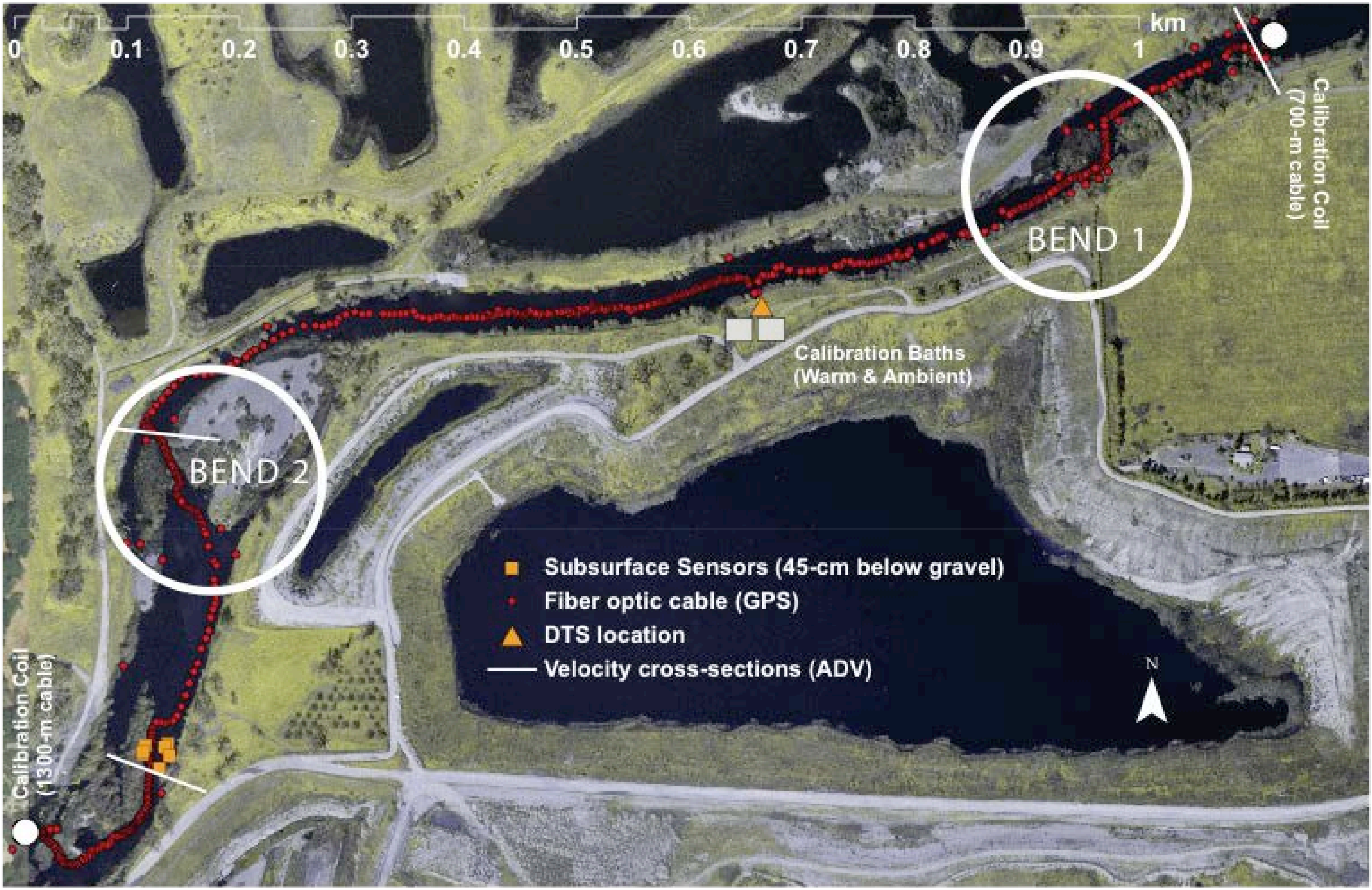
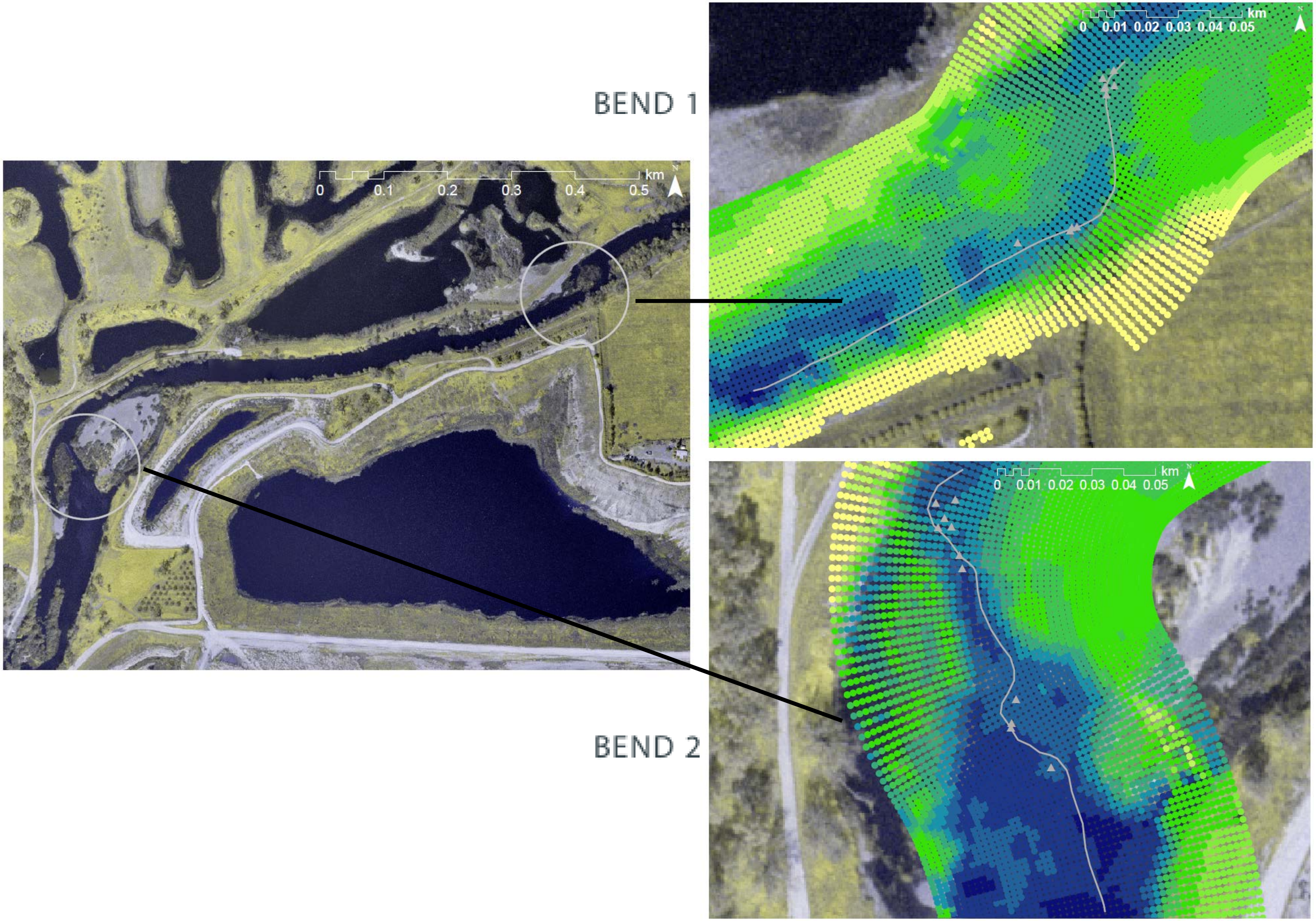
BREN SCHOOL OF ENVIRONMENTAL SCIENCE & MANAGEMENT
UNIVERSITY OF CALIFORNIA SANTA BARBARA

