

# ENHANCING SCIENCE AND PROMOTING PRACTICAL APPLICATIONS OF HIGH-RESOLUTION ALTIMETRY MEASUREMENTS

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## ABSTRACT

**N**ASA's Earth Science Mission Directorate Applied Sciences Program (ASP) is supporting a formal effort to optimize the value of upcoming NASA Earth missions to a broad user community and to society at large. The objective of the Surface Water and Ocean Topography (SWOT) Applications program is to pave the way for operational use of SWOT data products soon after the mission launches in 2020.

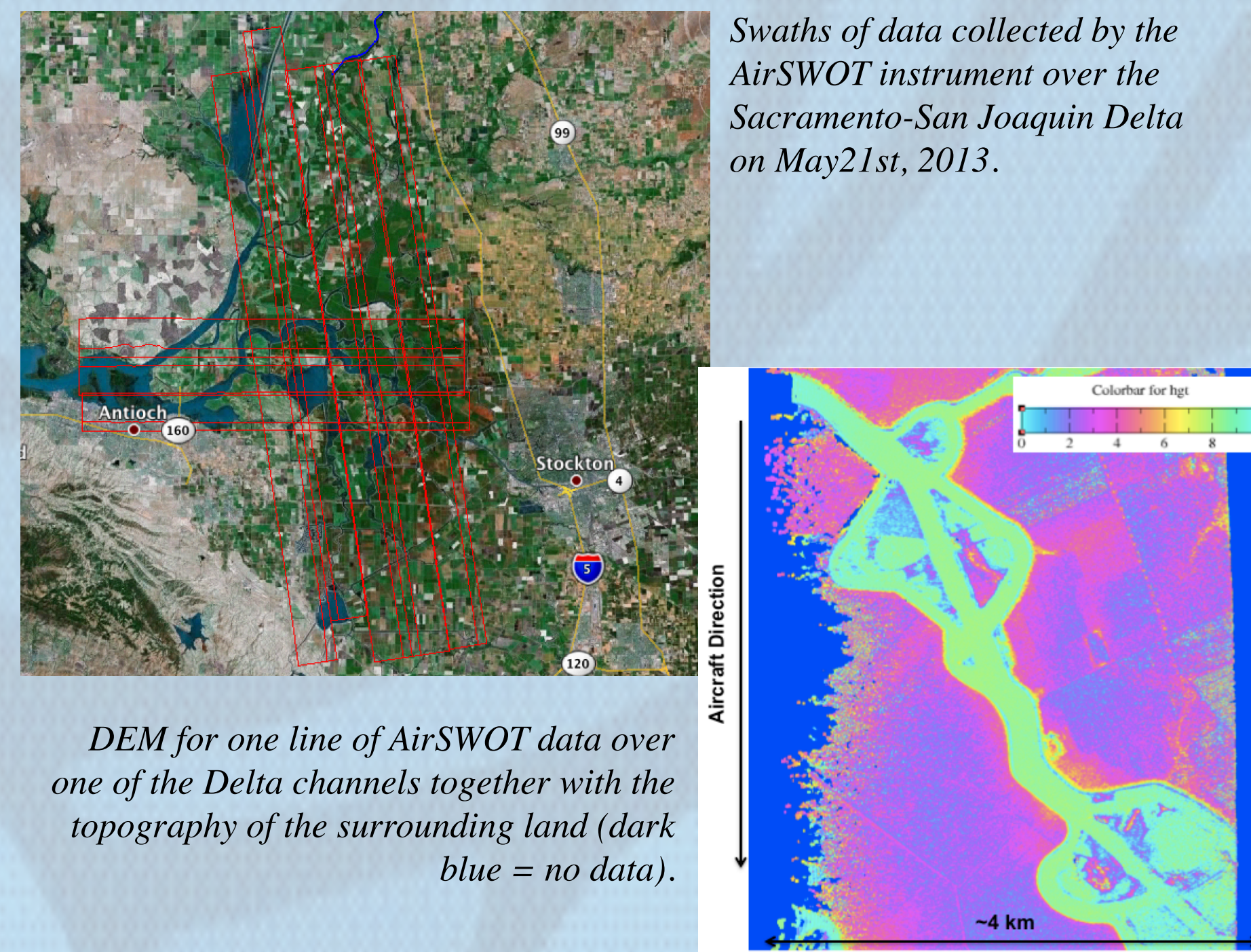
A wide range of existing and potential oceanography applications utilizing current altimetry data products will be enhanced with the introduction of high spatial resolution data from SWOT. With time series of surface water measurements provided by SWOT, a broad range of hydrology applications will inform water managers for river commerce, drought, floods, transboundary river issues, reservoir storage, and much more.

