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UPDATE ON SWOT: TRANSFORMATIVE DATA FROM REVOLUTIONARY TECHNOLOGY, AND IMPLICATIONS FOR HYDROLOGY AND WATER INTELLIGENCE

Abstract

A new satellite mission for oceanography and hydrology science called Surface Water and Ocean Topography (SWOT) was developed jointly by the U.S. National Aeronautics and Space Administration and France's Centre National d'Etudes Spatiales and launched on December 16, 2022. Using state-of-the-art "radar interferometry" technology to measure the elevation of water, SWOT will observe major lakes, rivers and wetlands while detecting ocean features with unprecedented resolution and spatial coverage. SWOT data is poised to 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 hydrology in several areas including surface water storage and discharge in rivers by providing a global baseline set of observations for millions of water bodies. SWOT will provide the very first comprehensive view of Earth's surface water 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 will also significantly advance oceanography by detecting ocean features with 10 times better resolution than present technologies. The higher resolution will reveal small-scale ocean features that contribute to the ocean-atmosphere exchange of heat and carbon. These are major components in global climate change, and will improve the 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.

SWOT is expected to achieve 1 cm precision at 1 km x 1 km pixels over the ocean and 10 cm precision over 1Km land areas. Other mission payloads 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 SWOT mission status, including post-launch experiences, preliminary results from the mission, and SWOT's capability for supporting downstream applications.