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Labile organic carbon in river runoff: the importance of carbon sources and water residence times

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ABSTRACT

In estuarine and coastal waters, river runoff represents a cause of oxygen consumption through dissolved organic carbon (DOC) degradation. Boreal and temperate surface waters receive large amounts of terrestrial organic matter (OM) that, according to the prevalent reactivity continuum concept, continuously decreases its reactivity with residence time in the riverine-estuarine environment. Here, we assessed the reactivity of DOC as a function of surface water residence times (SWRT) of Baltic Sea river catchments. We found that absolute concentrations of DOC and bioavailable DOC diminish with increases in SWRTs. In contrast, the reactivity per unit of DOC increased with increases in SWRT, probably due to increased contributions of labile phytoplankton-derived DOC fractions, as indicated by changes in the isotopic composition of the DOC. Bacterial enzymatic processes and UV radiation may also contribute to long-term transformation of refractory DOC into labile DOC. Our study underscores the importance of transformation processes and contrasting sources of DOC for the overall changes in reactivity of the DOC during its transit through freshwater systems towards the sea.