FLOATING SENSOR NETWORK
FOR REAL-TIME RESPONSE TO LEVEE BREACH

Rapid Repair of Levee Breaches Demonstration

Stillwater, Oklahoma | November 9, 2009

Cylinders 5" in diameter and 17" tall float (motorized, with their major axis vertical) and communicate water quality information via cell phone and short-range radio.

Why Track Water in Emergencies?

IN EMERGENCY SITUATIONS such as a levee failure, flood, or contaminant spill, responders need information about the movement of water and pollutants in complex networks of channels like deltas or estuaries. Permanently placed sensors are insufficient; with a limited number of sensors on an extensive water or levee system, the odds are high that there will be no sensor in the exact location where the emergency happens to occur. Permanent sensors also can't track where the water goes after it flows past the breach.

As part of the November 9, 2009 *Rapid Repair of Levee Breaches Demonstration,* the University of California, Berkeley's Floating Sensor Network project will demonstrate an immediate-response force capable of being deployed on demand in case of a natural disaster such as a levee breach. The rapid deployment of such a fleet can lead to an immediate and more precise understanding of "where the water is going," thus helping agencies to contain disasters more quickly and more efficiently.

In addition to tracking contaminants, the technology can be deployed in a levee system to search for signs of levee leaks (abnormal temperatures, abnormal salt concentration) and it can be deploy around levee breach to confirm a repair is functioning properly.

Team members from UC Berkeley's Lagrangian Sensor Systems Laboratory test their system on the San Joaquin Delta in Northern California.

UC Berkeley Project Overview

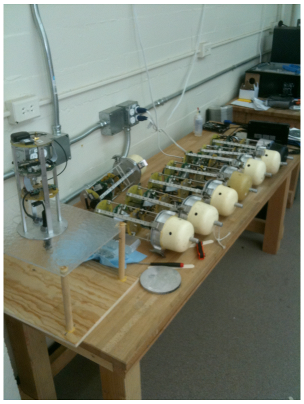
THE LAGRANGIAN SENSOR SYSTEMS LABORATORY (LSSL) at UC Berkeley, jointly with the Lawrence Berkeley National Laboratories (LBNL) and the California Department of Water Resources, is developing a suite of hydrodynamic models that can track where particles go in water. The system relies mainly on one-dimensional and two-dimensional shallow-water models that map the evolution of the water.

These models can track individual contaminants in the water (for now limited to salt), to model the evolution of concentrations of various waterborne agents in the riverflow. Further, the computational codes the team developed can integrate streaming measurements in the models in real time. The operational goal is to provide real-time online (Web-based) estimates of the riverflow and propagation of the salt.

The whole system – drifters, communication to the system, computation in real time, and broadcast of the information back to the operators – is planned to be operational in 2010.

PRINCIPAL INVESTGATOR: ALEXANDRE BAYEN, ASSISTANT PROFESSOR, SYSTEMS ENGINEERING · BAYEN@BERKELEY.EDU · 510.642.2468
LEAD GRADUATE STUDENT: ANDREW TINKA · TINKA@BERKELEY.EDU · 510.938.4620
DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING
UNIVERSITY OF CALIFORNIA BERKELEY · ROOM 3, MCLAUGHLIN HALL · BERKELEY, CA 94720

http://float.berkeley.edu



The batteries on board the drifters allow 24 hours of deployment before recharging.

How Does It Work?

MOBILE, PORTABLE, FLOATING SENSORS are placed into the flowing water where they are needed, and are carried by the water through the area of interest. The sensors send data construct maps of how the water is moving. The devices transmit information to the responders using the cellular phone network as well as short-range wireless radios. The devices can be retrieved once they leave the area of interest.

As the sensors are carried by the water, their GPS receivers keep track of their movement. This provides a snapshot of how fast the water is moving and where it's going. 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 "Google traffic map" for an entire delta, showing the speed of water, how deep the water is everywhere, and how contaminated the water is.

Major General Don. T. Riley of the U.S. Army Corps of Engineers with lead graduate student Andrew Tinka after a visit to the CITRIS Museum at UC Berkeley on Oct. 8, 2009.

Building an Operational System

California's Sacramento-San Joaquin Delta

FRESHWATER IN CALIFORNIA'S SACRAMENTO-SAN JOAQUIN DELTA must traverse a network of about 1000 kilometers 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," that is, to create a streaming system that will enable water managers and scientists to visualize the evolution of California's water resources in real-time.

PRINCIPAL INVESTGATOR: ALEXANDRE BAYEN, ASSISTANT PROFESSOR, SYSTEMS ENGINEERING · BAYEN@BERKELEY.EDU · 510.642.2468
LEAD GRADUATE STUDENT: ANDREW TINKA · TINKA@BERKELEY.EDU · 510.938.4620
DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING
UNIVERSITY OF CALIFORNIA BERKELEY · ROOM 3, MCLAUGHLIN HALL · BERKELEY, CA 94720

http://float.berkeley.edu