San Joaquin River Restoration Program
Restoration Goal Technical Feedback Group, March 21, 2013
Temperature Monitoring, San Joaquin River

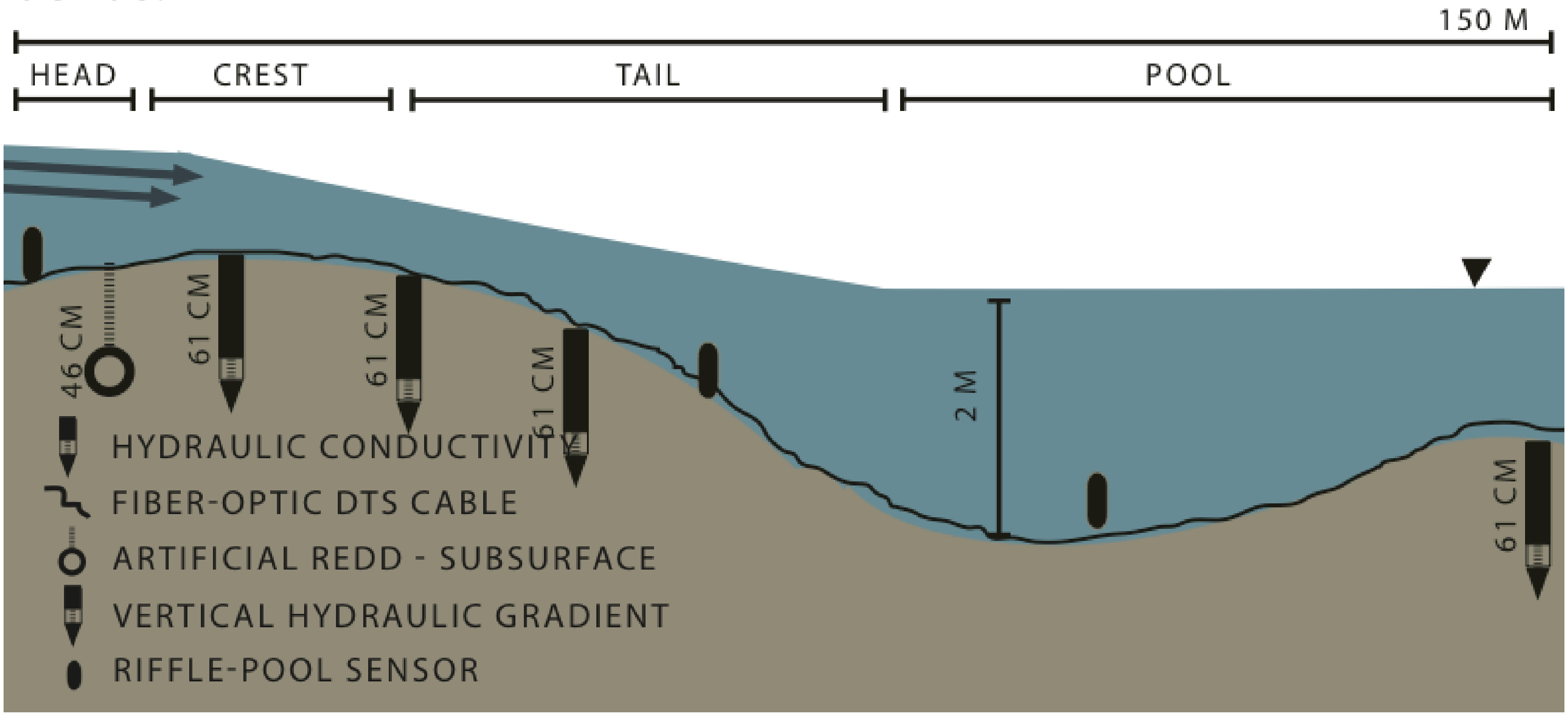
STUDY AREA:
2 KM RIVER REACH OF THE SAN JOAQUIN RIVER, CA, USA
LOCATED 12 KM DOWNSTREAM OF A FLOW EXPERIMENT AT FRIANT DAM




BEND 1
BEND 2
0 0.1 0.2 0.3 0.4 0.5 km
0 0.01 0.02 0.03 0.04 0.05 km
0 0.01 0.02 0.03 0.04 0.05 km

