Determining Transit Times and Hydraulic Response of Saturated Hillslope Flow Using a Low-Cost Chloride Sensor System and Groundwater Modelling.

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Subsurface saturated flow from hillslopes is a major pathway for delivery of water to riparian zones, particularly in humid climates. Tracer studies can aid in estimation of water transit times and flow pathways but widespread application of such techniques is hampered by lack of available sensors to continuously record solute transport processes at short timescales over dense spatial networks.

The objective of this work is to investigate the hillslope – riparian zone connection in an upland catchment using groundwater modelling of steady-state hydraulic response and direct measurement of transit times using a low cost chloride sensor system in observation bores installed in rows downslope from a cross-slope line of injection bores. We establish a steady-state hydraulic flux at the injection bores, followed by a chloride pulse and subsequent flushing with fresh water to determine transit times and downslope hydraulic connection.

Groundwater modelling results show that the observed hydraulic heads in the hillslope bores can only be maintained if the riparian zone soils are highly permeable and allow rapid transport of water to occur down-valley. Tracer studies confirm that transit times from the hillslope are in the order of minutes over a distance of 5 m and indicate the need for short timescale measurement and modelling in order to capture the hillslope response to injected water.