

#### **4. Tracing hydrological processes at catchment scales**

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For the prediction of catchment sensitivity to change, hydrological processes need to be conceptualized in a physically meaningful way. Field observations and tracers can provide integrated insights into the dynamic behaviour of catchment systems, which helps to improve our understanding of the dominant processes. Here we present results from studies in two different Scottish catchments. In the first study of a mesoscale catchment in the Scottish Highlands, GPS-based field mapping and a geochemical tracer, alkalinity, were used to conceptualize the dynamics of the fast, near-surface runoff generation processes, which dominate the hydrological response. In the second study of a nitrate vulnerable catchment in E Scotland, fine resolution stable isotope data has revealed important differences in flowpaths and mixing of different water sources at different scales. The studies have demonstrated that incorporating tracer and field data into catchment hydrological studies enhances our understanding of short and long-term hydrological processes, which will ultimately help reduce the predictive uncertainty of hydrological models.