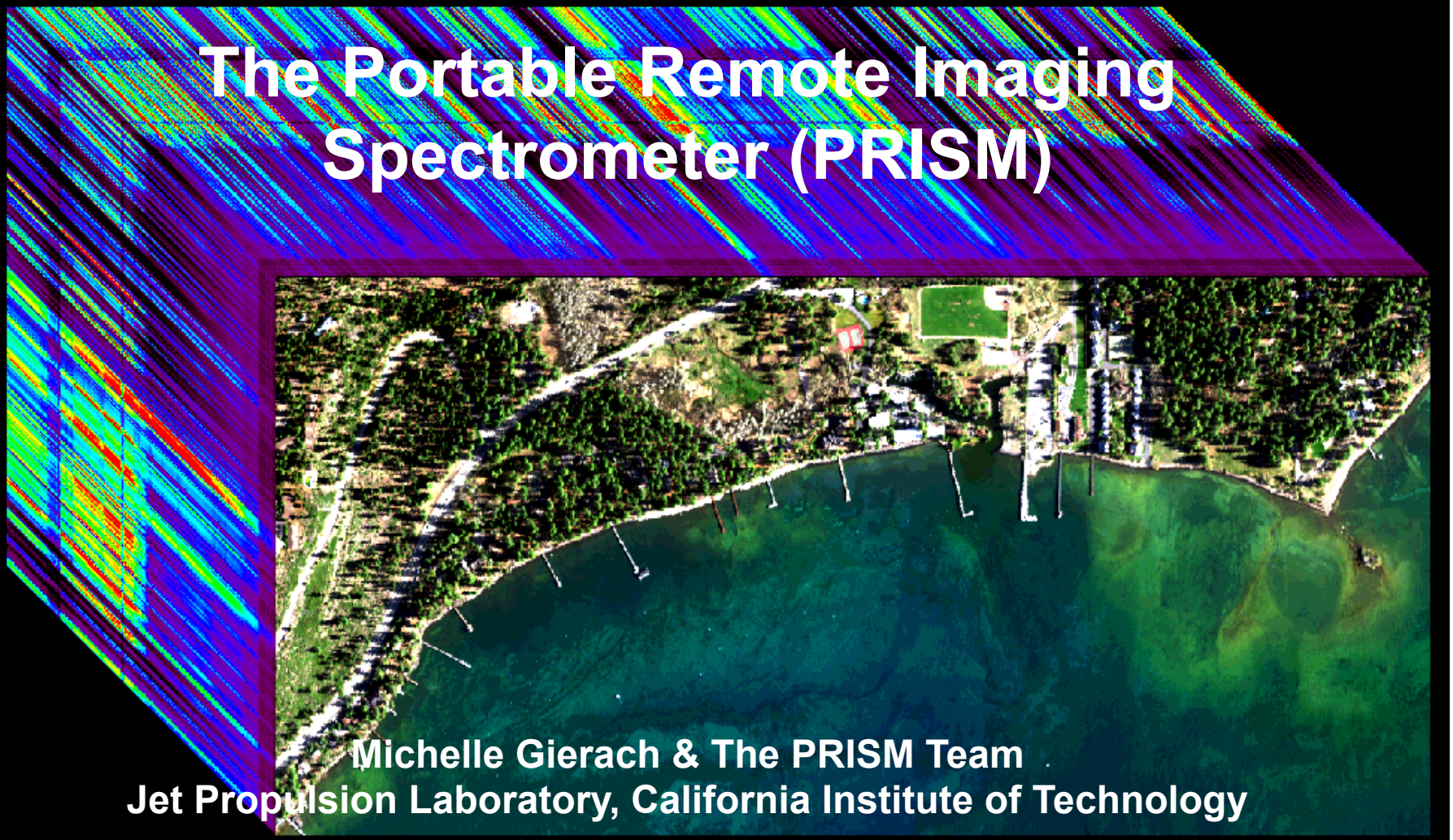
The Portable Remote Imaging Spectrometer (PRISM)



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Jet Propulsion Laboratory, California Institute of Technology

