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Earth Observation Applications, Societal Challenges and Economic Benefits (5)

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INVESTIGATING THE APPLICATIONS OF SMALL SATELLITES IN THE MEASUREMENT AND
EVALUATION OF THE ESSENTIAL OCEAN VARIABLES

Abstract

The state of Earth's complex ocean network is a clear indicator of the effects of the climate crisis. From the bleaching of corals to the acidification of the water, the condition of our oceans has reached a critical point, jeopardizing the health and livelihoods of billions globally. By capitalizing on the cost-efficiency of small satellites, the testing of existing and emerging technology can be more easily implemented to evaluate ocean health, improving global understanding of climate change. The Global Climate Observing System (GCOS) programme from the Intergovernmental Oceanographic Commission (IOC) has laid out a list of 54 Essential Climate Variables (ECVs) for characterizing the Earth's climate. Of these ECVs, 19 are the Essential Ocean Variables (EOVs) that monitor the health of our oceans. These can be further sub-categorized into groups describing the Ocean Surface Physics, Subsurface Ocean Physics, Biogeochemistry and observations on Ocean Biology or Ecosystems. Satellites are the only currently available tool to observe 71 The objective of this paper is to evaluate the role that satellites, especially small satellites (<500kg), have in monitoring the EOVs. This paper reviews current earth observation payloads and data and their relevance to the evaluation of the EOVs. The study evaluates emerging methods (novel optics systems, object based image analysis, etc.) to measure EOVs remotely and consolidate the relevant data into effective methods of communication. Active and passive remote sensing techniques and their applications across the visible, infrared, and microwave bands are evaluated. Based on this information, a framework is proposed using multiple platforms and constellation systems for the development of a cost-efficient plan to provide an optimal global view for each EOV. The goal is to improve ocean forecasts, early warnings, and climate projections. The final purpose of this paper is to evaluate the influence of

the emerging open-source data on international climate policy and coordination. By leveraging the near-global coverage of remote imaging networks, potential gaps in observation and the corresponding effects on policy are identified, suggesting methods to develop more accessible and useful data collection. This research is conducted by members of the Small Satellite Project Group (SSPG), representing the Space Generation Advisory Council's (SGAC) efforts to evaluate the role of students and young professionals in the fight to combat the climate crisis.