As part of the SWOT applications effort, several studies have already been proposed to ASP that will provide valuable demonstrations, data sets, and outcomes which will highlight the applications potential of SWOT for a broad range of users. The studies proposed to date include the development of an altimetry toolbox for forecasting floods in remote areas, the use of remote sensing measurements to improve the understanding, monitoring and management of estuaries and deltas, and the use of simulated SWOT data to assess the quality and potential value of SWOT measurements to both oceanography and hydrology applications.

Planned strategies to enhance science and practical applications of SWOT data will be discussed, including methods of engaging with the science community, operational users, and mission planners.

## APPLICATIONS STUDIES

Dr. Ernesto Rodriguez, JPL  
 Dr. Konstantinos Andreadis, JPL  
**AirSWOT SACRAMENTO-SAN  
 JOAQUIN DELTA SUPPORT**



DEM for one line of AirSWOT data over one of the Delta channels together with the topography of the surrounding land (dark blue = no data).

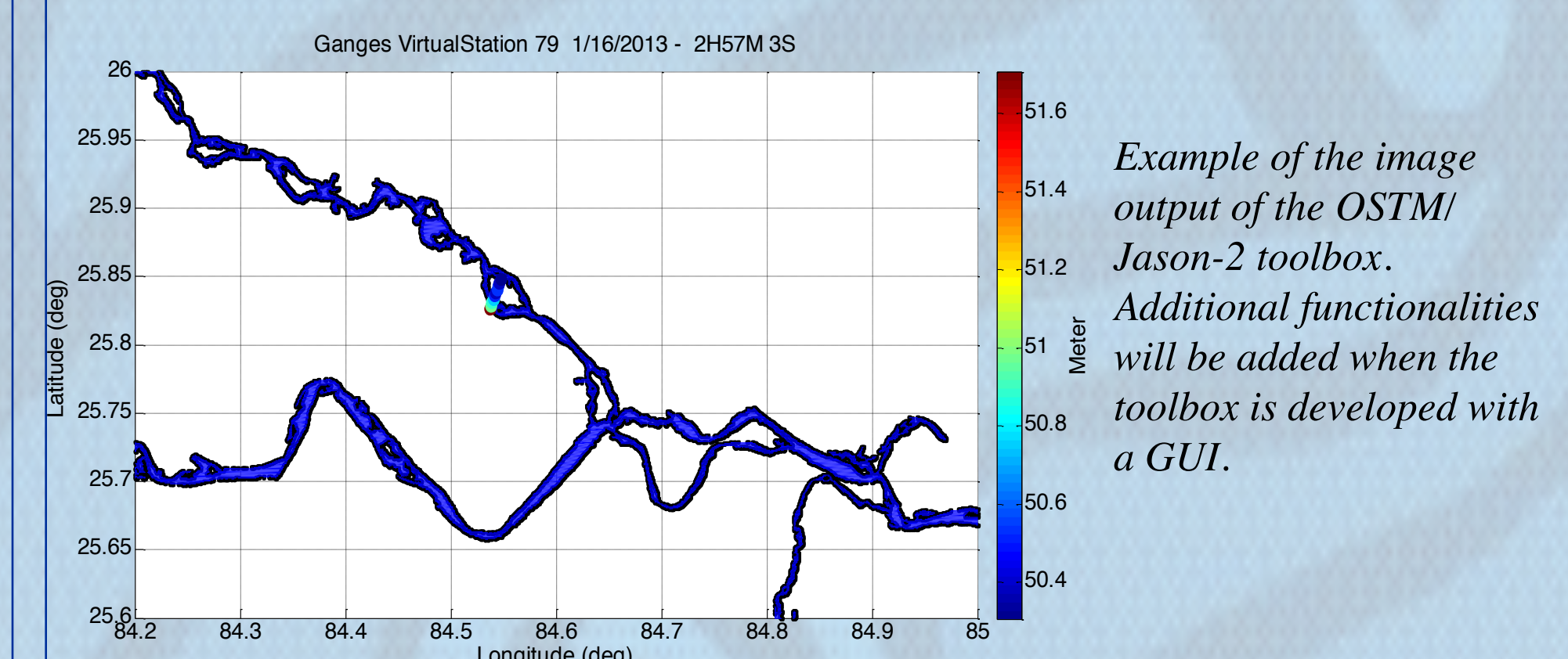
Water level observations from AirSWOT will be ingested into a hydrodynamic model of the Sacramento-San Joaquin and San Francisco Bay Delta system. The AirSWOT observations will then be assimilated to produce relevant data products that are easily accessible and usable to a broad community of end users in fields in and outside of the science objectives of the AirSWOT and SWOT missions. End users may include operational agencies, regional and coastal managers and decision makers, and commercial users. A secondary objective is the demonstration of the usefulness of the data products to a specific and well-recognized application problem: improvements in knowledge of the hydrodynamics of the Sacramento-San Joaquin River Delta. The results of this model will be shared with existing contacts at the USGS and the California DWR. The outcomes of this work will include a publicly available toolkit to produce data products that can be ingested by standard tools used by the hydrology community. In addition, a demonstration application use of these data will be conducted in conjunction with a hydrodynamic model to produce hydrology results of direct interest to the applications community.

