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# Watershed dissolved organic carbon transport: a modeling approach combining water travel times and reactivity continuum

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Although their contribution was neglected in the past, inland waters play a significant role in the carbon cycle and affect $CO_2$ global balance. Streams and rivers are now considered not only as pipelines but as active reactors able to collect and transform carbon from terrestrial ecosystems trough drainage, erosion, deposition and respiration. Quantifying the transfer of carbon from the terrestrial to the riverine ecosystems is thus of crucial importance to fully appreciate carbon cycle at the watershed, regional and global scales. Such transfer is largely controlled by the processes occurring in the critical zone where the carbon and water cycles are tightly coupled. Previous studies investigated how hydrological drivers can affect Dissolved Organic Carbon (DOC) concentration in streams highlighting an hysteretic and unsteady behavior for the DOC-discharge relationship. In this study, we focus on the drainage flux from hillslopes to stream and river networks during rainfall events combining a transport model for water and a model of carbon degradation in soil. Using high-frequency records of chloride and DOC in Plynlimon catchments (UK), we employ the recently developed StorAge Selection (SAS) theory to evaluate water travel time and its partition as evapotranspiration, discharge and storage. We combine this approach with the reactivity continuum theory to model carbon degradation along the flow paths using a gamma-distribution as probability density function of the quality. The developed model can thus predict not only the flux of DOC released from hillslopes but also its quality (i.e. lability). We also show how the variability of the DOC-discharge relationship can partially be explained by hydrological fluctuations.