ESTO
Earth Science Technology Office

Acknowledgments

The PRISM Team:

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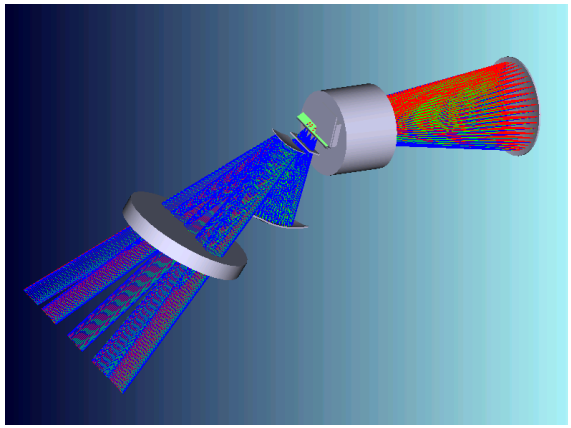
NASA Partner: AFRC

PRISM Sensor and History

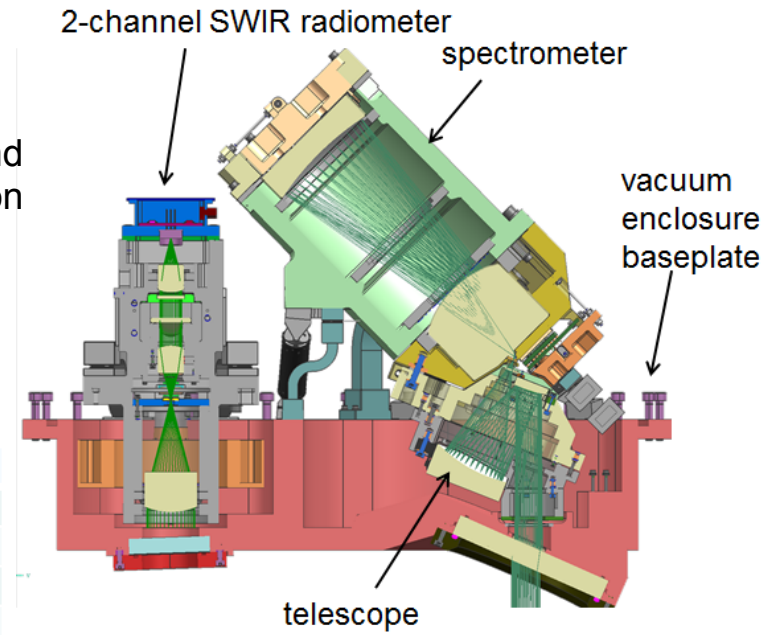
PRISM is a state-of-the-art imaging spectrometer optimized for the needs of coastal ocean science, providing high SNR and dynamic range, low polarization sensitivity, high spatial resolution, and high uniformity.

- PRISM development award: 2009
- First flight: May 2012
- First science campaign: Aug. 2012
- Additional science campaigns: January 2014, April-May 2014
- All campaigns utilized Twin Otter Aircraft (GRC and TOIL)
- Typical altitude range 1-10 kft
- Reached maximum TO aircraft altitude of ~20 kft in May 2014

PRISM Specifications and Design



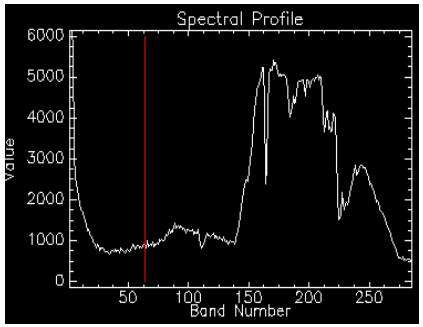
High throughput and high uniformity Dyson spectrometer