See <http://airbornescience.jpl.nasa.gov/instruments/airswot>

Dr. Faisal Hossain, Tennessee Tech  
 Dr. Hyongki Lee, Univ. Houston

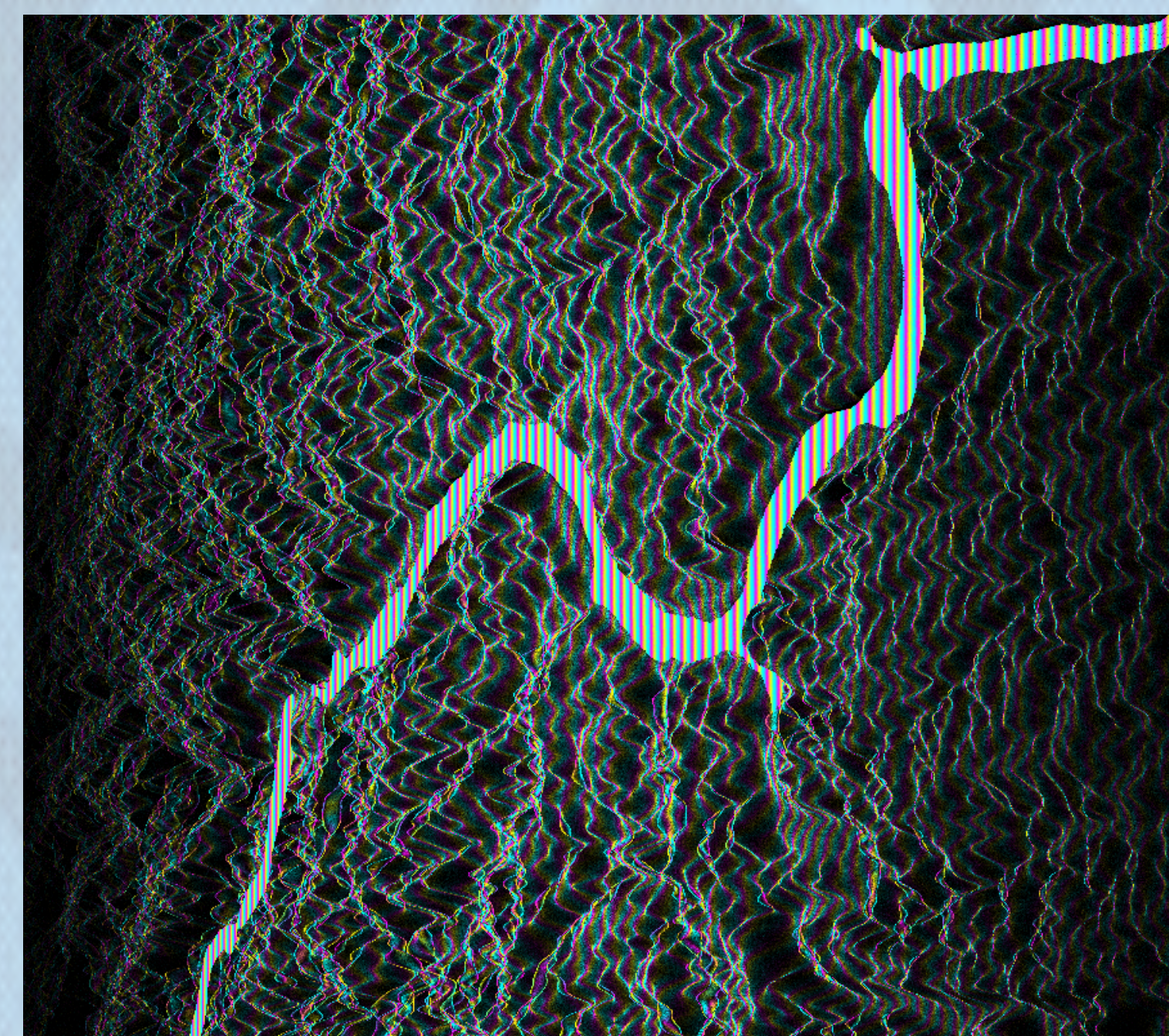
**River Height Data Extraction Toolbox;  
 Applications support for Jason-2 and  
 SWOT**

