satellites are positioned at variable distances behind or ahead of the "master" satellite, allowing for a single pass interferometry. The requirement for high resolution data and low payload mass, informed the decision of selecting the X-band frequency for payload operations. This paper addresses the potentials of implementing a formation of small SAR satellites in low Earth orbit, for interferometric operations over the equatorial region. It starts by examining the effects of varying the acrosstrack distance between two satellites flying in trailing formation and then considers the effects of varying the alongtrack distance. A coverage analysis of the time taken to capture high resolution DEM images of the entire ER is also discussed. The possibility of using the SAR network for velocity measurements is also highlighted. A brief analysis of the requirements necessary to maintain the formation is finally described.