field investigation at the meander-bend scale

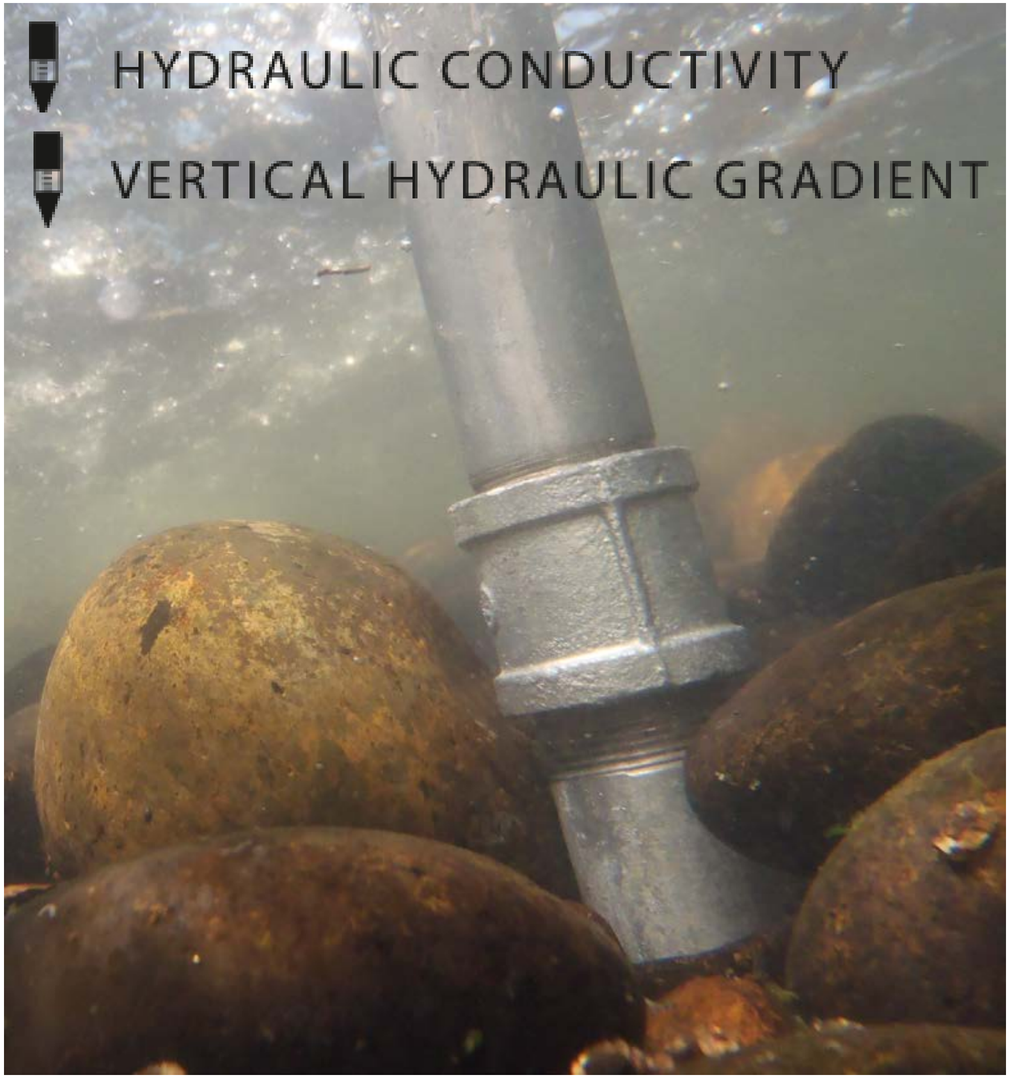
We measured the effects of a large-scale flow experiment on near-bed and subsurface temperature using fiber optic distributed temperature sensing (DTS) in conjunction with measurements of streambed hydraulic conductivity as a means to investigate groundwater-surface water exchange over the length of meander bends.



DIRECT MEASUREMENT OF
HYDRAULIC CONDUCTIVITY (M D^{-1}), K_{SAT}
VERTICAL HYDRAULIC GRADIENT (CM/CM)

Vertical hydraulic gradients (VHGs) obtained from head observations in streambed are used to describe the direction and magnitude of GW-SW fluxes.

Quantifying fluxes is possible with additional measurement of permeability.

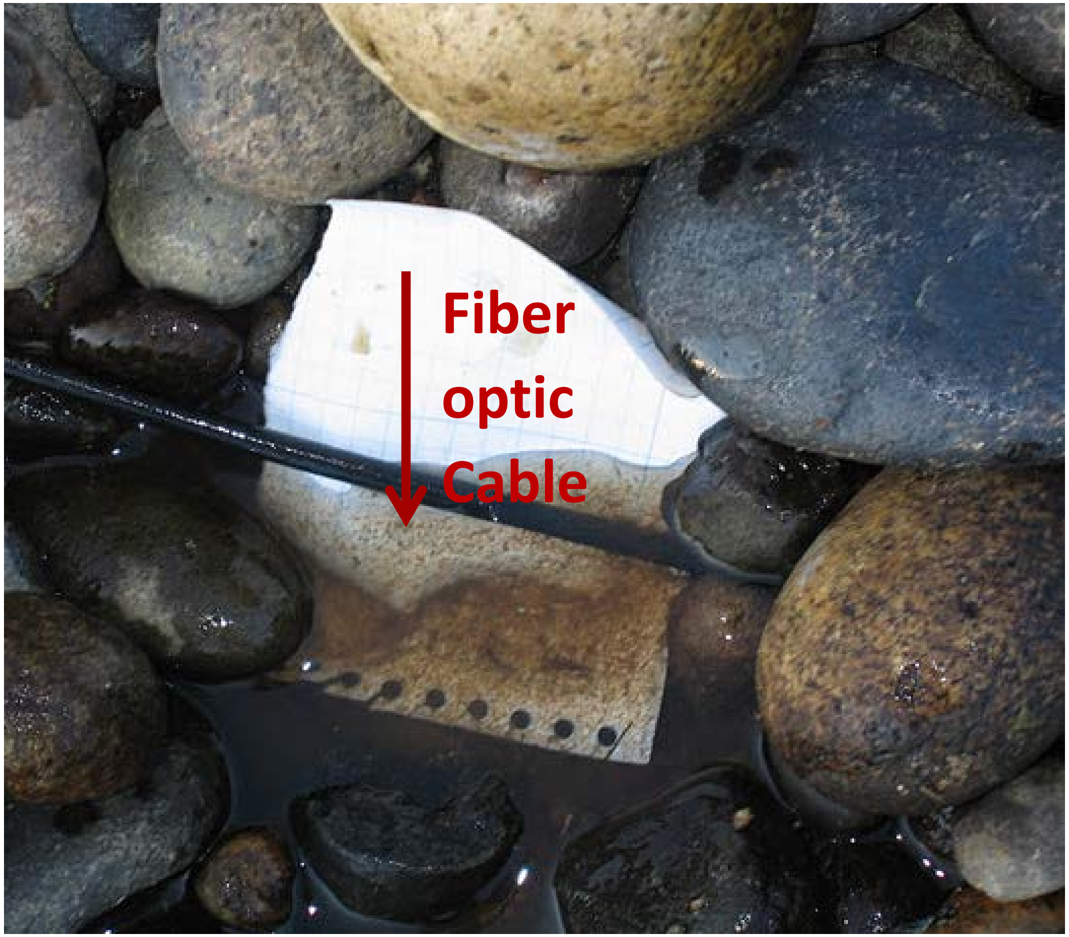


fiber optic distributed temperature sensing

DTS is employed to determine spatiotemporal dynamics of surface water–groundwater exchange by exploiting the temperature contrasts between surface water and groundwater [Henderson et al., 2009; Selker et al., 2006, 2006b; Tyler et al., 2009].

