

USGS ground- and boat-based support for the NASA airSWOT mission on the Sacramento River, California

The objective of NASA's Surface Water and Ocean Topography (SWOT) mission is to collect high-precision, wide-swath altimetry measurements of water-surface elevations in the ocean and inland waters of the world, enabling time-series measurements of global water dynamics on an unprecedented scale. The main satellite is planned to be launched in 2019 and an airborne platform-based test of the instrument (airSWOT) will take place beginning in 2013. One of the main issues is that there is very little field support for the calibration and validation of the airSWOT instrument measurements. SWOT has asked USGS CaWSC to assist with field measurements for this pilot flight and they will be working with us in the near future (under a separate agreement) to develop the discharge algorithms. To fund this effort, NASA has asked CaWSC to submit the proposal as a NASA ROSES Rapid Response proposal. The limit on a Rapid Response Proposal is \$75K. This proposal covers the collection of data and initial processing of the data. Additional funds of \$20K have been provided by COE to support data collection in a reach downstream of Knight's Landing that is of interest to COE. The rest of the processing and appropriate archiving and delivery of the data will be funded via the larger agreement that is being negotiated at Reston.



Side-scan sonar mapping of the bed of the Sacramento River near Colusa, CA.

This field work on the Sacramento River will be performed at two scales: a coarse-scale sampling from Keswick Dam to the I-5 Bridge near the city of Sacramento using Hobo stage recorders at approximately 10 – 20 km spacing; and fine-scale surveys in two reaches, one from approximately 30 km upstream and downstream of Colusa and another 30 km reach downstream of Knight's Landing using Hobo stage recorders at approximately 0.5 – 1.5 km spacing. The Hobo data will be used primarily as a test of the vertical accuracy of the airSWOT instrument at the locations of the deployed Hobo stage recorders. At the fine-scale study site in addition to the deployed Hobo stage recorders, a boat-mounted acoustic Doppler current profiler (ADCP) and Differential Global Positioning System (DGPS) will be used for simultaneous

California Water Conditions



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measurements of water-surface elevation, river bottom topography, velocity, and discharge. These data will be collected in a longitudinal profile with occasional cross-sections spaced at approximately the same location as the deployed Hobo stage recorders. These measurements will be collected on the same day as airSWOT overflights and will cover 20 – 30 km of river per day (1/3 to 1/2 of the Colusa study site area), based on previous experience with this technique. These measurements will be used to test the accuracy of the airSWOT instrument as well as the discharge algorithms being developed for the larger SWOT mission. A secondary priority that will be pursued only if there is time and funds available is to use a mobile Terrestrial Laser Scanner (TLS) mounted on a boat to measure river width, streambank vegetation overhang, location of sand bars, cross-stream water-surface elevations, and wave heights. These parameters are of great interest to the airSWOT team for the potential error they introduce to airSWOT water surface elevation measurements as well as the discharge algorithms. The pressure transducers will be tied into a vertical datum using the differential GPS, and the field team will fill out the appropriate field sheets with all necessary data. The collected data will be archived according to USGS policy; if the data do not fit into NWIS, they will be archived in a manner determined in consultation with the Data Management Group. An USGS Digital Data Report will be produced for this project. The funding for this will come from the next NASA agreement being negotiated at Reston.

This project is relevant to all USGS Science Strategies associated with water, in particular, Water Census, with "improved watershed characterization and flow-system definition," and Environmental Flows "to develop and test tools and techniques that can be used nationwide to help resource managers understand water use and ecosystem function," as described in the Water Resources Mission Area Informational Memorandum no. 2011.01.

Cooperating Agency: [National Aeronautics and Space Administration \(NASA\)](#)

Cooperating Agency: [Army Corp of Engineers \(COE\)](#)

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