# ESTIMATING RATES OF EXCHANGE ACROSS THE SEDIMENT/WATER INTERFACE IN THE MERCED RIVER, CALIFORNIA, USING TEMPERATURE AS A TRACER AND DIRECT MEASUREMENT

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## ABSTRACT

The Merced River Basin in central California is one of seven study areas participating in a nationwide U.S. Geological Survey study of how hydrological processes and agricultural practices interact to affect the transport and fate of agricultural chemicals in nationally important agricultural settings. Key to achieving this objective is an understanding of how the agricultural chemicals move through and between hydrologic compartments─atmosphere, surface water, the unsaturated zone, ground water, and the surface-water/ground-water interface. Monitoring of the surface-water/ground-water interface was accomplished by installing 20 monitoring wells across two transects separated by approximately 100 meters. Each transect consisted of five pairs of monitoring wells at two depths; three pairs were installed in the river and one pair on each bank in the riparian zone. All monitoring wells were equipped with temperature loggers and screened sampling tips. A subset of them had pressure transducers and water-quality monitors for pH, dissolved oxygen, and specific conductance. Temperature was used as a tracer to estimate rates of exchange between surface water and ground water. A total of 32 high-precision data loggers recorded temperature every 15 minutes in both the surface water and at three depths below the streambed of the Merced River at both transects. Pressure transducers located in-stream and below the streambed recorded water-level data. Measured temperature and water-level data constrained the upper and lower boundary conditions for a numerical model of the streambed using the Variably Saturated 2-Dimensional Heat (VS2DH) model. VS2DH uses an energy transport approach by way of the advective-dispersion equation to simulate the transport of heat and water. The model of the streambed was calibrated to measure temperatures below the sediment/water interface and above the lower boundary condition. The average vertical flux across the sediment–water interface was gaining at 0.4–2.2 centimeters per day. Direct measurements of vertical flux at the sediment/water interface also were made using seepage meters. Seepage meters generally failed in this high-energy system because of slow seepage rates and a moving streambed, resulting in scour or burial of the seepage meters.

## KEYWORDS
Surface water/ground water interaction, temperature as a tracer, seepage meter