

Global observations of fine-scale ocean surface topography with the Surface Water and Ocean Topography (SWOT) Mission

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Abstract

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The future international Surface Water and Ocean Topography (SWOT) Mission, planned for launch in 2021, will make high-resolution 2D observations of sea-surface height using SAR radar interferometric techniques. SWOT will map the global and coastal oceans up to 77.6° latitude every 21 days over a swath of 120 km (20 km nadir gap). Today's 2D mapped altimeter data can resolve ocean scales of 150 km wavelength whereas the SWOT measurement will extend our 2D observations down to 15-30 km, depending on sea state. SWOT will offer new opportunities to observe the oceanic dynamic processes at these scales, that are important in the generation and dissipation of kinetic energy in the ocean, and act as one of the main gateways connecting the interior of the ocean to the upper layer. The active vertical exchanges linked to these scales have impacts on the local and global budgets of heat and carbon, and on nutrients for biogeochemical cycles.

This review paper highlights the issues being addressed by the SWOT science community to understand SWOT's very precise SSH / surface pressure observations, and it explores how SWOT data will be combined with other satellite and in-situ data and models to better understand the upper ocean 4D circulation (x,y,z,t) over the next decade. SWOT's new SAR-interferometry technology aims to observe ocean SSH scales down to 15-30 km in wavelength. At these scales, SSH includes "balanced" geostrophic eddy motions and high-frequency internal tides and internal waves. This presents both a challenge in reconstructing the 4D upper ocean circulation, or in the assimilation of SSH in models, but also an opportunity to have global observations of the 2D structure of these phenomena, and to learn more about their interactions. At these small scales, the ocean dynamics evolve rapidly, and combining SWOT 2D SSH data with other satellite or in-situ data with different space-time coverage is also a challenge. SWOT's new technology will be a forerunner for the future altimetric observing system, and so advancing on these issues today will pave the way for our future.

Data availability statement

Generated Statement: No datasets were generated or analyzed for this study.