Field scale measurements for separation of catchment discharge into flow route contributions

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ABSTRACT

Agricultural pollutants in catchments are transported towards the discharging stream through various flow routes such as tube drain flow, groundwater flow, interflow, overland flow and direct precipitation. Several indirect methods (e.g. hydrological modelling, water balance studies and hydrograph separation) can be used to estimate flow route contributions. Direct measurements of flow route contributions are scarce, because physical separation of water from different flow routes is problematic and often impossible. The objectives of this study were (1) to perform direct field scale measurements of the tube drain flow route contribution to the total discharge from an agricultural field towards the surface water system and (2) to extrapolate the field scale measurements to the catchment scale. In a lowland catchment, we installed an experimental setup that could physically separate the tube drain effluent from the discharge of all other flow routes. Extrapolation of the field scale flow route discharge contributions to the sub-catchment and the catchment scale showed remarkably consistent results. Moreover, NO_3 concentrations at the catchment were successfully predicted by a flow route mixing model. The field scale measurements of flow route discharges within a nested setup of discharge and concentration measurements provided essential insight into discharge generation and solute transport. This study shows that an accurate separation of the total catchment discharge into flow route contributions combined with a thorough understanding of the site-specific hydrology, is essential for solute transport modelling.

Keywords: *discharge, flow routes, up scaling, tube drains, overland flow, groundwater, solute transport, nitrate*