Stable Isotope Signature, Groundwater Return Flow and Seasonal Changes in the South Platte River

Katherine Davila Olmo, William E. Sanford and John Stednick
Department of Geosciences, Colorado State University

Abstract. Stable isotope ($\delta^2$H and $\delta^{18}$O) compositions in a water system signal processes and sources controlling recharge mechanisms that drive stream flow. $\delta^2$H and $\delta^{18}$O isotopic signatures and water quality parameters were examined at 17 sites along the South Platte River, Colorado and several tributaries and reservoirs nine times during the 2009/2010 annual hydrograph. Enrichment of stable isotopes was observed as a function of incrementing distance downstream from Henderson to Julesburg, CO. These relations imply a general behavior of isotopic enrichment during low discharge periods (evaporation, irrigation return flow) and isotopic depletion during snow-melt runoff periods. A similar relationship is seen in the sulfate concentration data where values increase moving downstream and are generally higher during low-flow periods. Stream flow variations are produced by diverse sources such as groundwater return flow, snowmelt and treated wastewater discharged into the river. This study shows that the combined use of stable isotopes and water chemistry data has the potential to aid in identifying and potentially quantifying the contribution of the diverse sources of recharge to the South Platte River.