

Monitoring the Northern San Francisco Bay Water Quality with Landsat-8

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Introduction

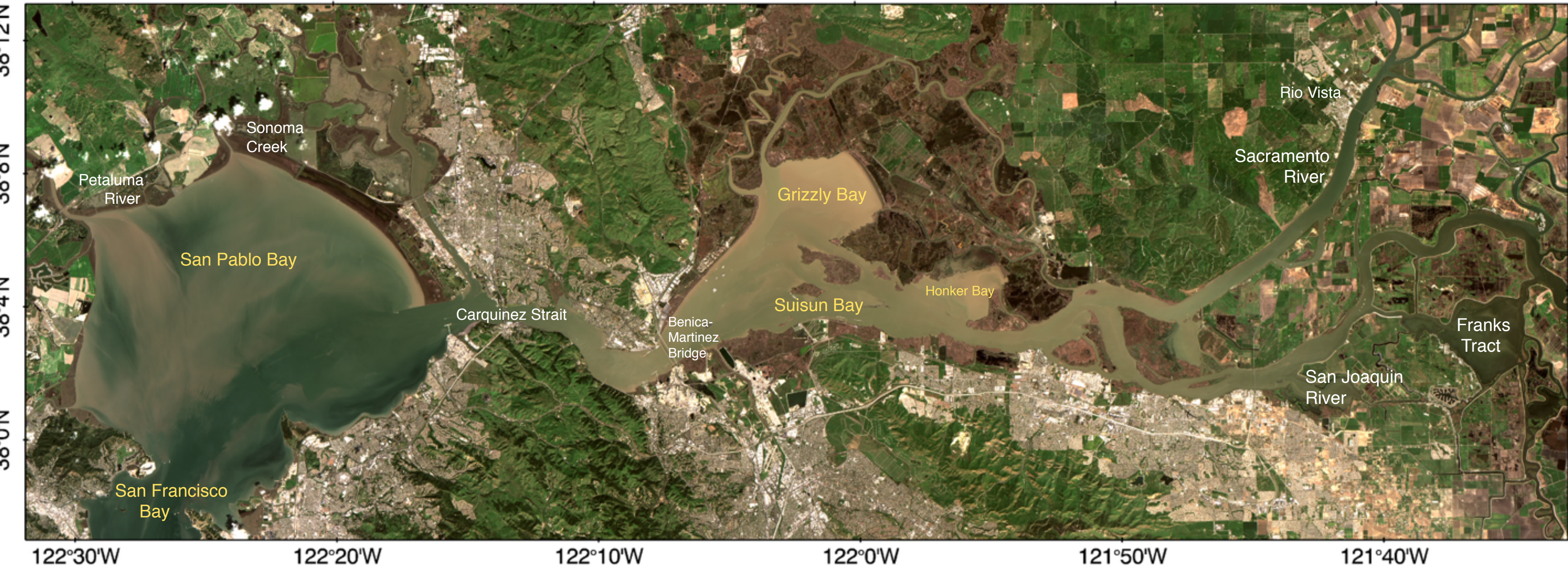
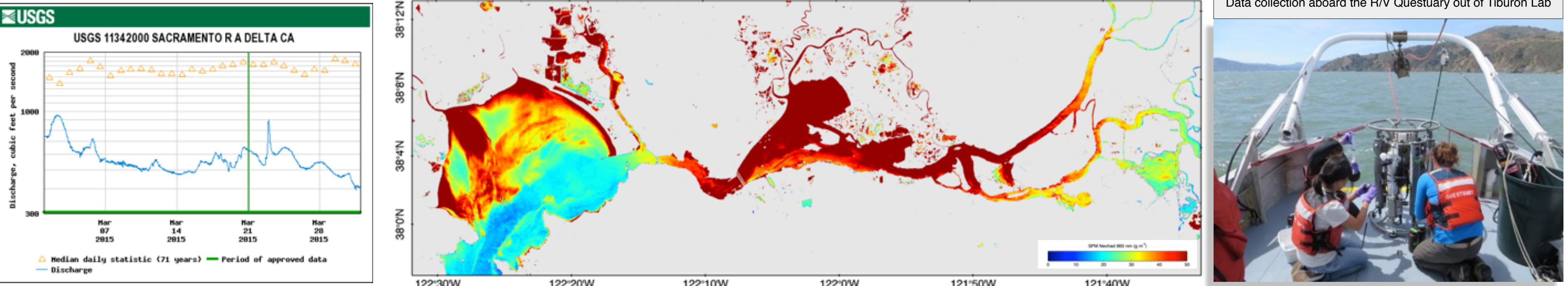
The goal of this NASA Interdisciplinary Science project is to put in place the tools and modeling framework for an ecosystem approach to the stewardship of the San Francisco Bay and Delta Ecosystem (SFE). Here we highlight using Landsat 8 OLI for remote sensing of the Delta, Sacramento, and San Joaquin Rivers.

