Geophysical Research Abstracts
Vol. 12, EGU2010-3353, 2010
EGU General Assembly 2010

Using multiple tracers in “snap-shot“ sampling to reveal the scaling and coupling of water and chemical fluxes in mesoscale catchments

Doerthe Tetzlaff, Chris Soulsby, Markus Hrachowitz, Julian Dawson, and Mark Speed
Northern Rivers Institute, University of Aberdeen, School of Geosciences, Aberdeen, United Kingdom (d.tetzlaff@abdn.ac.uk)

The need to upscale hydrological understanding has become a central research theme within catchment science. At larger spatial scales (>1000km^2), aspects of the hydrological functioning of entire catchments can potentially be predicted using spatial data obtained from constituent sub-catchments. At these larger scales, however, other influences of landscape controls - such as climate change, land use change or even topographic features - may exert an important influence on catchment hydrological dynamics and confound any relationships identified at the smaller scale. In addition, larger river basins often encompass a number of ecohydrological regions that contribute differentially to the integrated hydrological and biogeochemical characteristics of river systems.

Tracers have proven utility as tools that can provide insight into integrated hydrological functioning at a range of larger scales. Here, we show examples from a two year nested tracer study, examined the 2,000km2 catchment of the River Dee, northern Scotland where multiple tracers (18O, DOC, alkalinity, temperatures) were used along with landscape modeling to investigate (i) how controls on water and carbon fluxes contrast in different ecohydrological regions; (ii) how these differences integrate at larger catchment scales and (iii) how larger scales are affected by process emergence.

The sub-catchments encompassed high mountains, peatlands at intermediate altitudes and lowland agricultural landscapes. Water fluxes from montane headwaters were highest and quickest and reflected by low transit times both reflecting climate and catchment characteristics in different ecoregions. At the larger scale mainly averaging of tributary inputs occurred and groundwater influence from alluvial aquifers emerged. Stream temperatures largely reflect emergence resulting from and increase in riparian tree cover and groundwater inputs further downstream. DOC fluxes are decoupled from scale influences and water fluxes and mainly controlled by distribution of peaty soils. At larger catchment scales, decreasing channel gradients and increased channel width:depth ratios, coupled with increased nutrient inputs from agricultural sub-catchments resulted in increased in-stream processing of carbon at larger catchment scales.