Geophysical Research Abstracts
Vol. 14, EGU2012-13252, 2012
EGU General Assembly 2012

Innovative interdisciplinary approaches in catchment hydrology: on the potential for diatoms and thermal infrared imagery for documenting spatio-temporal dynamics and connectivity of saturated areas in the hillslope-riparian zone-stream system

L. Pfister (1), N. Martínez-Carreras (1), C. Wetzel (1), L. Ector (1), J. Frentress (1,2), and J.J. McDonnell (2)

(1) CRP-Gabriel Lippmann, EVA, Belvaux, Luxembourg (pfister@lippmann.lu), (2) Oregon State University, Department of Forest Engineering, Corvallis, USA

Over the past decades, hydrologists have been relentlessly investigating water source, flowpaths and residence time. These issues are of paramount importance when it comes to both the quantitative and qualitative management of water resources. Support from the scientific community has indeed been repeatedly sollicited by the European Union in the context of an optimization of the implementation of its framework directives on water quality and floods.

However, to date large uncertainties remain adjunct to our measurements of hydrological processes on the one hand and the modelling of the precipitation-runoff relationship on the other hand. Originally, investigations on the rainfall-runoff transformation were based on conventional geochemical and isotopic tracing techniques. Unfortunately, well-known and documented technical limitations (e.g. non-stable end-members, incomplete mixing assumptions) have rapidly stymied further progress in our understanding of the rainfall-runoff transformation.

More recently, technological progress has created new potential for going well beyond the traditional sources of information, such as rainfall and discharge. New measuring techniques have been recently introduced (e.g. thermographic systems such as temperature fiber optic cables and thermal IR cameras for tracing water source and flowpaths, satellite aperture radar for measuring flood extents and/or soil humidity, laser spectrometers for stable isotope measurements, etc.).

Indeed the rainfall-runoff transformation inside a catchment is the result of a plethora of interrelated processes that go well beyond water movements. As a consequence, it is crucial to the development of hydrological science to integrate the advances and knowledge from different disciplines. In other terms, knowledge from ecology, biology, as well as other sciences is needed to better understand the functioning of catchments. We need to work together on common problems to find better solutions

In recent years, our research activities have been focusing on the exploration of new research avenues for untapping new insights on inherent hydrological processes, guiding water source and flowpaths. Here, we will present the most recent results obtained to date from interdisciplinary proof-of-concept studies carried out in the Weierbach experimental watershed. New research avenues, such as the introduction of terrestrial diatom tracing in flood waves, will hopefully contribute to reduce uncertainties in the determination of the onset/cessation of surface runoff and connectivity in the hillslope-riparian zone-stream system. Likewise, thermal infrared imaging has shown considerable potential for tracing surface water flowpaths, connectivity, as well as saturated area dynamics.