Landsat 8-OLI Processing Methods

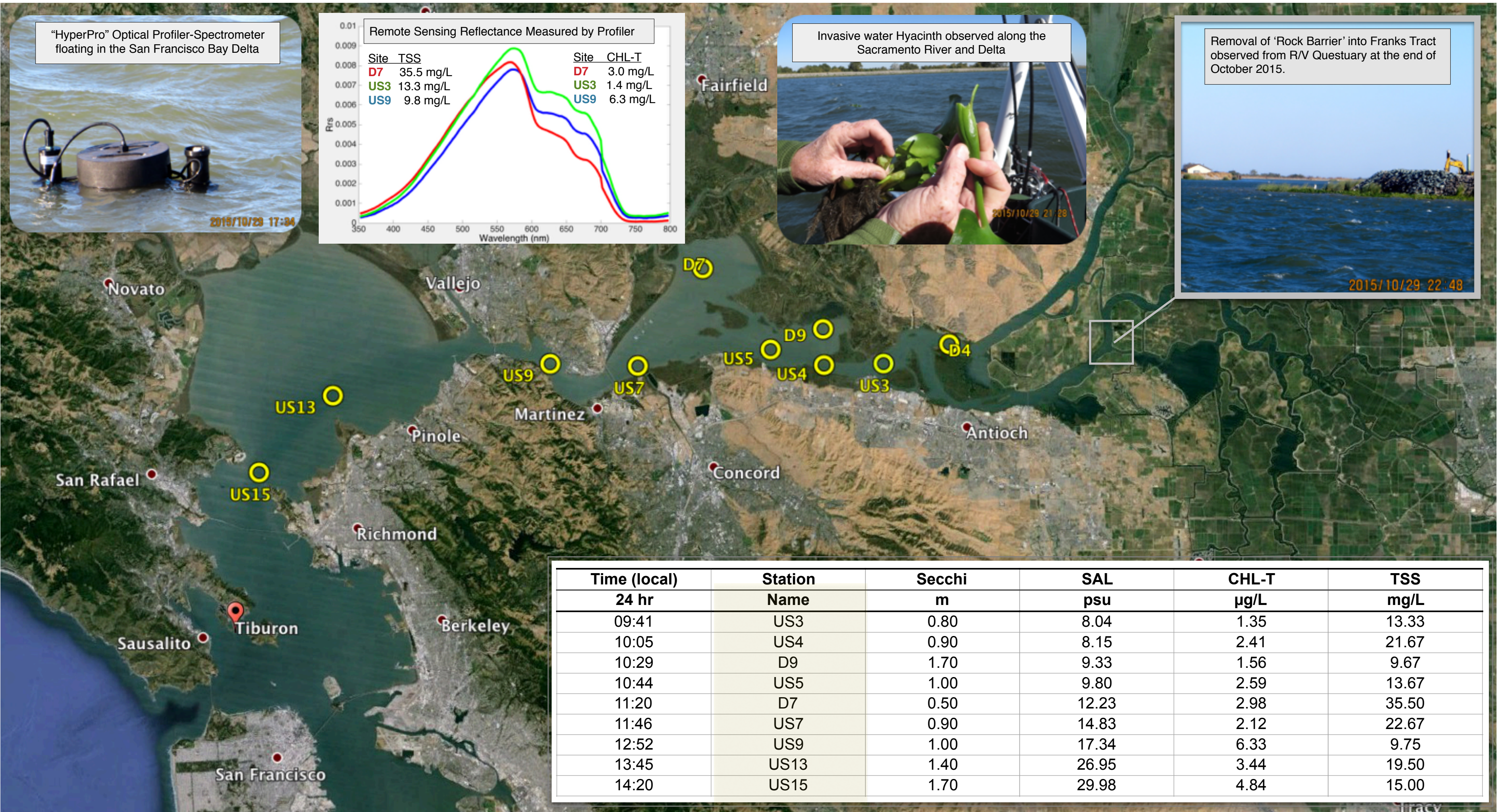
Landsat-8 OLI San Francisco Bay Atmospheric correction uses an iterative SWIR method optimized for highly turbid waters (Vanhellemont & Ruddick 2014) using the ‘Acolite’ processor created by Vanhellemont and co-workers. Total Suspended Sediment (TSS) maps (Nechad, Ruddick, and Park 2010) typically show an increase of turbidity in the lower Sacramento River and North San Pablo Bay. Product maps like these are used for the calibration and validation of the SFE model. The product maps are ‘regionally tuned’ using *in situ* observations.

