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# Modelling high temporal resolution dynamics of dissolved organic carbon in peat-dominated headwater catchments: A parsimonious approach

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Riparian peatlands are an important interface between terrestrial and aquatic environments that can regulate hydrological and biogeochemical fluxes between hillslopes and streams. Dissolved organic carbon (DOC) is an important component of freshwaters that can influence water quality and in-stream ecology. Stream DOC concentrations are controlled by a complex series of hydrological and biogeochemical interactions at catchment scale, but crucially within riparian peatlands.

Here, we present high resolution (daily) data of streamwater DOC over an 18 month period including two growing seasons and highly variable hydrometerological conditions. First, we used time series modelling to identify the controls of DOC dynamics. Furthermore, we utilised a parsimonious rainfall-runoff model coupled with a biogeochemistry sub-routine able to simultaneously simulate streamflow and DOC fluxes. The model conceptualizes the quick near-surface (high DOC) and slower deeper groundwater (low DOC) runoff sources in combination with a DOC mass balance module to produce a low-parameter representation of system function.

Time series analysis showed that DOC was strongly related to air temperatures with a key hydrological control on DOC transport. However, this hydrological influence was markedly non-linear. During a wet summer DOC was highly variable; with small events generating high DOC concentrations in surface waters due to the fact that the riparian peats were quasi-continuously connected to the stream. DOC was diluted in larger events as more minerogenic hillslope soils became increasingly connected to the stream, implying supply limited conditions. However, during a dry summer DOC showed a stronger correlation with flow as connectivity with the riparian peats was highly intermittent, with transport-limited conditions.

The model was able to reproduce both these subtle hydrological nonlinearities in the DOC-flow relationship as well as the general temperature-driven seasonality. This was due the capability of the model in simulating riparian peatland dynamics and DOC transport via near-surface runoff generation mechanisms. Almost all parameters in the model were identifiable. This highlights the usefulness of using parsimonious models in the simulation of hydro-biogeochemical dynamics controlling surface water quality, for example in the production of DOC loading predictions.