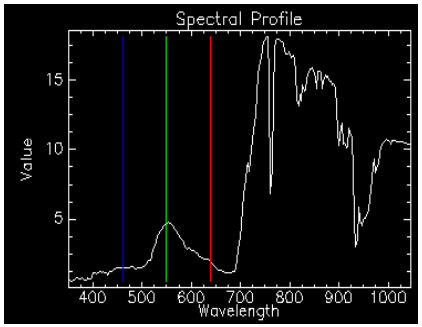


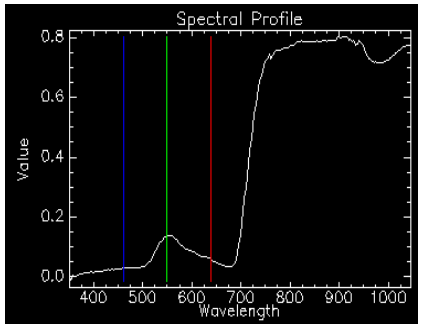
Spectral	Range	349.9 – 1053.5 nm
	Sampling	2.83 nm
	Resolution (FWHM)	3.5 nm typ
	Calibration uncertainty	<0.1 nm
Spatial	Field of view	30.7°
	Instantaneous FOV sampling	0.882 mrad
	IFOV resolution (FWHM)	0.97 mrad
	Cross-track spatial pixels	608
Radiometric	Range	0 – 99% R
	Sampling	14 bit
	Calibration uncertainty	<2%
	Signal to Noise Ratio *	500 @ 450 nm
	Polarization variation	<1%
Uniformity	Spectral cross-track uniformity	>95%
	Spectral IFOV uniformity	>95%

Parameter	Channel 1	Channel 2
Channel center (nm)	1242	1608
Bandwidth (nm, FWHM)	22	56
FOV (mrad, FWHM)	2.4	2.4
Boresight knowledge (mrad, rel. to spectr.)	0.05	0.05
Sampling	13 bit	13 bit
SNR @ 1.2 mW/cm² sr	325	390

PRISM Data Processing







Level 0: Raw instrument DNs

1. Measure incident radiance at 100 lines/sec.
2. Associate data with Inertial Measurement / GPS for orthorectification

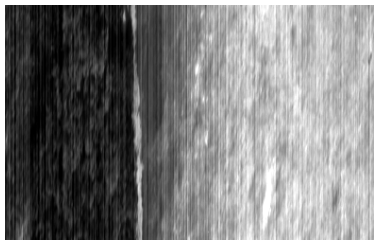
Level 1: Calibrated radiance

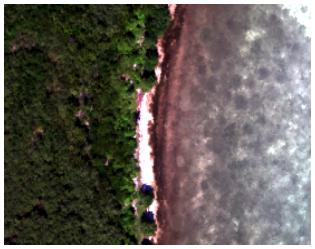
1. Characterize dark current
2. Correct panel artifacts
3. Correct panel tap boundaries
4. Correct pedestal shift
5. Apply flat field
6. Apply radiometric calibration

Level 2: Surface reflectance

1. Calculate atmospheric absorption, aerosol and molecular scattering based on aircraft imaging geometry
2. Retrieve water vapor and optical path for each spectrum
3. Correct data to apparent reflectance at the surface

