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Hyporheic Exchange With and Without Traveling Surface Waves

Vaughan R. Voller
University of Minnesota

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The MSU Sustainability Seminar Series Presents:
**Hyporheic Exchange with and without
Traveling Surface Waves**

WHEN: April 10, 4:00 pm

WHERE: CELS 120 lecture hall

Vaughan R. Voller
University of Minnesota



Vaughan Voller is a professor in the Department of Civil, Environmental, and Geo- Engineering at the University of Minnesota. His research interest is the modeling and analysis of heat and mass transport processes and phenomena. Applications span from the modeling of the dynamics of sedimentary deltas to crystal growth. According to Google Scholar his work has been cited over 11,000 times.

Hyporheic exchange, the flow of surface water into and out of sediment substrates, play an important role in controlling temperature, pollutant, and dissolved oxygen levels in aquatic. A key driver for hyporheic flow is pressure variations over the water/sediment interface. Here, we compare and contrast, for a range flume conditions, hyporheic exchange in a flowing current with and without travelling surface waves. This is achieved experimentally by using a vertical array of electrical conductivity probes to track the movement of a conservative solute tracer in a gravel bed of a recirculating flume. In analyzing the experiment we fit a basic advection-dispersion model to the measured values of the solute uptake at our probe locations. This fitting shows, in the presence of waves, a significant (an order of magnitude or more) enhancement of the dispersion coefficient. Our hypothesis is that moving waves on the water surface drives a vertical pumping within the solute bed that, in turn, enhances the dispersion. This is confirmed by constructing a numerical simulation that directly accounts for the wave induced pressure fluctuations at the water/sediment interface and a vertically oscillating (pumping) velocity within the bed itself. We show that, on appropriate setting of the fluctuation amplitude (within the expected experimental range), predictions from the simulation exactly recover the fits to the experimental measurement.

For more information contact Dr. Jorge Lorenzo-Trueba at 973-655-5320