

## Poster #21-61

### **A Last Line of defense: Understanding Unique Coupled Abiotic/Biotic Processes at Upwelling Groundwater Interface**

Chen Wang<sup>1\*</sup>, Lee Slater<sup>1</sup> and Martin Briggs<sup>2</sup>

<sup>1</sup>Rutgers University-Newark

<sup>2</sup>U.S. Geological Survey

Contact: [cw701@scarletmail.rutgers.edu](mailto:cw701@scarletmail.rutgers.edu)

BER Program: SBR

Project: University Award

Groundwater discharges to streams are critical to surface water quality due to the exchange of heat, gasses, nutrients, and contaminants. Deposition of metal oxides frequently occurs at sediment-water interfaces when groundwater low in dissolved oxygen and high in soluble metal ions mixes with oxygenated surface water. These metal oxides function as a sorption sink for dissolved contaminants (e.g. As, U) due in part to their large surface area. Temporary decreases in dissolved oxygen at the interface can reduce metal oxides and release absorbed contaminants to downstream transport. Therefore, a better understanding of the precipitation and dissolution of metal oxides in sediment-water interface materials is needed to predict contaminant transport through the river corridor. Field characterization at watershed scales necessitates the development of remote sensing methodologies for the comprehensive mapping of groundwater discharge locations, particularly those with high metal oxide content.

Geophysical methods are widely used to characterize the near-surface earth properties as they are non-invasive, high spatial resolution, and time-efficient. There is currently a paucity of benchmark studies regarding how the deposition of metal oxides impacts the electrical and thermal properties of interface sediments. The presence of metal oxides in sediments could potentially 1) increase the ability of electrical current storage when an alternating current is injected; 2) increase the degree of magnetization when a magnetic field is applied and 3) accelerate heat propagation within the sediments. Those three properties can be evaluated by 1) frequency domain phase response acquired from spectral induced polarization (SIP), 2) magnetic susceptibility (MS) and 3) thermal diffusivity, respectively. Along with Dr. Lee Slater, I am leading the thermal and geophysical property analysis on this project based at the East River SFA.

Since Feb 2017, I have collected both lab and field scale geophysical data and have acquired preliminary conclusions guiding then next phase of research at the East River SFA. Lab results show that the occurrence of metal oxides in sediments increase the phase response and MS, which is distinguished from regular sediments. In the 2017 summer field trip to East River, I lead field SIP and MS survey and participated in the other research work including fiber-optic distributed temperature sensing along river, core sampling, self-potential measurements and dye test conducted by our research team. This trip was a great opportunity for me, as all of my previous research had been laboratory-based. Unlike our controlled lab results, the field MS is contaminated by high background noise produced by small magnetite fraction in the parent riverbed sedimentary rocks and failed to detect metal oxides which have a lower MS value. In contrast, SIP is only sensitive to Fe oxides in high content, which was proven to be more reliable than MS for mapping Fe deposition in the field. We will focus SIP survey in the upcoming field trip in the 2018 summer and develop field methodologies to quantitatively characterize the metal oxide distribution in the streambed associated with groundwater discharge zones.