HYDROLOGIC MEASUREMENT FACILITY
PROOF OF CONCEPT GEOPHYSICS SUPPORT

Title: HMF Geophysics Investigation at the HJ Andrews Experimental Watershed, Oregon

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Nigel Crook, Ph.D. and David A. Robinson, Ph.D.
Environmental Geophysics at Stanford
http://pangea.stanford.edu/research/enviro/

Using a dc Resistivity Survey to Determine Hyphoreic Zone Sediment Structure

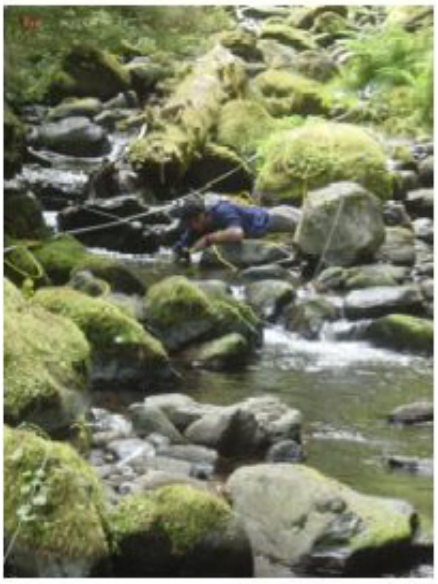
Background:
The interaction between subsurface fluxes of water, solutes, and biogeochemical processes is of critical importance to the stream ecosystems, especially those that are nutrient limited. The region where these subsurface-surface water interactions occur is the hyporheic zone . The hyporheic zone can serve as either a source or a sink for limiting resources (e.g., nitrogen) and is an important location for biogeochemical and temperature alteration in stream ecosystems. Our objective is to better understand the hyporheic zone processes associated with denitrification (i.e., the removal of biologically available nitrogen) in stream networks and to quantify the influence of the hyporheic zone on whole stream nitrogen cycling. Our approach couples hyporheic tracer and denitrification experiments with hydrodynamic modeling. The integration of geophysical surveying with our extant empirical approach and hydrodynamic model development provides an opportunity to realize unprecedented precision in modeling hyporheic denitrification.

Approach:
A geophysical d.c. resistivity survey was conducted at Mack Creek in the HJ Andrews Experimental Forest between August 7-18. This work compliments ongoing research supported by the NSF to understand stream denitrification. The survey was conducted to provide characterization of the hyphoreic zone sedimentary structure. The stream sediment and rock load make it almost impossible to dig boreholes to determine the location of the bedrock alluvial interface. Non-invasive imaging allows delineation of the substructure non-intrusively. The survey presented a range of challenges including the confinement of electrode lines to the channel or near channel. Duff and fallen trees on the forest floor prevented good electrode contact with the ground and prevented surveying being extended up the valley sides. Ultimately, the geophysics-enhanced knowledge of the stream-adjacent aquifer will allow for more accurate interpretation of hyporheic observations and parameterization of hyporheic hydraulic and denitrification models.

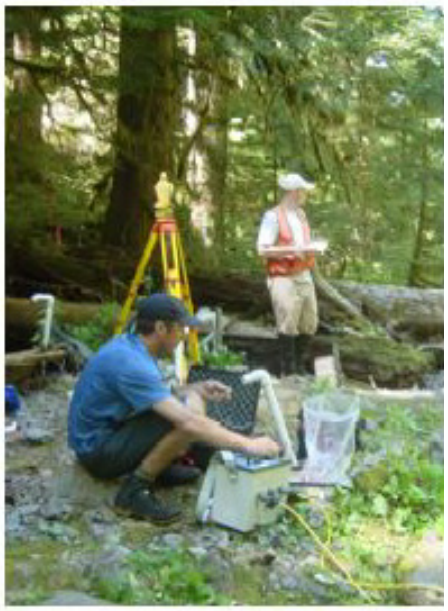
Mack Creek in the HJ Andrews Experimental Forest.

The sediment wedge behind a log-jam in Mack Creek.

Team preparing equipment on the sediment wedge



Inserting electrodes into the stream bed for the dc resistivity system.



Nigel Crook programming the dc resistivity system, Jay Zarnetske in the background preparing the survey equipment.