We deployed 2 km of fiber-optic cable directly on top of the riverbed over three pool-riffle sequences each with a different degree of bed mobility.

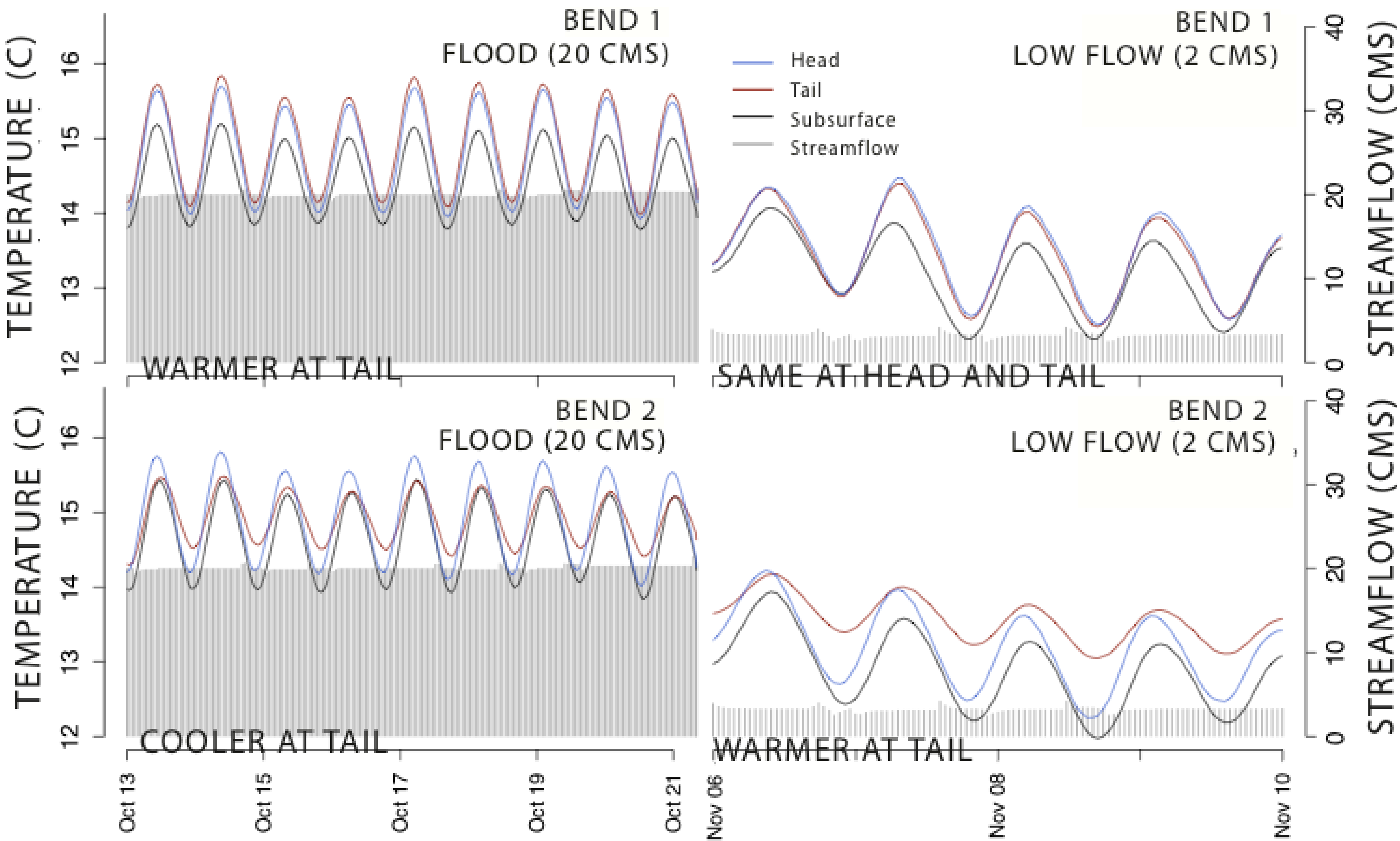
DTS data were collected every **2 meters and every 5 minutes** for an installation lasting 32 days.
1.5 days at 10 cms,
10 days at 20 cms,
16 days at 10 cms, and
4.5 days at 2-4 cms.



