VADOSE ZONE MOISTURE DYNAMICS OF THREE ROCKY MOUNTAIN HILLSLOPES OBSERVED USING TIME-LAPSE ELECTRICAL GEOPHYSICS

Andrew Parsekian, University of Wyoming; Maneh Kotikian, University of Wyoming; Nadia Fantello; Ginger Paige, University of Wyoming; Thijs Kelleners, University of Wyoming; Brent Ewers, University of Wyoming; Noriaki Ohara, University of Wyoming; Daniel Beverly, University of Wyoming; Heather Speckman, University of Wyoming; David Millar

Snowpack in the mountains of the American west are the primary source of water that feeds streams and aquifers to meet human use needs. Observation of hillslope hydrologic partitioning is a critical link between pore scale properties and catchment hydrology. To understand what controls partitioning of meltwater between interflow, vadose zone storage, bedrock flow, and deep storage, we investigated three hillslopes of contrasting subsurface properties. Two sites are glacially reworked, while the other has been exposed for ~50Ma; two sites are granitic parent material, and the other is metamorphic/gneiss. Using permanently installed electrical resistivity arrays, sites were monitored for 1 – 3 years at a frequency of up to four acquisitions per day. Seismic refraction was used to constrain weathering zone depth, and meteorological/hydrological parameters were measured. We observe vadose-zone behavior consistent with the fill-and-spill model, deep vertical preferential infiltration, and contrasting vadose zone storage heterogeneity. By using electrical resistivity imaging, we are able to observe changes in water content near the base of the weathering zone and measure lateral flow associated with this interface, well beyond the reasonable depth to instrument with convention moisture probes. Similarly, we find evidence of plant water use related to water content at depths to > 2.5 m below the surface, highlighting the role that vegetation plays in vadose zone water redistribution.