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Organic carbon processing in inland waters : potential feedback between browning and climate

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ABSTRACT

Inland waters are becoming enriched in brown-colored terrestrial organic carbon (termed “browning”), due to increasing exports of colored dissolved organic matter (CDOM) from land to water. The current state of knowledge, however, does not allow to predict the potential impact of browning on global freshwater CO₂ efflux, due to a lack of quantitative estimates of the biological and photochemical reactivity of this terrestrial organic carbon at relevant spatial and temporal scales. Here we present empirical evidence that both the amount and the proportion of dissolved organic carbon that can be transformed into CO₂ by bacterial and photochemical oxidation increase as water becomes richer in colored organic carbon across a wide range of temperate and boreal aquatic environments, implying that browning will enhance current aquatic CO₂ fluxes to the atmosphere, at a continental scale. Considering the major contribution of inland waters to the global carbon cycle, current and future browning may represent an indirect, but potentially globally significant positive feedback to climate change that has not yet been taken into account.