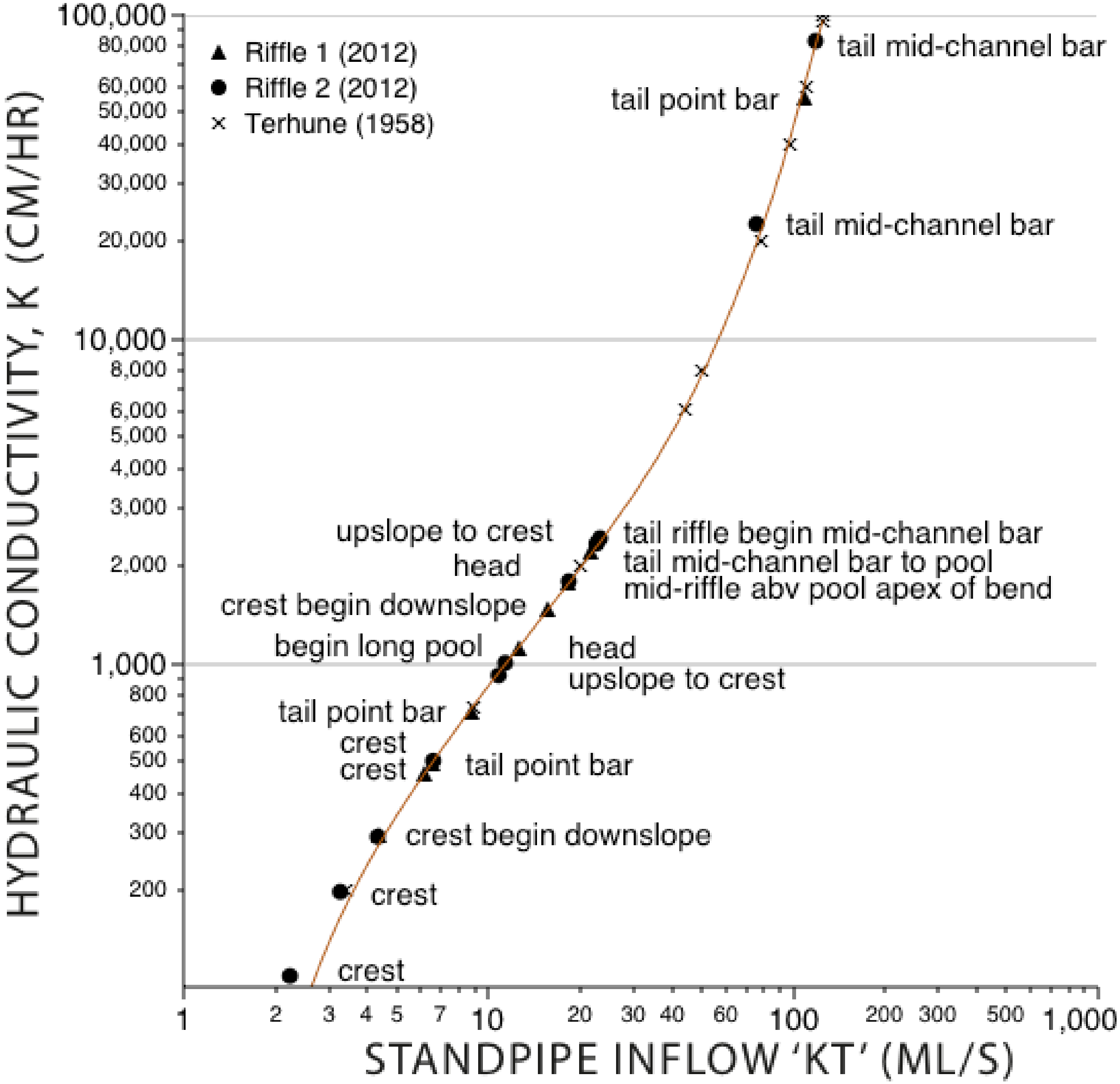
subsurface pore water tempera… ds

We installed 18 artificial redds at 3 sites. Each site was excavated by hand using a 5-gallon bottomless bucket to remove substrate, bury sensors + trout eggplates, and re-covered for the monitoring period.

