Inferring DOC export mechanisms from high-frequency instream UV-vis measurements

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The flux of dissolved organic carbon (DOC) derived from soils is a significant term in terrestrial carbon budgets, and as a result, a dominant link between terrestrial and aquatic ecosystems. Concentrations of DOC in streams and rivers have been increasing over the last decades in particularly North America and Europe. Providers of drinking water from surface water reservoirs are increasingly facing problems as elevated DOC concentrations cause higher costs for removal and potentially to toxic byproducts. Mitigating these problems requires a mechanistic understanding of the controls and dynamics of DOC export from catchments.

The rapid dynamics in the DOC concentration-discharge relationship during hydrological events, benefits from high frequency UV-vis observations to develop understanding of processes controlling the DOC export mechanisms. In addition, changes in absorption spectral slope can be used to identify modifications in DOC quality. As such, the adsorption spectral slope can be used to provide information on changes in DOC quality under different hydrological conditions. These relationships may provide new insights into the mechanisms that control DOC export dynamics.

We aimed to evaluate the response and interaction of DOC concentrations and quality between riparian zone soil and stream water under different hydrological conditions. UV-vis sensors were installed in both the riparian soil and stream of two headwater catchments, the Hassel and Rappbode, in the Harz Mountains in Germany. The two headwater catchments are approximately equal in size, however, differ in their land-use. The Hassel catchment is dominated by agricultural land-use, whereas the Rappbode catchment is mainly forested. In-situ UV-vis and discharge measurements at 15min intervals during a full hydrological year allowed for capturing roughly 50 events and obtaining spectral information. The DOC concentration-discharge relationships show intricate hysteretic behavior, which differs between the two sites and shifts in time. The rich data-set will allow for a characterization of space and time patterns of DOC export as well as changes in its quality, providing valuable insights into the hydrologic mechanisms that govern the delivery of DOC to streams.