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

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The future international Surface Water and Ocean Topography (SWOT) Mission, planned for launch in late 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 smaller scales, that are important in the generation and dissipation of ocean kinetic energy, and are one of the main gateways connecting the surface to the ocean interior. 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.

SWOT's unprecedented 2D ocean SSH observations include "balanced" geostrophic eddy motions and high-frequency internal tides and internal waves. SWOT will provide global observations of the 2D structure of these phenomena, enabling us to learn more about their interactions, and helping us to interpret what is currently observed in 1D with conventional altimetry. Yet this mix of balanced and unbalanced motions is a challenge for calculating geostrophic currents directly from SSH or for reconstructing the 4D upper ocean circulation. At these small scales, the ocean dynamics evolve rapidly, and even with SWOT's 2D SSH images, one satellite cannot observe the temporal evolution of these processes. SWOT data will need to 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 technology will be a forerunner for the future altimetric observing system.

We will present recent progress in understanding the ocean dynamics contributing to fine-scale sea-surface height, including high-frequency processes such as internal tides, from 1D alongtrack altimetry, SAR data, in-situ data and models. We will also discuss the specific problems of validating the SWOT 2D small, rapid dynamics with in-situ data and other satellite data.