spatial patterns of near-bed and subsurface temperature over bends

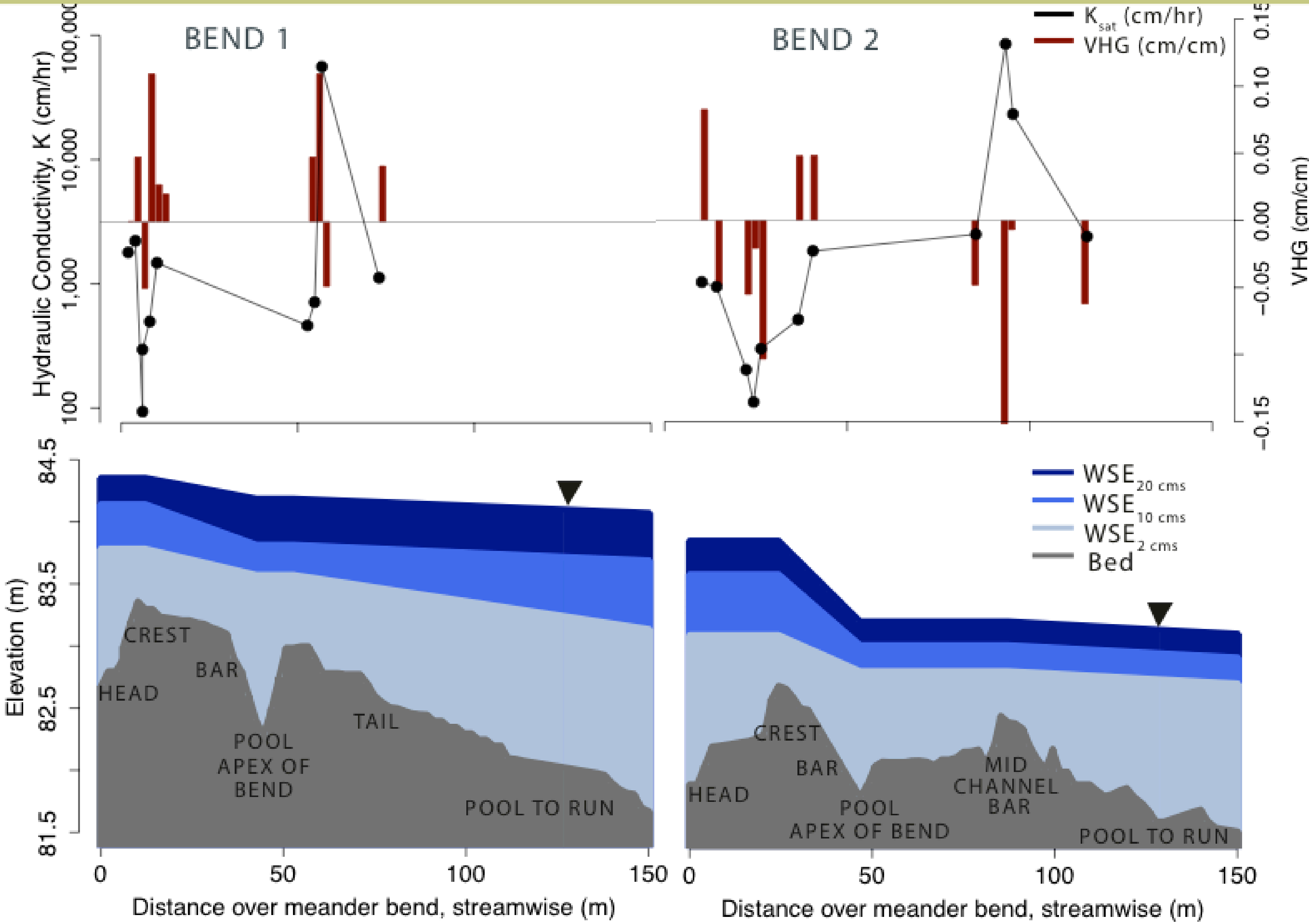


direct measurement of K_{sat} over the length of a meander bend

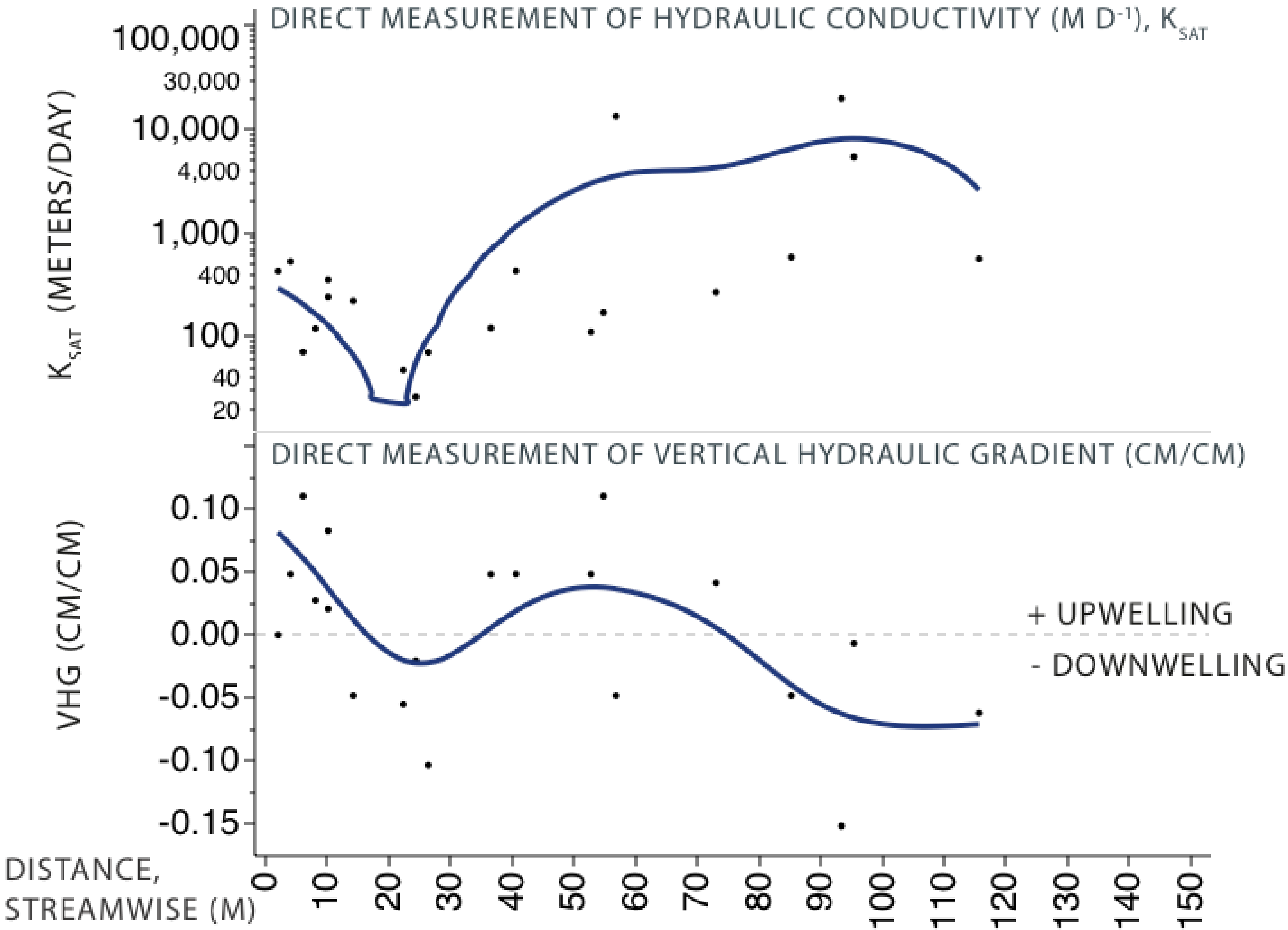


We measure permeability based on the methods of Terhune (1958), with only minor modifications in the standpipe design to prevent clogging by fine sediment.

