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ALTICUBE: A KA-BAND ALTIMETER CUBESAT CONSTELLATION FOR OCEAN MONITORING

Abstract

Satellite radar altimetry provides very valuable Earth observation data over oceans and inland water, for example, for the monitoring of ocean currents, annual sea level rise, the kinetic energy of ocean circulation even with small-scale features, etc. During the past several decades, several radar altimeters have been launched onboard satellites such as ERS-1, Jason, Envisat and so on. However, since these are missions based on single large satellites, some performance parameters including swath coverage and temporal resolution are very limited. On the other side, with RainCube as an example, the tremendous progress of small satellite technologies in recent years brings unique opportunities for satellite radar altimetry. Flying radar altimeters onboard a group of very small satellites could provide better swath observation, an equivalent or even improved performance and coverage at a much lower price, while complementing large satellite missions. To this end, a feasibility study of a Ka-band altimeter CubeSat constellation for ocean monitoring, called AltiCube, is being carried out by the Delft University of Technology, under the support of the European Space Agency. This paper provides an overview of the AltiCube mission study. The paper consists of three major parts. Part One analyses the potential observation products and performance of various constellation/formation concepts, including a comb constellation, a specular constellation, an interferometric constellation, and an along-track formation. In Part Two, the requirements on the platform are discussed based on these concepts, respectively. The main focus is on the altimeter antenna sizing and the needed delta-V for the constellation/formation maintenance. Based on the assessment with respect to performance, platform, technological readiness level, cost and other factors, the interferometric constellation (consisting of one microsat with active radar and four CubeSats with passive antenna) and the along-track formation (consisting of five identical CubeSats) are selected for further study. In Part Three of this paper, more detailed definitions of these two concepts are given. Finally, the two selected CubeSat altimeter constellations have the capability to map the ocean sub-mesoscale structures, which is extremely hard to monitor using traditional large spaceborne radar altimeters. It will be of great significance in helping to understand the dynamic interactions between the ocean and the

air. From this, post-processing of the data can be used to model the Earth heat balance and assist in predicting climate change.