Geophysical Research Abstracts
Vol. 15, EGU2013-6139, 2013
EGU General Assembly 2013

Investigating surface saturated and subsurface mixing processes using hand-held IR, isotope tracers and piezometers in a small headwater catchment (Luxembourg).

Jay Frentress (1,2), Núria Martinez-Carreras (2), Laurent Pfister (2), and Jeff McDonnell (3)

(1) Oregon State University (Corvallis, Oregon USA), (2) Centre de Recherche Public - Gabriel Lippmann (Luxembourg), (3) Global Institute for Water Security, University of Saskatchewan, National Hydrological Research Centre (Saskatoon, Canada)

Precipitation events are often partitioned into their hydrologic source components using simple mixing models that differentiate stored and event water in stream discharge. However, such models suffer from invalid assumptions regarding mixing between source components. In particular, the extent of mixing between surface and sub-surface sources remains unknown. We investigated mixing in the near-stream saturated zone between streamflow sources – rainfall, hillslope and groundwater – by combining infrared thermography, isotopic geochemistry and hydrometric observations. A hand-held thermal infrared camera was used to generate infrared images in a near-stream area of the 50 ha Weierbach catchment (Luxembourg), multi-level piezometers within the IR field of view were used to determine hydraulic head throughout rainfall events. The saturated area, piezometers, and stream channel were sampled at regular intervals for isotopic and geochemical analyses. Previous work in this catchment indicated that infrared imagery can quickly quantify saturation extent as well as infer water source; groundwater seeps were readily identifiable via IR and differed by 3-5 ˚C from stream channel temperatures. Our current work extends these observations and seeks to determine the dominant controls on mixing in the saturated zone by directly correlating spatial temperature patterns to hydraulic head gradients and micro-topography within the near-stream saturated zone. Preliminary results suggest that the near-stream saturated zone reflects a shifting combination of exfiltrating groundwater, intermittently connected hillslope water and incident rainfall components whose mixing are mediated by microtopography within the saturated area itself.