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MULTI-SENSOR APPROACH TO OVERCOME NANOSATELLITE OPERATION CONSTRAINTS IN OCEAN MONITORING

Abstract

Satellite systems and Remote Sensing are nowadays assuming a central role in oceanographic monitoring. The processes involved may assume a very wide amplitude of spatial scales, and satellite systems have been proving to be very effective on providing broad coverage of these processes. With the evolution of space technologies and the drastic reduction of launching costs, the recent ample dissemination of nanosatellites has significantly changed innovation and Earth Observation (EO) missions carried out by traditional satellite systems. CubeSats, following a modular and simplified approach, changed significantly the way satellites are designed and deployed, and contributed to diversify the market availability of components and payloads. The AEROS mission is a 3U (10 x 10 x 30 cm3) CubeSat that is seen as a precursor for a constellation of satellites dedicated to monitor the Atlantic. The mission aims to advance Portuguese capacity to deliver technologies that bridge the interactions between Ocean and Space. AEROS' objectives are as follows: 1) develop and launch a novel CubeSat platform for ocean monitoring, 2) demonstrate miniaturized and efficient hyperspectral imaging, 3) implement data science techniques for monitoring and forecasting oceanic evolution and generate value-added data for stakeholders, 4) develop flexible software-defined communication modules to support connectivity and network operations of autonomous vehicles and biologging tagging technology (e.g. tagged migratory marine organisms), and 5) establish a Data Analysis Centre (DAC) to collect, process, and analyse data acquired by the AEROS payload. This manuscript is dedicated to the analysis and discussion of the operation parameters of AEROS, considering the characteristics of the hyperspectral payload, the downlink possibilities, the other payloads on board including the RGB camera and the SDR, and the requirements in terms of calibration. This analysis is carried out considering the main use cases of the mission, including the monitoring of essential ocean variables (EOVs) and predefined areas of interest such as Marine Protected Areas (MPAs), the tracing of ocean fronts and of large marine animals with tags, among other complementary processes. The multi-operation of payload devices seems particularly promising to overcome the typical constrains associated to the nanosatellite architecture, allowing to maximize the rate of data acquisition and improve information delivery.