measurements of K_{sat} and VHG over the length of a meander bend

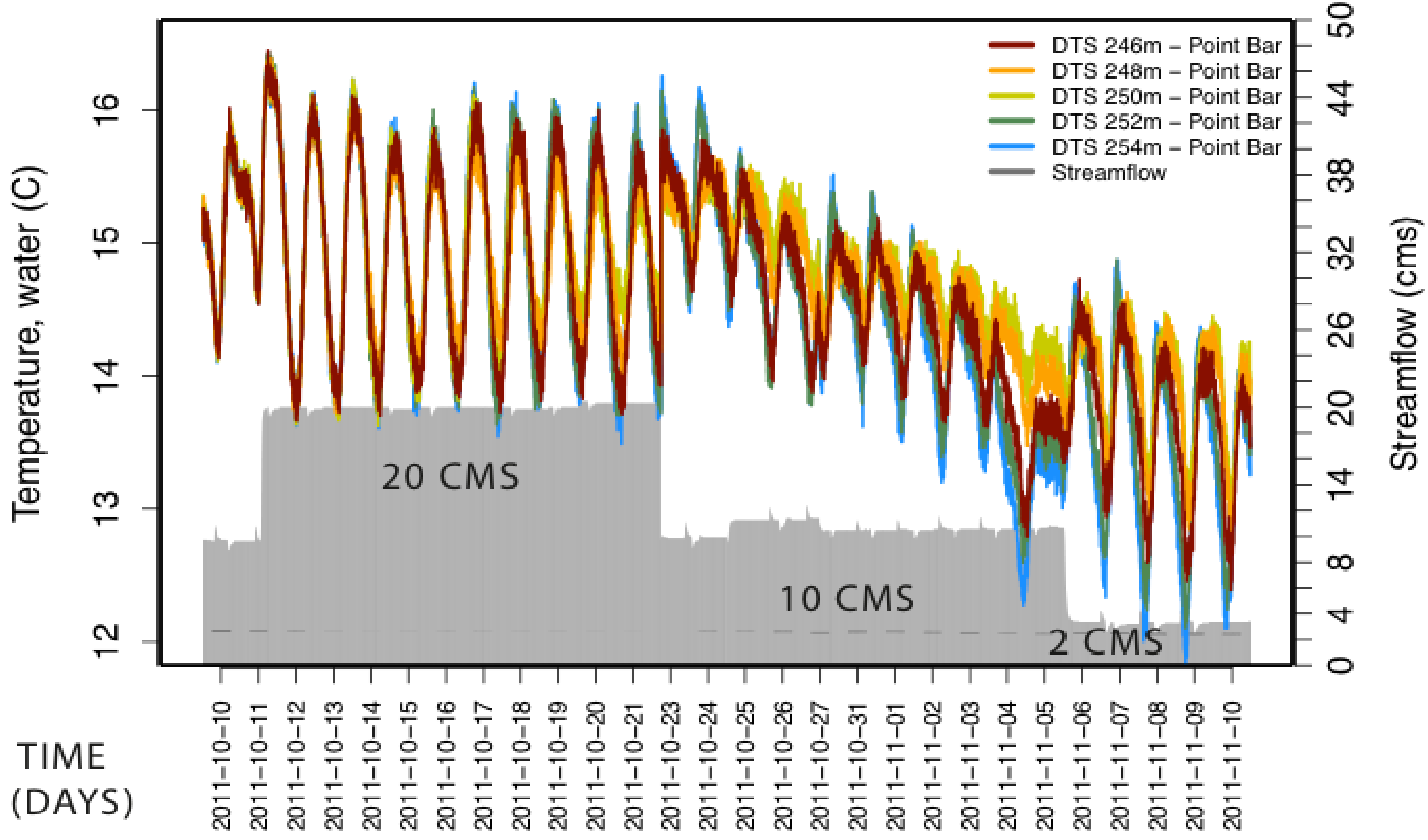


spatial patterns of K_{sat} and VHG over the length of a meander bend



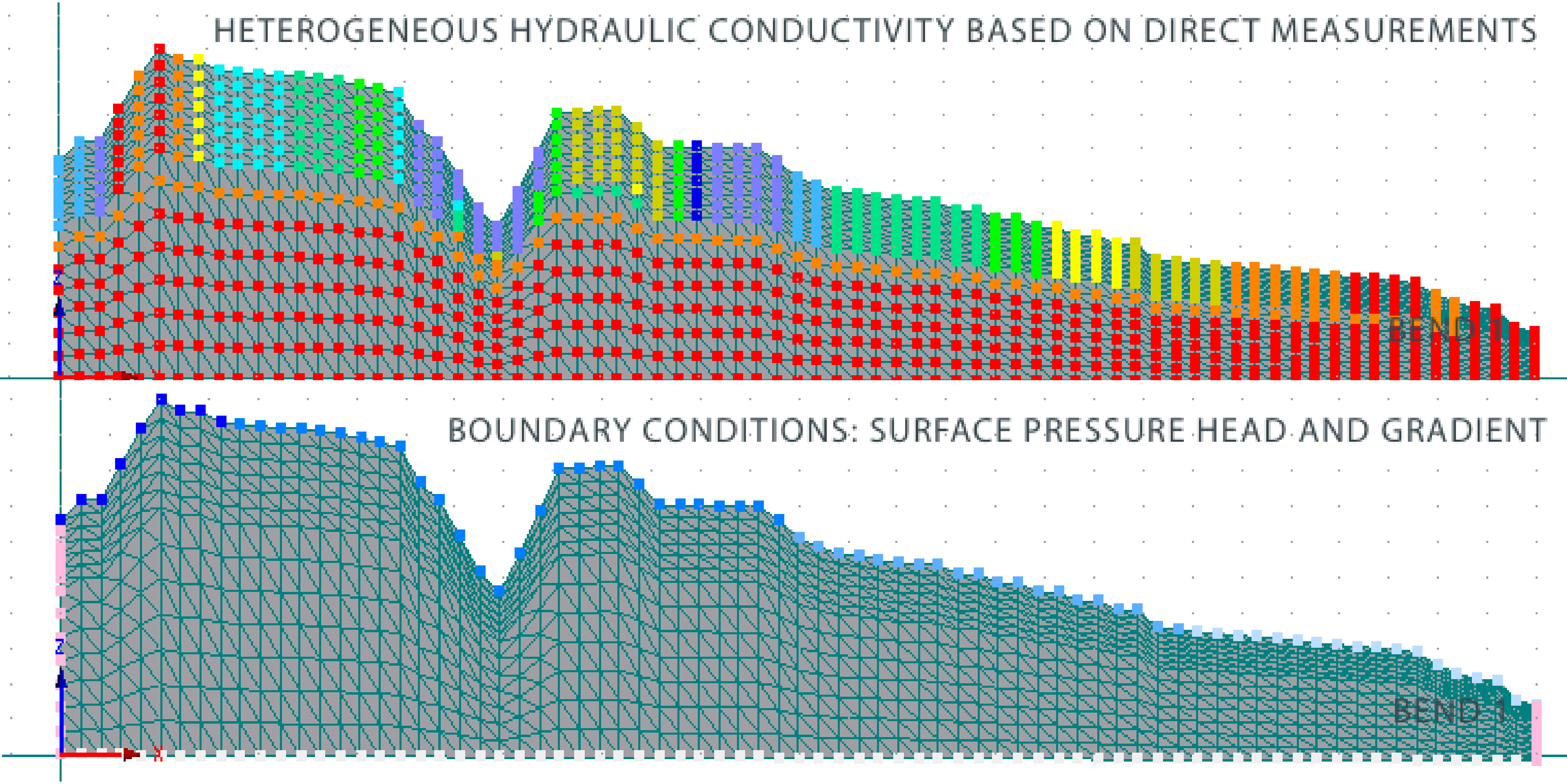
DTS measures sediment deposition during bed-mobilizing flow

Each line represents a temperature trace at a different distance along the cable. Red is upstream of the point bar, blue is downstream of the point bar.



2D modeling of exchange through gravel-bedded meander bends

We build upon current efforts by instrumenting and modeling a larger gravel bed river along which we have observed the formation of point bars and mobilization of the riverbed in response to pulse high flow releases during a flow experiment.



