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Author: Dr. Benjamin Hamlington
NASA Jet Propulsion Laboratory, United States, benjamin.d.hamlington@jpl.nasa.gov

Mr. Parag Vaze
National Aeronautics and Space Administration (NASA), Jet Propulsion Laboratory, United States, parag.v.vaze@jpl.nasa.gov

THE EXPANDING CONSTELLATION OF SEA LEVEL OBSERVING SATELLITES AND THE NEED FOR MORE

Abstract

With the successful launch of the Sentinel-6 Michael Freilich satellite in 2020, the modern satellite radar altimeter record of sea level has now surpassed three decades in length. The continuous record of high-accuracy and near-global measurements of sea level from what are known as conventional altimeters have led to wide-ranging advances in our understanding of global and regional sea level change. These missions have revolutionized the field of physical oceanography, and increased scientific knowledge in many others including geodesy, hydrology and climate science. On the passing of its 30th anniversary, the question has been asked "what's next for satellite altimetry?" The answer appears to be an emerging golden age of altimetry marked by a growing constellation of satellites, with new observing systems changing the way we study the oceans and the processes that drive it.

In particular, the push for improvement in satellite observations of sea level has led to two areas of measurement focus: smaller scales and closer to the coast. In the open ocean, the effective resolution of a single conventional radar altimeter is on the order of hundreds of kilometers with repeated measurements generally separated by several days. Among other consequences, this sampling misses a range of smaller scale ocean variability that plays an important role in circulation and the transport of heat and carbon in the ocean–both critical to understanding ongoing climate change. Additionally, conventional radar altimeters provide useful measurements of sea level only to within tens of kilometers of the coast. This means that many near-coast processes are missed by satellites, and gaps in the coastal zone are increasingly problematic as impacts associated with sea level rise expand and worsen.

New technology is providing a solution to these challenges. With the launch of the Surface Water and Ocean Topography (SWOT) mission in 2022, we now have near-global satellite measurements of the ocean at smaller scales and closer to the coast than ever before. This will pave the way for advances in our understanding of climate change, and provide improved information for tackling the impacts of climate change across the globe. SWOT fills important gaps in our constellation of satellites measuring sea level, but also motivates a renewed look at what is needed in the future both in terms of continuity and augmentation of this constellation. Here, we describe these needs after highlighting SWOT and discussing its impact on our response to ongoing climate change.