



Using multiple tracers to determine the effects of hydrogeology and anthropogenic influences on the hydrology of larger catchments

S. McGrane (1), D Tetzlaff (1), R. Essery (2), and C Soulsby (1)

(1) University of Aberdeen, Northern Rivers Institute, School of Geosciences, Aberdeen, United Kingdom
(scott.mcgrane@abdn.ac.uk), (2) Grant Institute, University of Edinburgh, Edinburgh, Scotland

Using tracers to develop an understanding of geographical water source and the timing of water movement through a catchment provides a means of characterising both the spatial and temporal dynamics of water fluxes in rainfall-runoff transformation. Understanding these dynamics is of particular relevance in larger catchments, which integrate upland and lowland areas as issues such as flooding and diffuse pollution are often critical in piedmont areas. Here, we present results from a study investigating catchment behaviour across eight heterogeneous mesoscale (104-488km²) catchments in the North East of Scotland which have a systematic change in the relative importance of upland and lowland areas which reflect the relative distribution of metamorphic and sedimentary rocks. Precipitation and streamwater were monitored over a prolonged period and stable isotopes were used to examine spatial variations in the Transit Time Distributions (TTD) at the catchment scale. Streamwater samples were also analysed for geochemical tracers which were used to infer the geographic sources of runoff. TTD's were explored using a gamma distribution, which inferred that the length of transit times increased systematically with sedimentary geology. This was consistent with the inferences of geochemical tracers on the increased role of sedimentary aquifers as runoff sources in lowland areas. In addition, lowland catchments also show evidence of increased influence of anthropogenic factors, most notably urban runoff and agricultural abstractions. However, the dual tracer approach also provided valuable insight into both their short term and longer term influences on the quantity and quality of streamflow.