21 March 2015. LT 06:47 0.0 HT 13:20 5.8. Landsat-8 Image and Total Suspended Sediment (TSS).

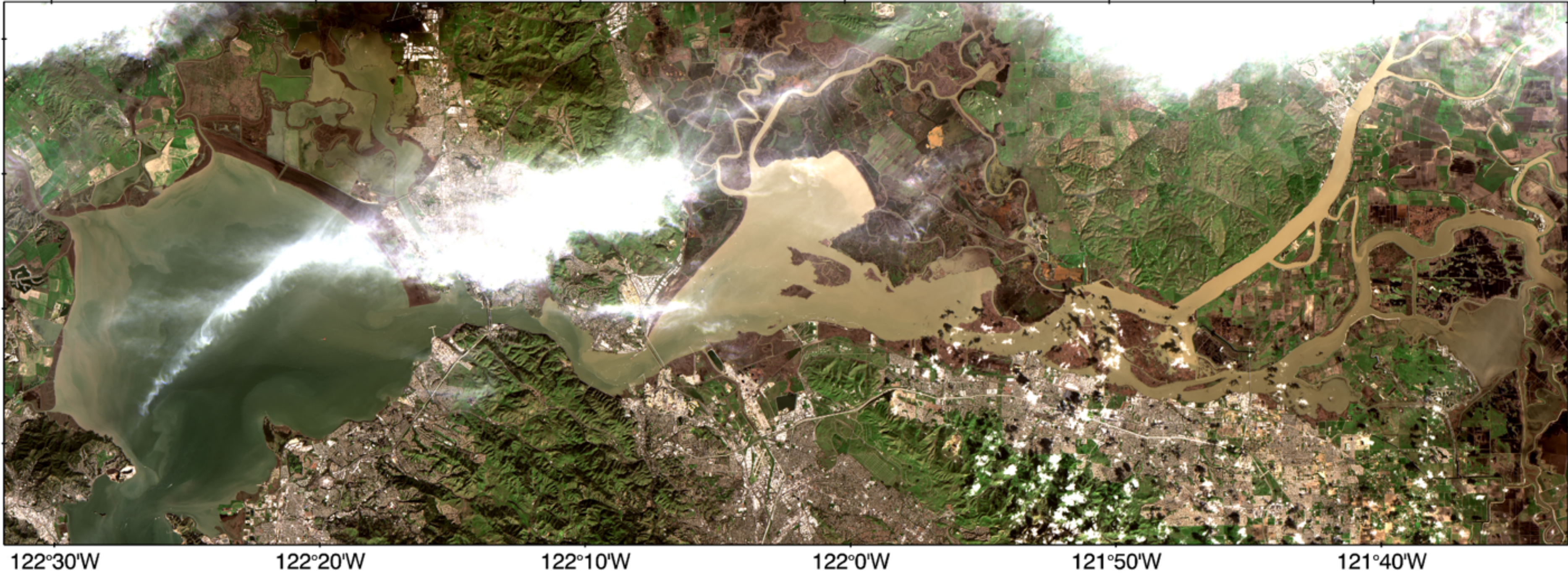
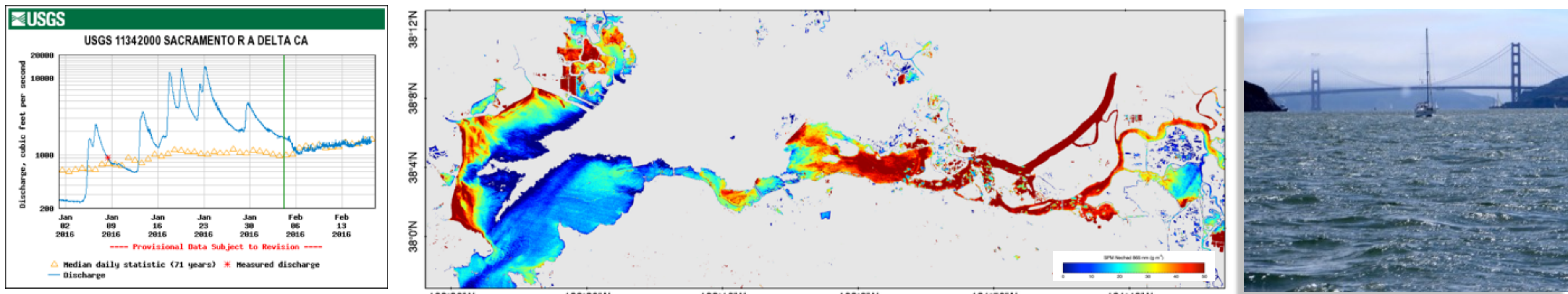
(Tides at Golden Gate. Rio Vista Tides lag 4-5 hours.)



