Title: Drying and rewetting of riverbed sediment shifts DOM thermodynamics and influences sediment respiration rates

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Abstract (400 words maximum):
River corridors experience natural and anthropogenic disturbances including floods, droughts, wildfire, land-use changes, and water use and management. With the changing climate, disturbances have increased in frequency and intensity. River corridor biogeochemical processes and dissolved organic matter (DOM) composition are susceptible to changes in flow regimes and variable inundation conditions, yet the mechanisms behind these biogeochemical impacts are rarely studied and are not represented in Earth system models. As over 60% of global rivers experience at least one dry day per year, and intermittent rivers are on the rise in the United States, it is crucial to investigate the mechanisms associated with the effects of drying on key biogeochemical processes like sediment respiration rates and DOM composition across diverse river ecosystems. Here, we apply DOM thermodynamic theory to investigate the effects of drying and rewetting on sediment DOM composition and respiration rates across 53 sites in the contiguous United States. Specifically, we conducted laboratory manipulative experiments with sediments from each site where one treatment was allowed to remain inundated, and the other treatment was allowed to dry over the course of 21 days. Both treatments were then fully saturated with native riverine water and aerobic respiration rates were measured noninvasively using optodes. Samples were collected for ultra-high resolution mass spectrometry analysis post respiration measurements. We investigated the effect of drying on DOM chemistry (i.e., DOM properties, elemental composition, chemical classes) and thermodynamics (i.e., Gibbs free energy and lambda) and the effects of these changes on respiration rates. We hypothesize that DOM thermodynamic metrics in the dry treatments will be lower than the wet treatments and that these shifts in thermodynamics will be linked to cold moments in respiration rates. By understanding how drying affects DOM chemistry and thermodynamics we can generate mechanistic inferences regarding the effects of stream intermittency in global biogeochemical cycles.