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SWOT: A high-resolution wide-swath altimetry mission for oceanography and hydrology

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A new satellite mission called Surface Water and Ocean Topography (SWOT) has been developed jointly by the U.S. National Aeronautics and Space Administration and France's Centre National d'Etudes Spatiales. Based on the success of nadir-looking altimetry missions in the past, SWOT will use the technique of radar interferometry to make wide-swath altimetric measurements of the elevation of surface water on land and the ocean's surface topography. The new measurements will provide information on the changing ocean currents that are key to the prediction of climate change, as well as the shifting fresh water resources resulting from climate change.

Conventional satellite altimetry has revolutionized oceanography by providing nearly two decades' worth of global measurements of ocean surface topography. However, the noise level of radar altimeters limits the along-track spatial resolution to 50-100 km over the oceans. The large spacing between the satellite ground tracks limits the resolution of 2D gridded data to 200 km. Yet most of the kinetic energy of ocean circulation takes place at the scales unresolved by conventional altimetry. About 50% of the vertical transfer of heat and chemical properties of the ocean (e.g., dissolved CO_2 and nutrients) is also accomplished by processes at these scales. SWOT observations will provide the critical new information at these scales for developing and testing ocean models that are designed for predicting future climate change.

SWOT measurements will be in Ka band ($\sim$35 GHZ), chosen for the radar to achieve high precision with a much shorter inteferometry baseline of 10 m. Small look angles ($\sim$ 4 degrees) are required to minimize elevation errors, which limits the swath width to 120 km. An orbit with inclination of 78 degrees and 22 day repeat period was chosen for gapless coverage and good tidal aliasing properties. With this configuration, 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.

This presentation will be in two parts. Firstly we will give a brief overview of the SWOT mission and its sampling characteristics. We will then introduce a number of recent scientific results on our present understanding of ocean topography and surface geostropic velocities at mesoscales and sub-mesoscales, results which have been inspired by the upcoming SWOT measurements.