Sampling Locations on 30 October 2015 (Google Earth Map)



04 February 2016. HT 07:49 5.9 LT 14:48 0.1 HIGH FLOW



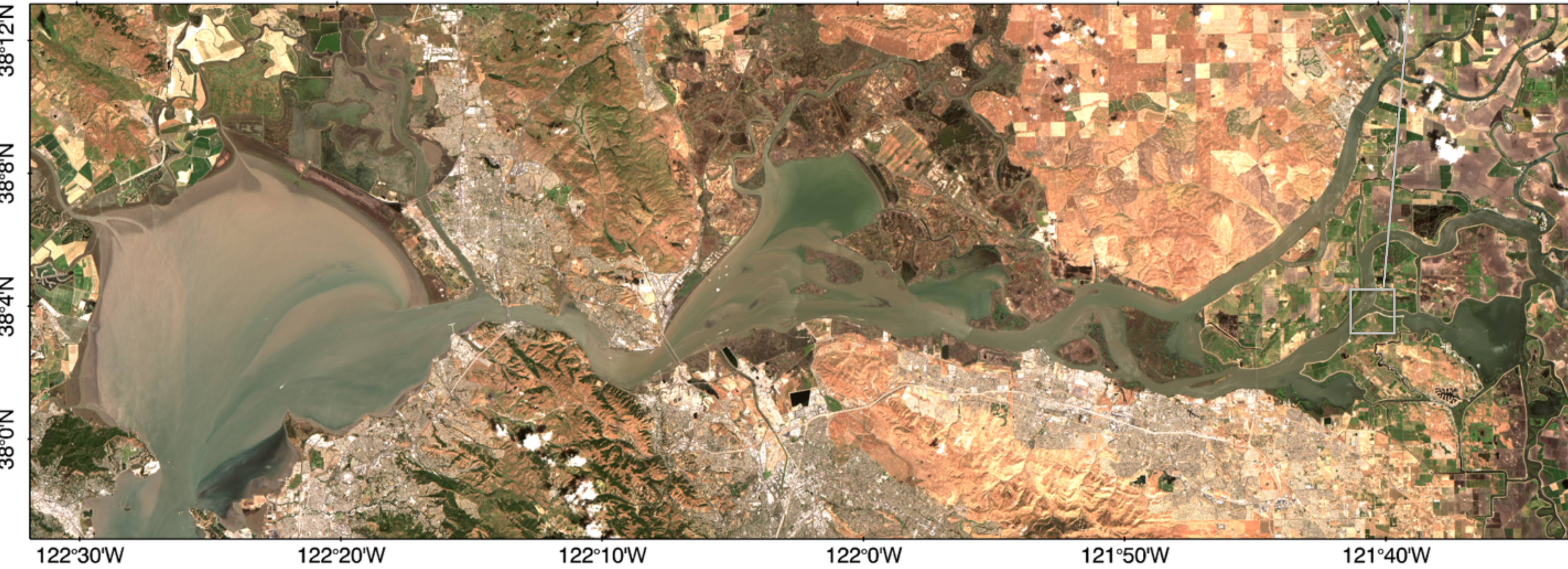
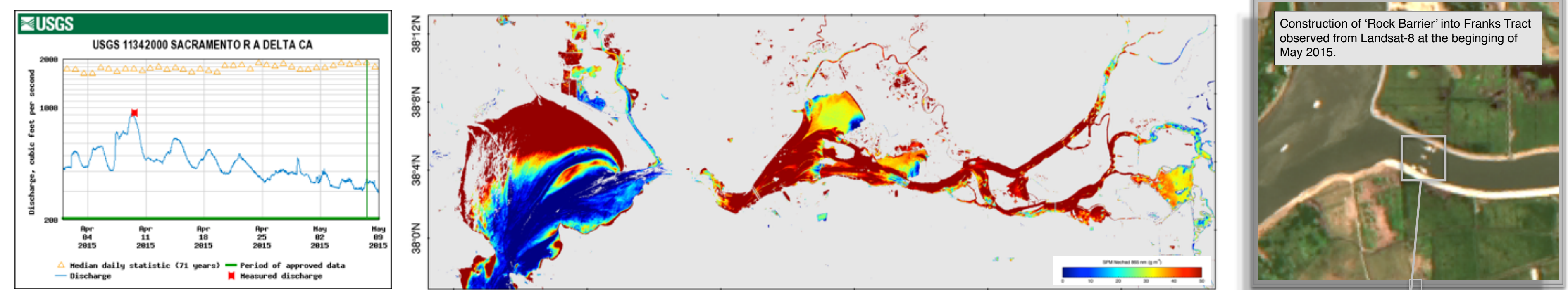
Field Operations

