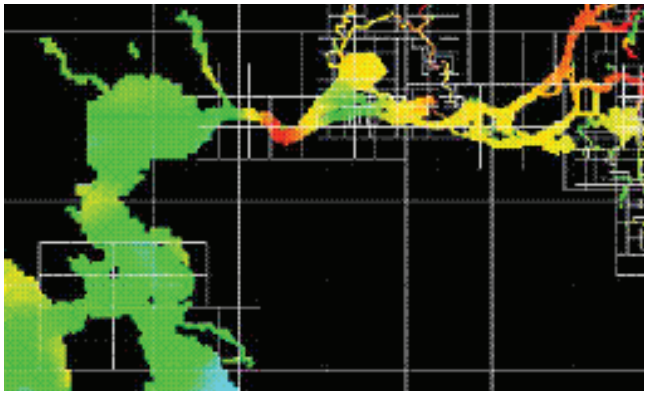
Building an Operational System

FRESHWATER IN CALIFORNIA'S SACRAMENTO-SAN JOAQUIN DELTA must traverse a network of about 1000km of channels to make its way from the riverine source in the north to the pumping stations in the south. Tidal oscillations enhance the mixing of fresh water with polluted water from the San Joaquin River and with salt water from the ocean. The challenge of managing salinity in the Delta system lies in the complexity of its topology and hydrodynamics.

In the face of this complexity, managers of the Delta are beginning to focus on the maintenance of a freshwater corridor that bisects the entire Delta – seen as crucial to the future of water management in California. Part of the emphasis of our joint work with the Department of Water Resources and the LBNL is the design, deployment, and testing of the fleet, the building of an interface with existing USGS sensors already deployed in the Delta, and the integration of all data feeds into a single system.

THE LONG-TERM VISION of our project is to put California water online, to create a system that will enable water managers and scientists to visualize the evolution of California's water resources in real time.



The data collected by the Floating Sensor Network will improve a Sacramento-San Joaquin River Delta in conjunction with LBNL.

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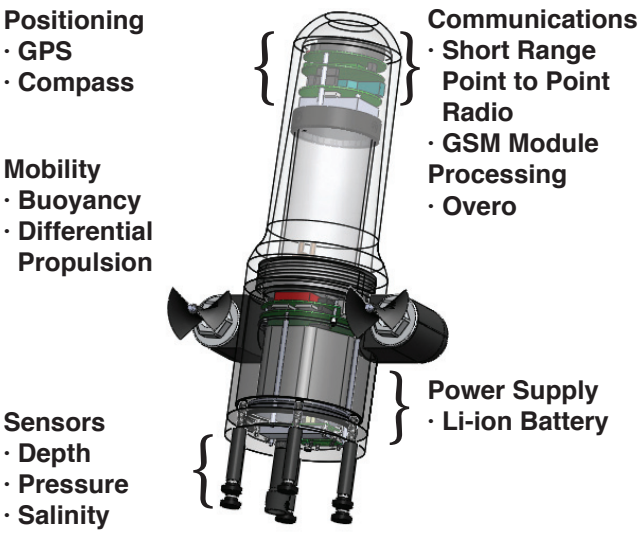
Floating Sensor Network

The Floating Sensor Network project at UC Berkeley is building a water monitoring system that can be deployed in estuarine environments and rivers, and can be integrated into existing water-monitoring infrastructure.

Why Track Water?

Water managers need to track the movement of water, salinity, and contaminants in complex networks of channels like deltas or estuaries. Whether in emergency situations such as a levee failure, flood, or contaminant spill, or for management efforts such as maintaining the freshwater channel in Northern California's Sacramento-San Joaquin Delta, is important to understand where the water is going. Permanently placed sensors alone are important tools, but they cannot be placed everywhere on a large complex network of water or levees, and they don't track water as it moves.

Generation 3 Drifter



The Floating Sensor Network Project

The Floating Sensor Network team will build 100 motorized drifters, which are communication-enabled and integrate numerous sensors, including GPS, temperature, and salinity. The fleet will be deployable rapidly, in response to unanticipated events such as floods, levee breaches, and contaminant spills. The team is also working on hydrodynamic models (one and two dimensional shallow-water equations) and inverse modeling algorithms (Ensemble Kalman Filtering and its extensions) to integrate these measurements in the models.

Jointly with the Lawrence Berkeley National Laboratories (LBNL) and the California Department of Water Resources, the team is developing a computational infrastructure which will run online (Web-based), and integrate in real time the measurements from static sensors (for example, USGS permanently deployed sensing stations), mobile measurements, and any other data feed.

How Does It Work?

MOBILE, PORTABLE, FLOATING SENSORS are placed into the flowing water where they are needed, and are carried by the current through the area of interest. Data sent from the sensors is used to estimate and produce maps of water flow. The devices transmit information to the responders using the cellular phone network as well as short-range wireless radios. As the sensors are carried by the water, their GPS receivers keep track of their movement. This provides a snapshot of the direction and speed of the water at a point. The "particle outcome" (where the sensor ends up) is especially valuable when responders are concerned about the movement of contaminants. The real time information from multiple sensors is combined to provide a big picture — a situation awareness map — of the entire system. Each drifter traces a different path; combining all these paths together is more informative than the individual parts. Imagine a "traffic map" for an entire delta, showing the speed of water, how deep the water is everywhere, and how contaminated the water is.