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MISSION STATUS AND PERFORMANCE OF THE SURFACE WATER AND OCEAN TOPOGRAPHY PROJECT FOR OCEANOGRAPHY AND HYDROLOGY

Abstract

A new satellite mission for oceanography and hydrology science called Surface Water and Ocean Topography (SWOT) developed jointly by the U.S. National Aeronautics and Space Administration and France's Centre National d'Etudes Spatiales was launched on December 16, 2022. Using state-of-the-art "radar interferometry" technology to measure the elevation of water, SWOT observes the major lakes, rivers and wetlands while detecting ocean features with unprecedented resolution. SWOT data will provide critical information that is needed to assess water resources on land, track regional sea level changes, monitor coastal processes, and observe small-scale ocean currents and eddies.

SWOT will revolutionize oceanography by detecting ocean features with 10 times better resolution than present technologies. The higher resolution will unveil small-scale ocean features which contribute to the ocean-atmosphere exchange of heat and carbon, major components in global climate change, and will improve understanding of the ocean environment including motion of life-sustaining nutrients and harmful pollutants. SWOT data will be used to improve ocean circulation forecasts, benefiting ship and offshore commercial operations, along with coastal planning activities such as flood prediction and sea level rise.

Surface water storage and fluxes in rivers, lakes, reservoirs, and wetlands are currently poorly observed at the global scale. SWOT will provide the very first comprehensive view of Earth's freshwater bodies from space and will allow scientists to determine changing volumes of fresh water across the globe. These measurements are key to understanding surface water availability and in preparing for important water-related hazards such as floods and droughts. SWOT will contribute to a fundamental understanding of the terrestrial branch of the global water cycle.

SWOT is expected to achieve 1 cm precision at 1 km x 1 km pixels over the ocean and 10 cm precision over 50 m x 50 m pixels over land waters. Other payloads of the mission include a conventional dual-frequency altimeter for calibration to large-scale ocean topography, a water-vapor radiometer for correcting range delay caused by water vapor over the ocean, and precision orbit determination package (GPS, DORIS, and laser retroreflector).

The purpose of this paper is to present the current SWOT mission status and performance, including technical development challenges regarding the Payload Instrument, Spacecraft, ground data system and calibration/validation plans.