# Multi-year increase in the stable isotopic composition of stream water from groundwater recharge due to extreme precipitation

DAVID F. BOUTT, QIAN YU, STEPHEN MABEE

Department of Geosciences, University of Massachusetts-Amherst, dboutt@geo.umass.edu

The long-term isotopic response of systems to hydrologic change is critical for interpreting isotopic information for streamflow generation, stream-aquifer-coupling, and recharge processes. To evaluate the response of stream-aquifer systems to extreme precipitation events we use 743 surface and groundwater isotopes with drainage areas ranging from 0.1 to > 800 km$^2$. Results show multi-annual trends from high to low isotopic compositions associated with increases in the composition of shallow groundwater. The year of 2011 was one of the wettest calendar years and the months of August and September were the wettest consecutive two-month period in the 123-year record. This increase in the isotopic composition has long-term impact on the isotopic composition of surface and groundwater highlighting the importance of groundwater sources of baseflow to streams and the transient storage and release mechanisms of groundwater at the catchment scale.

These results have important implications for isoscape reconstruction of surface and ground water systems. Grab samples of surface water isotopic composition may be biased by previous large storm events. There is immense power in co-sampling and analysing the isotopic composition of both surface and groundwater. Surface water isoscapes are not time-invariant and with anthropogenic climate change causing the isotopic composition of precipitation to evolve as dominant moisture sources change (e.g. Puntsag et al., 2016), it is even more important to understand the hydrologic and temporal context of surface and groundwater isotope results. These results suggest important reflection on what stream waters tell us about critical zone hydrologic functioning.