Spatial processing: Cropping, binning and orthorectification

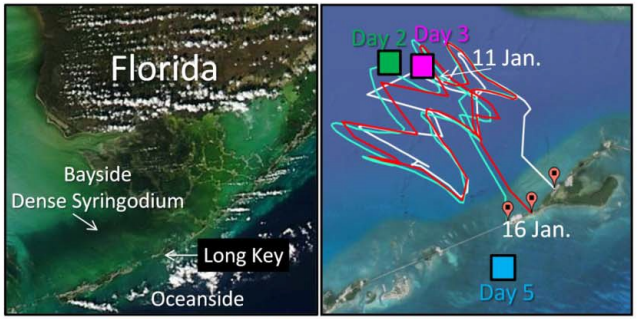


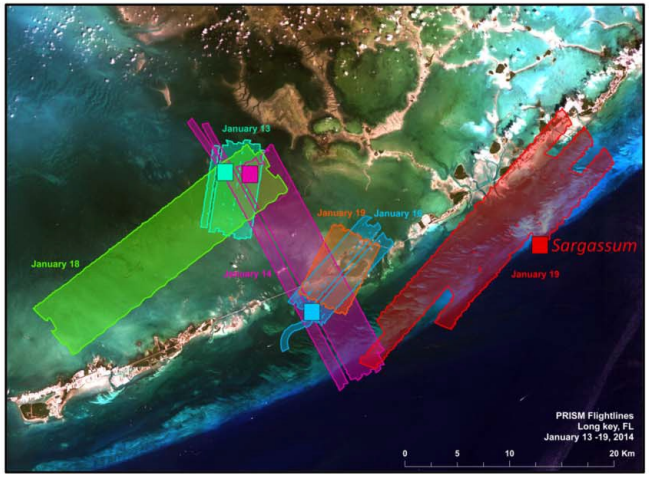


Data Dissemination

http://prism.jpl.nasa.gov

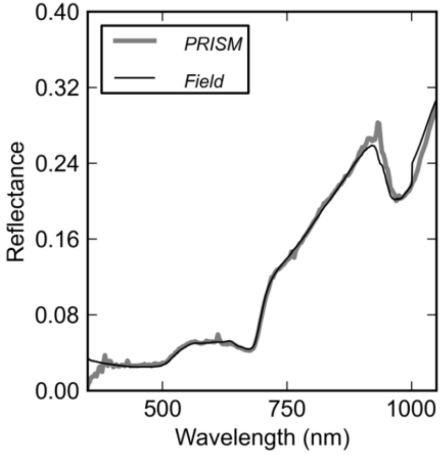
Floating vegetation and carbon transport in Florida Bay: Jan. 2014



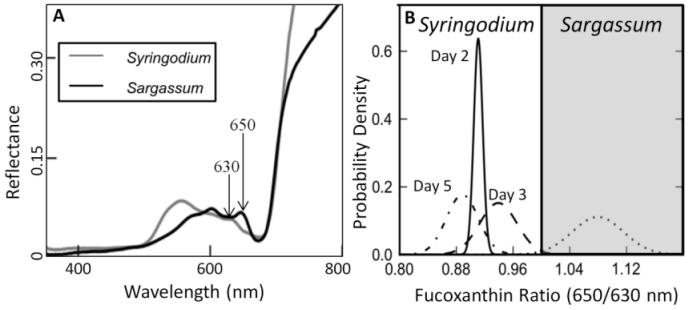


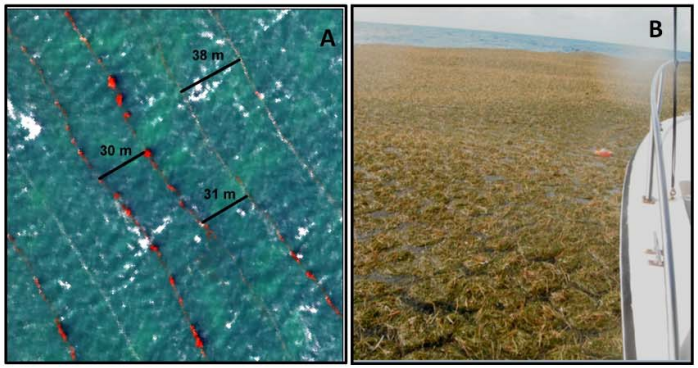
PRISM flightlines and drifter buoy locations

Verification with in-situ data



Algorithm development for distinguishing between vegetation types based on unique pigments



