Finding Groundwater Seeps into Surface Waters
Advances in Distributed Temperature Sensing (DTS)

Overview

- Distributed temperature sensing (DTS) locates groundwater seeps by detecting hot and cold spots across large areas of sediment
- DTS reveals dynamic effects of tides, precipitation, pumping, barriers, etc. by monitoring continuously and simultaneously over thousands of locations
- Finds seeps, verifies and refines site models, helps design remediation, develop monitoring plans.

Advances

- Cost reduction with new installation equipment, also avoids need for divers, contact with sediment, and improved installation quality
- Improved sensitivity and flux estimates using new algorithms for fiber burial depth
- New applications in wells and streams

How it Works

- Fiber optic cable in sediment
- DTS instrument records temperatures continuously over length of fiber
- Post-processing identifies seeps and time-dependence
- Typically as part of projects including site models, sampling, and remediation

Example: Gowanus Canal

SelkerMetrics with Geosyntec (P. Schillig & D. Adilman)

✓ Seeps Located

- 2 acre installation at Superfund site, Brooklyn, NY.
- Avoided worker-sediment contact, used no divers, achieved uniform burial, provided as-built GPS data
- Discovered seep locations using direct temperature and tidal influence on temperature, confirmed with seep meters
- Helped validate groundwater discharge model

Example: Refinery Pond

Winter Installation Shows Tidal-Affected Seeps

✓ Seeps Located

- Hot spots disappearing during high tides suggest presence of intermittent seeps

Example: Mediterranean

Experimental installation to test depth analysis

✓ Cable-Depth Verified

- Data collected before and after storm showed changes associated with re-deposition of sand
- Improved depth estimates improves accuracy and supports estimate of seep flux rates

Other DTS Applications

Stream Inflows
- Wall Walla river
- Identified both inflows and areas of hyporheic exchange
- Best prediction available for location of salmon

Well Installations
 Detect Water Movement
- Methods include passive temperature, uniform heating, patented intermittent “dotted line” heating
- Continuous across entire well for extended times

The Sky - and Soil and Water - are the Limits!
- Continuous, accurate temperatures over large distances and times

Installation of “dotted line” with 250 heaters (above) and modelled plume from one “dot” (left)

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