



Multi-scale assessment of hydrological behaviour using tracer and GIS techniques in mesoscale catchments in Scotland

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Process conceptualisation is fundamentally important to understanding and predicting the hydrological behaviour of catchments. Here, we present investigations on the spatial and temporal dynamics of hydrometric and tracer data in a large river basin in north east Scotland with seven contrasting subcatchments. We apply an integrated approach using GIS analysis to characterise landscape organisation (land use, topography, geomorphology, and geology) and tracer monitoring to identify runoff sources under different hydrological conditions. This is used as a basis to conceptualise dominant runoff processes at multiple spatial scales. The catchment covers two contrasting geomorphological provinces; (a) a mountainous upland with distinct glacial features and underlying metamorphic bedrock, and (b) the coastal plain with an extensive sandstone aquifer. Isotopes, 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 the larger spatial scale. Such conceptualization of process understanding is crucial to allow the development of model approaches to predict hydrological response in these catchments. This is obviously important for effective environmental management and provides the basis for improved predictions of climate change impacts on catchment hydrological behaviour.