“Old” water in mountain streams: a case study of the Elbow River and its river-connected alluvial aquifer

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ABSTRACT
We investigate the connections between isotopically “old” mountain stream water and the structure of river-connected alluvial aquifer sediments in eastern-slopes rivers. Glaciers are thought of as the source of eastern-slopes rivers, but climatic change has significantly diminished the Rae Glacier (traditionally described as the source of the Elbow) without reducing streamflows. Worldwide, mountain streams have less than 5% “young” (<2.3 months) water (Jasechko et al. 2015). Both of these points indicate that there must be significant detention or storage of precipitation inputs in headwater catchments before that water reaches the open stream. Here we present results from our first year of isotope data and geophysical surveys carried out in Spring 2017. These results follow up on our findings from our first year of data collection. Preliminary water level data show changes in the slope of local water table surfaces, indicating seasonal changes in source influence, and water chemistry data show that the chemistry of samples from Elbow Falls (where all waters from the headwater catchment are integrated) is heavily influenced by that of groundwater from the river-connected alluvial aquifer. Delineating the sources, storage processes, and dynamics of groundwater/stream water interactions in the Elbow river system is important to resource use and water security, and also helps answer the intriguing fundamental scientific question of why high-gradient mountain streams contain mostly “old” water.

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