This work centers on the development of a toolbox to make satellite data far more accessible and interpretable to a wide range of end users. The toolbox will be developed using altimetry data from the OSTM/Jason-2 satellite and will have the capability for expanded use around diverse geographic regions for a wide range of users and stakeholders engaged in water resources management. The toolbox will also have potential value for AirSWOT test bed and standard datasets as they become available. Using extracted river height data, an agency or stakeholder can then use the toolbox outputs more conveniently for various applications related to water resources planning, management and forecasting. Beyond flood forecasting, this highly accessible data set will be useful for decision-making applications, such as: a) hydrologic/hydrodynamic model calibration/validation; b) data assimilation; c) climatology; d) ecosystem function; e) visualization in the NASA-SERVIR centers of Africa, Mesoamerica and Asia. One immediate real-world application of the toolbox for this project will be to extend flood-forecasting lead-time at the Flood Management Division of Institute of Water Modeling-Bangladesh (IWM-BD). IWM-BD is the technical resource of the Bangladesh government for maintaining and upgrading the flood forecasting tool used during the Monsoon season in Bangladesh.



Example of the image output of the OSTM/Jason-2 toolbox. Additional functionalities will be added when the toolbox is developed with a GUI.

Dr. Yi Chao & Dr. Delwyn Moller, Remote Sensing Solutions  
 Dr. Ed Beighley, Northeastern Univ.



Interferogram from the high resolution SWOT Level 1 simulator in a region of the Ohio basin. The horizontal dimension is the slant-range swath for one-side of the spacecraft. The brightness indicates variations in the backscattered power.

**HYDROLOGIC AND COASTAL OCEAN SCIENCES  
 SUPPORT FOR DECISION MAKING: San Francisco  
 Bay/Estuary, Lower Sacramento River**

While the San Francisco Estuary receives nearly one half of California's runoff, the quantity and quality of the incoming water has significantly decreased over time, with inflows lower than historical levels. In addition, water diversions from within the estuary for urban and agricultural use can be as high as 50% during typical years. The estuary is also impacted by the coastal ocean. In the past few years, the deterioration of the estuary has risen to crisis levels, with native fish populations collapsing (Sommer et al., 2001), and resource managers being forced to take unprecedented and controversial actions, including curtailing water deliveries to drought-afflicted farmers.

For this assessment, we will use the SWOT Level 1 high resolution simulator will be used to synthesize sample SWOT observations over the estuary, the lower section of the Sacramento River and the American River draining through the City of Sacramento for a 3-year period, comparable to the proposed SWOT mission life. These will then be translated to high-resolution water surface elevations (WSE).

The SWOT 2D dynamic WSE's (and thus slope, flood extent, derived discharge) will be used to calibrate/validate and hydrodynamic models in a hindcast experiment.

This study will promote the use of SWOT products to a community of end-users and decision makers that understand SWOT and related mission capabilities and are interested in using SWOT data products in their application. It will facilitate feedback between SWOT user communities and the SWOT project and provide information on collaborations with different types of users and communities including those of ocean research, ice and drought studies, agricultural impacts, operational oceanography, and others. An important outcome will be the design of communication strategies to target and support requirements of the user community.