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Capturing dominant runoff processes in a heterogeneous mesoscale catchment: Integrating tracers and modelling

René Capell (1), Dörthe Tetzlaff (1), Chris Soulsby (1), Iain Malcolm (2), and Adrian Hartley (3)

(1) Northern Rivers Institute, University of Aberdeen, UK, (2) FRS Freshwater Laboratory, Faskally, Pitlochry, UK, (3) Department of Geology, University of Aberdeen, UK

Dominant hydrological processes in complex meso-scale catchments are strongly influenced by landscape characteristics such as topography, geology and soils. In this study, we examine differences in the hydrological response and how small scale processes integrate at larger scales in seven contrasting sub-catchments (21 km2 – 307 km2) of a large river basin (749 km2) in north east Scotland.

We use hydrometric and tracer data in conjunction with GIS analyses and simple model applications. The catchment covers two contrasting geomorphological landscape units: a mountainous upland with distinct glacial features and underlying metamorphic bedrock, and a lowland unit with an extensive sandstone aquifer. Gran alkalinity and stream water chemistry are used as environmental tracers to identify major runoff sources and to assess how small scale processes are integrated at larger spatial scale. A multivariate analysis of tracer data, spatial catchment characteristics and runoff response is applied to delineate first order controls for hydrological behaviour. This is used as a basis to conceptualise dominant runoff processes at multiple spatial scales.