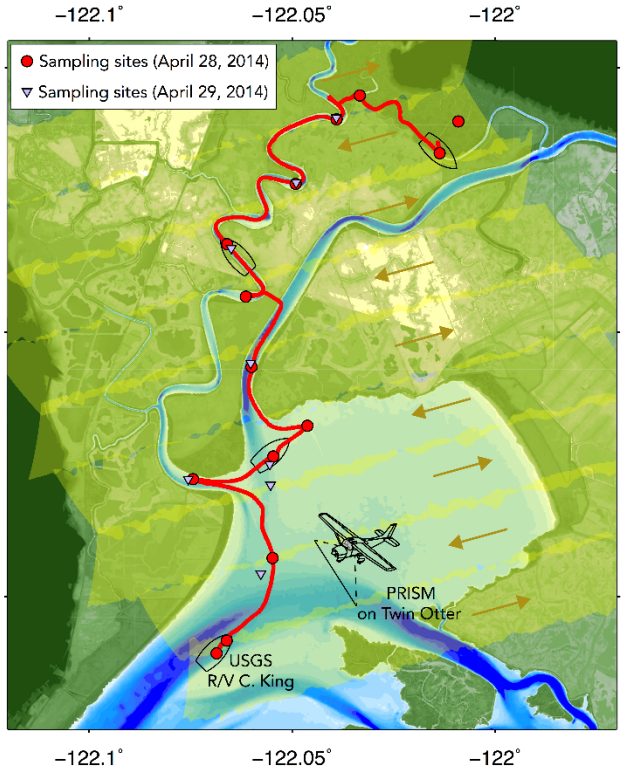


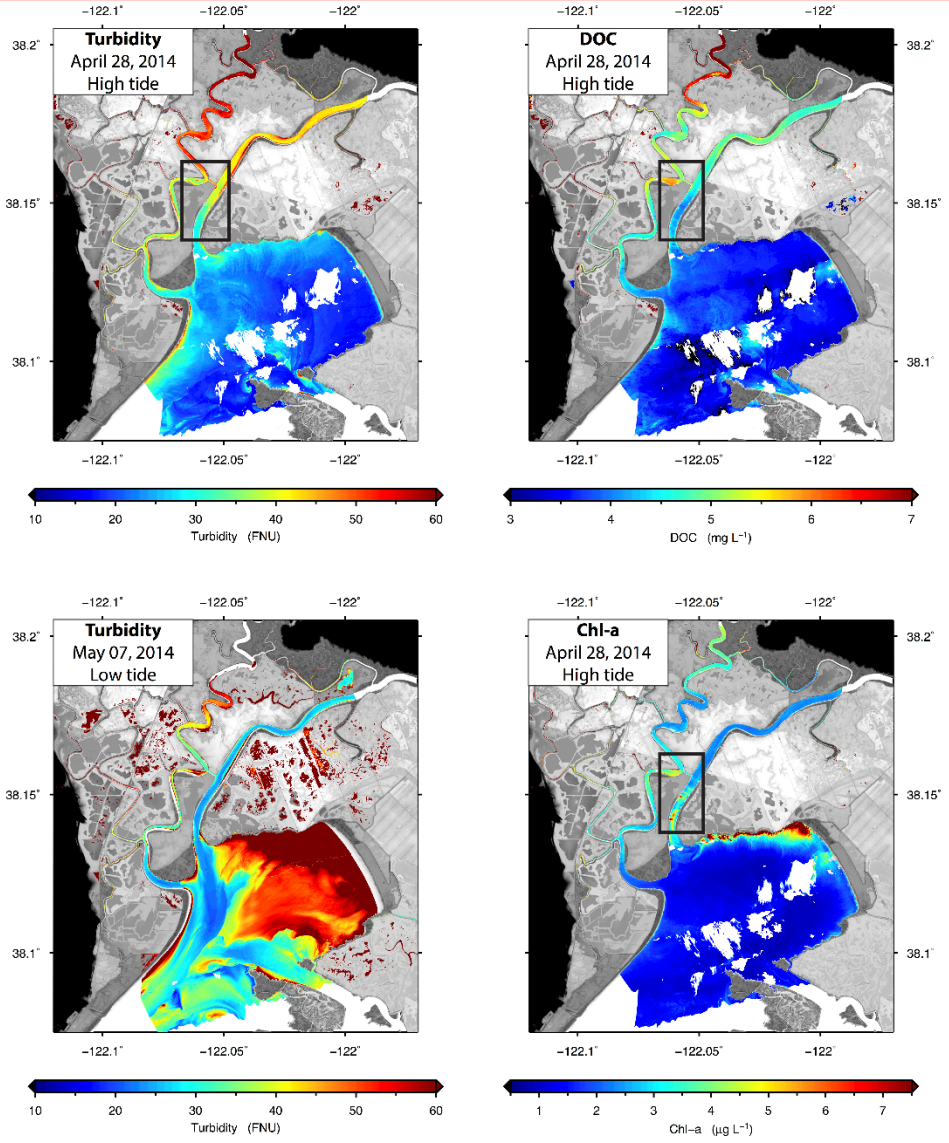
Floating seagrass wrack mapping with PRISM demonstrates required spatial scale.

