WATER FLUX PROBE

A more complete understanding of subsurface water and groundwater interactions

Pacific Northwest NATIONAL LABORATORY

A UNIQUE PERSPECTIVE, FASTER RESULTS

The Thermo-Electric Water Flux Detection Probe, or TEFLUX, developed by researchers at Pacific Northwest National Laboratory, is a vertical array of sensors that can be installed in the sediment to determine the vertical movement of water from the surface through the soil and groundwater. It determines pressure over time, fluid electrical conductivity (EC), temperature, and bulk conductivity for a more complete picture of water flux. These data are sufficient to estimate the vertical distribution of porosity and permeability. From all these geophysical measurements, the calibrated flow model that comes with the probe computes the corresponding Darcy flux and pore velocity time-series. No other tool provides such a wealth of data this accurately and quickly.

KEEPING RIVERS AND LAKES HEALTHY

The movement of water from the surface through the soil and into groundwater governs many ecological functions critical to ensuring the health of lakes and rivers. Water inflow and outflow, or flux, effects the type of microbes in the soil and the nutrients present.

TECHNOLOGY FEATURES

Uses multi-physics monitoring with joint inversion to estimate porosity, permeability, transient pore velocity, and Darcy flux for a more comprehensive understanding of surface water/groundwater interactions

Couples measurement and analyses

Surface water flux is also key to understanding contaminant transport through soil and groundwater. However, traditional methods for monitoring this flux do not provide sufficient information to confidently determine water movement under dynamic conditions.

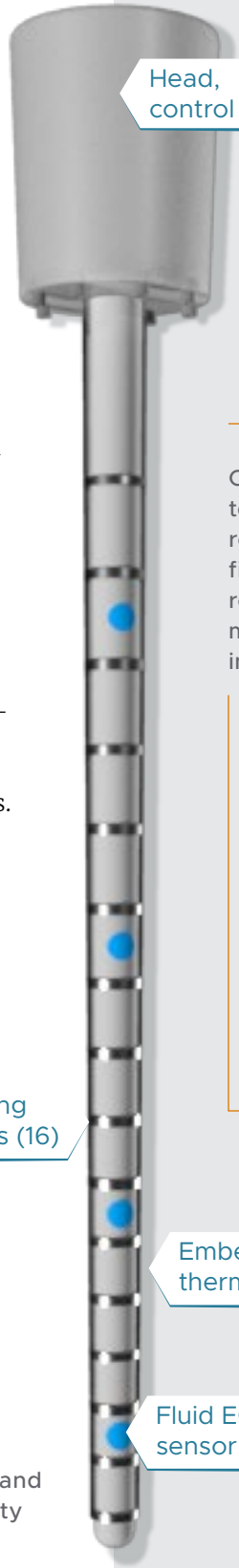
MORE INFORMATION, BETTER DECISIONS

TEFLUX comprises a non-metallic conduit approximately 2 to 5 cm in diameter and 50 to 300 cm long, which includes a series of ring electrodes that can be used to monitor the bulk EC time-series of the sediment along the longitudinal axis. It can also be equipped with miniature sensors that monitor pressure, temperature, and fluid conductivity along the vertical axis of the probe.

All time-series data from TEFLUX can be simulated using PNNL's PFLOTRAN-E4D, an open-source parallel multi-physics code that simulates reactive flow and transport in porous materials. The combination of calculations available through TEFLUX and corresponding analysis using PFLOTRAN-E4D offers a unique perspective not available with any other tool or approach, for faster, more thorough results.

MORE THAN ANY OTHER TOOL

Traditional methods for monitoring movements of groundwater and surface water do not provide enough information to allow confident calculations. For example, flux chambers determine the total mass flux, but they do not provide any information on pore velocity or residence time, which are needed to track contaminants. Another common method, vertical temperature arrays, provides information on pore velocity and residence time but not on total mass flux, preventing accurate calculations of water movement.



Quantifying the spatial and temporal pattern of hyporheic respiration remains a key gap in field studies as well as river reach-scale reactive transport modeling. The flux tool includes:

- Electronics deployed in the head
- Drift free fluid conductivity sensor
- Solid state digital pressure sensors
- Multiple pressure sensors to establish 3D boundary conditions
- Software developments enabling 3D flux estimation.

INDUSTRY APPLICATIONS

The Water Flux Probe can be configured to assess the vertical movement of surface water and groundwater even under conditions when flow is transient, and sediments vary highly. The data it provides can be used to:

- Inform river corridor flux models
- Determine movement of water between surface water and groundwater
- Monitor interactions between surface water and groundwater for a variety of regulatory needs.

This information is of key importance to research organizations, subsurface monitoring companies, and state and federal regulators.

LET'S CONNECT

If you would like to license the Water Flux Probe or have questions, please contact:

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