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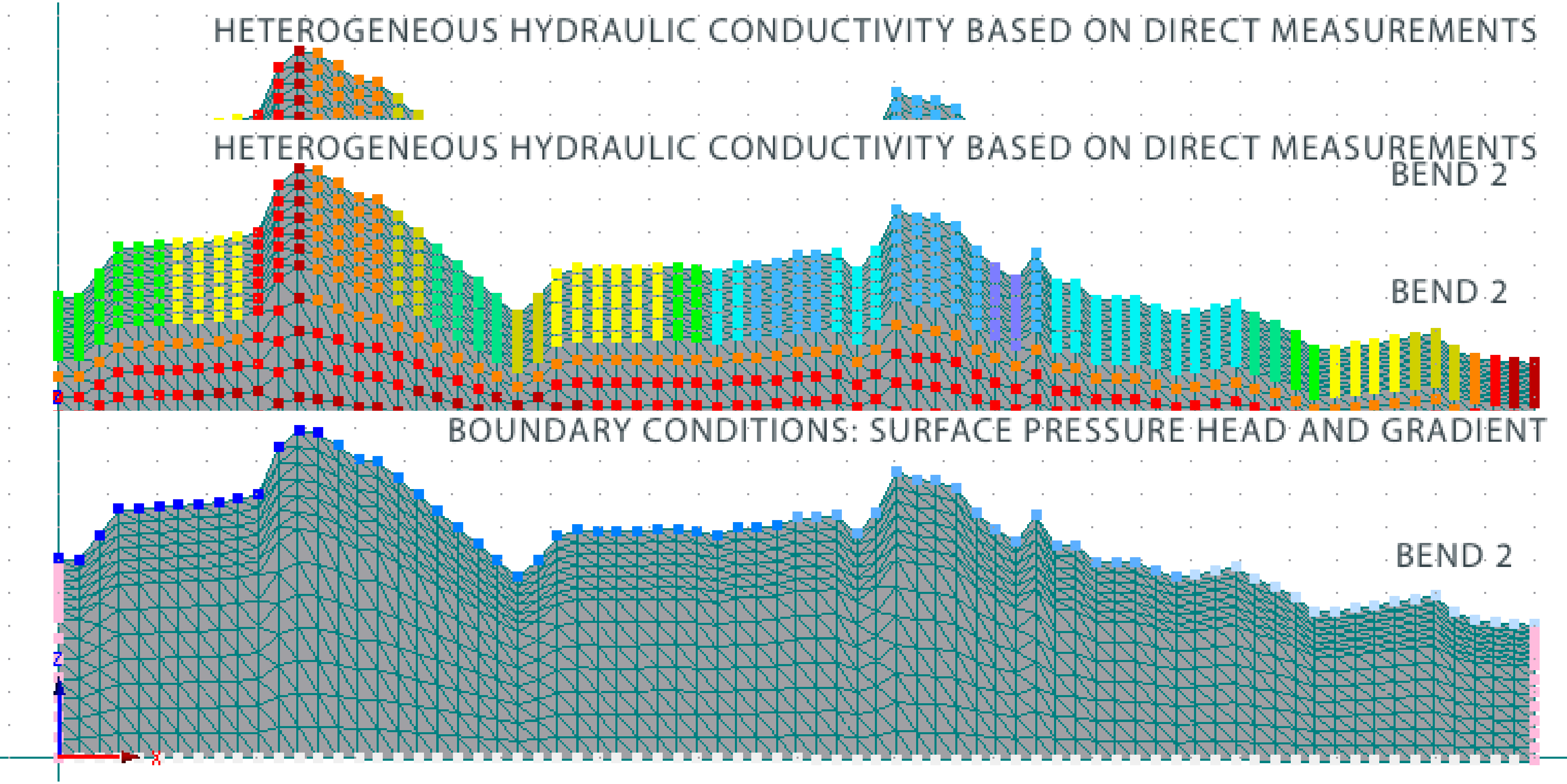

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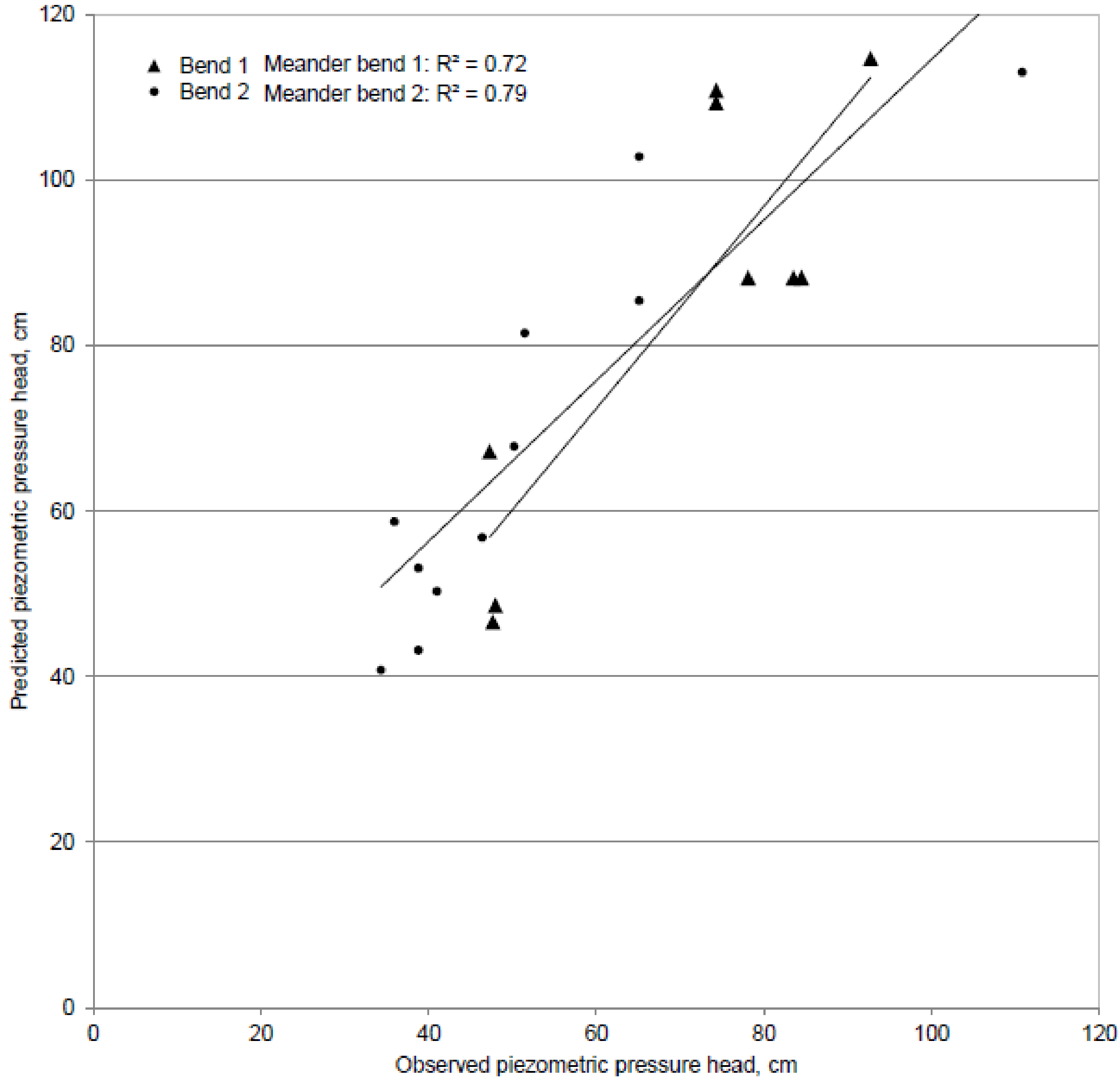

thank you & questions

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This research is supported by
The California Delta Science Program in cooperation with the Delta Stewardship Council and the California Bay-Delta Authority 2011 Delta Science Fellows, The Henry Luce Foundation, and an Instrumentation Grant from the Center for Transformative Environmental Monitoring Programs (CTEMPS)