* H. Dierssen et al: “Hyperspectral discrimination of floating mats of seagrass wrack and the macroalgae Sargassum in coastal waters of Greater Florida Bay using airborne remote sensing”, Rem. Sens. Environment, in print.

Water quality monitoring in the Sacramento Bay Delta: May 2014

Algorithm development and products for turbidity, dissolved organic content, and chlorophyll-a, supported by in-situ data.



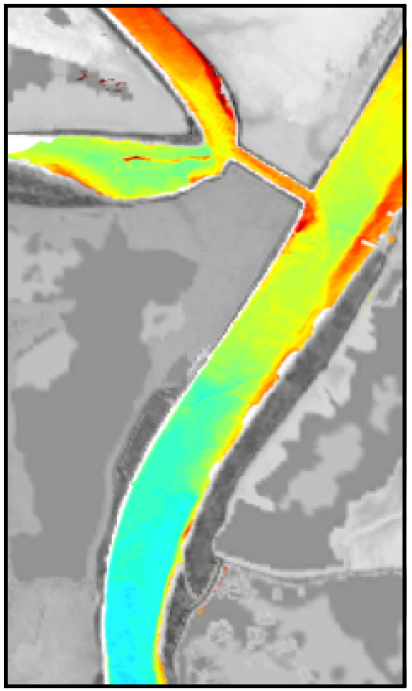


Water quality monitoring in the Sacramento Bay Delta: May 2014

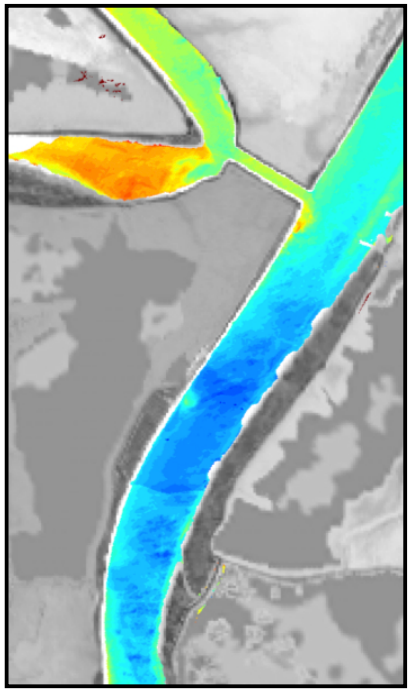
Zoom-in example, spatial resolution 2.5 m

Remote Sensing Reflectance

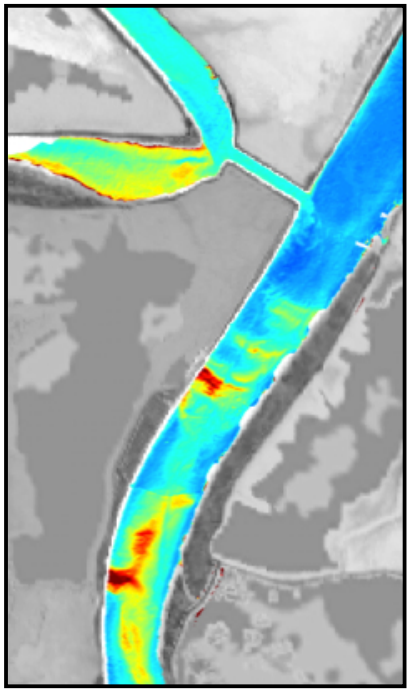
Turbidity



Dissolved Organic Carbon



Chlorophyll-a



Water quality monitoring in the Monterey Bay: May 2014