Coordinated field operations, with cruises out of the San Francisco State Romberg-Tiburon Center (RTC), including data collections by the RTC, Oregon State University (OSU), and the US Naval Research Laboratory (NRL).

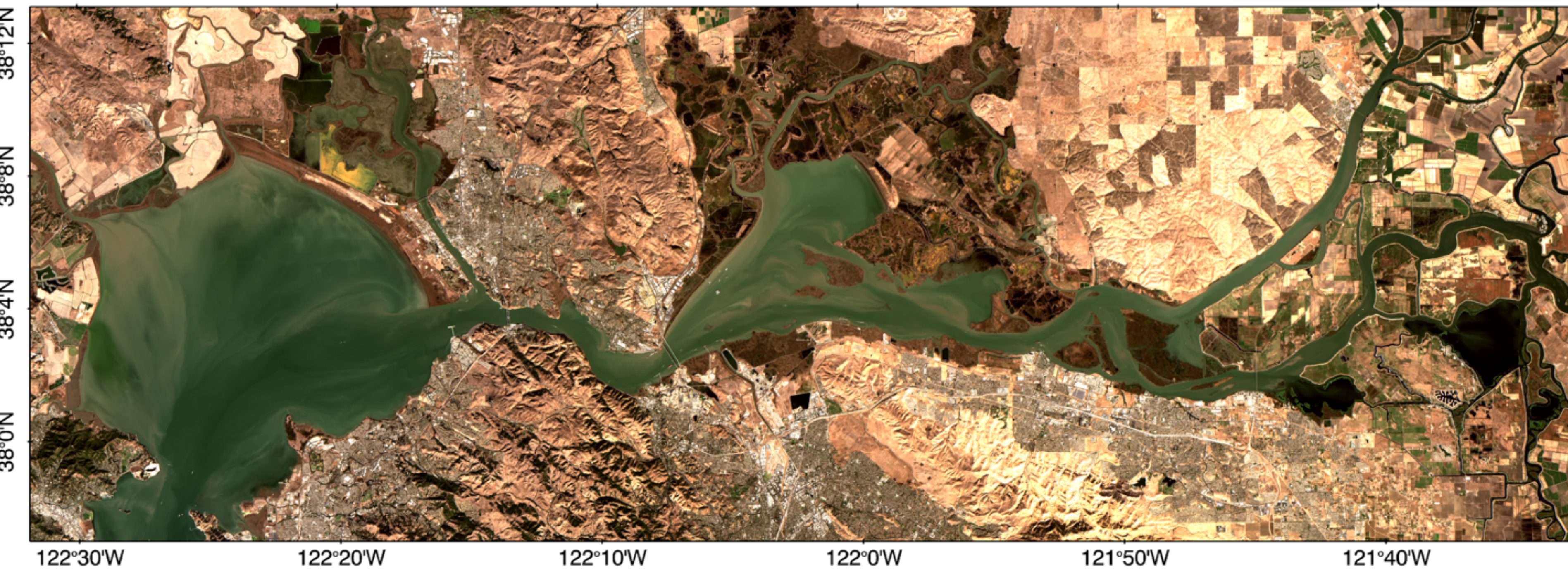
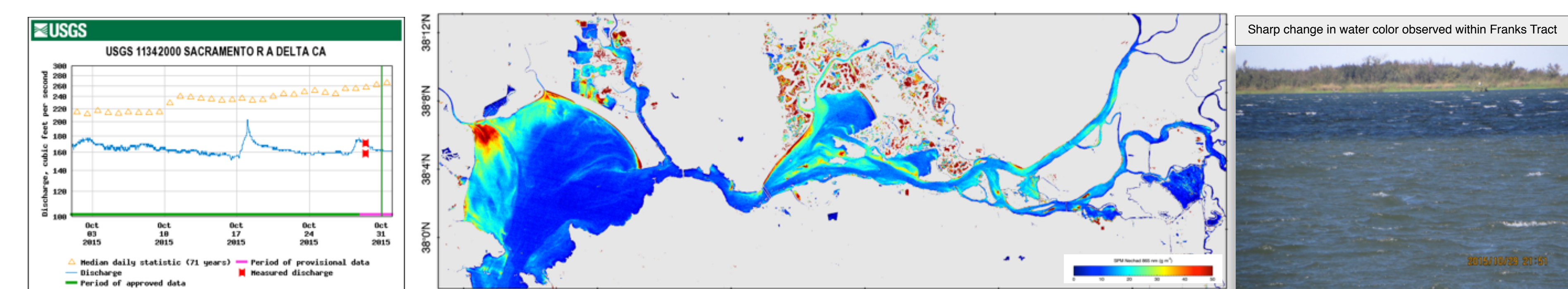
Biogeochemical *in situ* data samples include: Secchi depth, chl-T, chl-F, TSS, HPLC (RTC); above and in water spectrometry, HPLC (OSU); TSS, CDOM, particle analysis (NRL). Instrument deployments include: Filter Rigs, PhytoFlash (RTC), HyperPro and Spectral Evolution spectrometer (OSU); LISST, AC-S (NRL).

Team members responsible for data collection, and coordination with San Francisco Bay Stake holders, include: Frances Wilkerson, Dick Dugdale and Sarah Blaser (RTC); Alex Parker (CSU Maritime Academy); Steve Ackelson and Joe Rhea (NRL).

08 May 2015. LT 09:12 -0.7 HT 16:39 4.4



31 October 2015. LT 08:43 2.5 HT 14:44 5.9



CONCLUSIONS

Landsat 8 OLI data provides a valuable new tool for remote sensing of rivers and estuaries. It is the first Landsat data to have sufficient SNR and additional blue band for coastal ocean remote sensing. Products from *Acolite* algorithms are being validated with RIO-SFE *in situ* data. The time series of Landsat data combined with *in situ* data from the RIO-SFE Project provides a unique new view of upper San Francisco Bay and Estuary.

RIO-SFE Related Presentations at Ocean Sciences 2016

- EC21B-06: Using Remote Sensing to Determine the Spatial Scales of Estuaries
- HI34A-1801: Suspended and Dissolved Matter in the Sacramento River and Delta Region Under Drought Conditions
- HI34A-1802: Nutrients and Phytoplankton Productivity in the Sacramento River and San Francisco Bay Delta Region Under Drought Conditions
- HI34A-1796: A Modeling Study of the San Francisco Bay and Delta Ecosystem in High and Low River Flow Years
- HI34A-1803: Towards a real-time forecasting system for the San Francisco bay/estuary and rive delta
- B14A-0291: Effects of Ammonium-rich Wastewater Effluent on Phytoplankton Productivity in Experimental Mesocosms from the northern San Francisco Estuary

Funding

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Cruise Dates	
2014	May 28-29 October 15-17
2015	March 24-25 May 28-29 October 28-30
2016	March 8-30 May 18-24