Hydrological Transport and Biological Degradation of Dissolved Organic Carbon in a Headwater Tributary of the Yangtze

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Abstract

River systems represent important drivers of carbon loading, utilization and storage. However, underlying controls of hydrological transport and biological degradation on fluvial dissolved organic carbon (DOC) have yet to be revealed. Here, we explored spatiotemporal variability of DOC concentrations, components and sources, as well as its biodegradability in a headwater tributary of the Yangtze. We found that temporal rainfall stimulated terrestrial inputs and increased terrigenous DOC abundance. Hydrological transport was accompanied by biological generation and utilization of DOC, resulting in reduced labile components and accumulated recalcitrant components from tributaries to the main stem. Biodegradable DOC (BDOC) notably responded to temperature gradients over a 56-day laboratory incubation. Riverine DOC component, molecular weight and source highly predicted its biodegradation. Particularly, partial refractory (ultraviolet humic-like) fractions contributed to biological degradation of DOC, which was incompletely degraded from high-molecular to low-molecular weight compounds. The findings hope to supplement a new understanding of carbon fate under global change.

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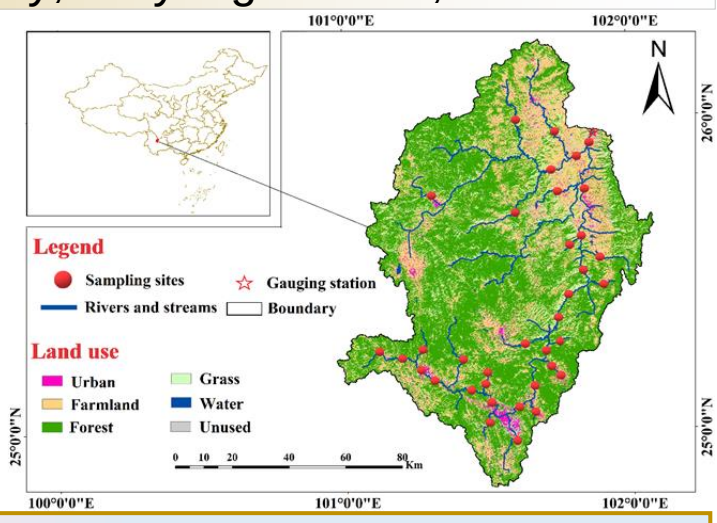
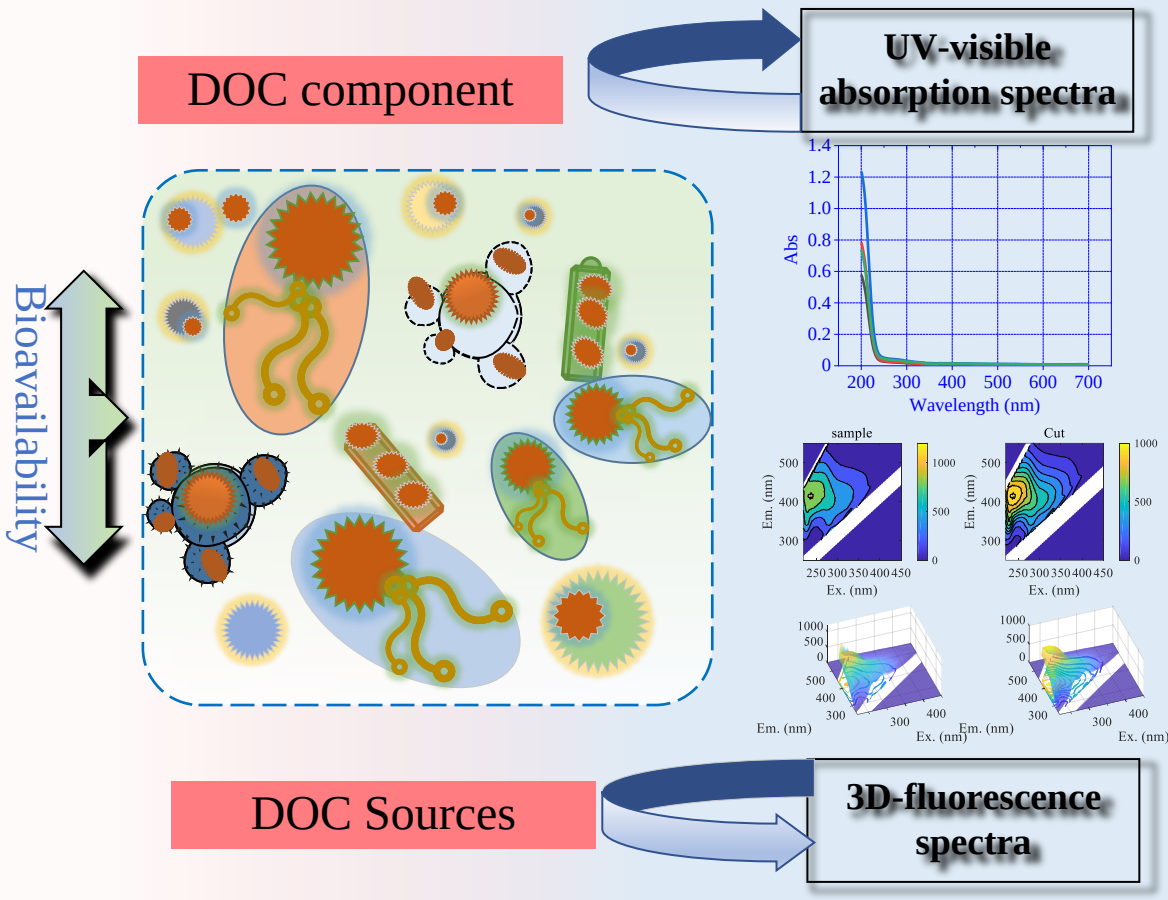
Background

River systems represent important drivers of carbon loading, utilization and storage. However, underlying controls of hydrological transport and biological degradation on fluvial dissolved organic carbon (DOC) have yet to be revealed. Here, we explored spatiotemporal variability of DOC concentrations, components and sources, as well as its biodegradability in a headwater tributary of the Yangtze.



Method

1. Riverine DOC was determined by multi N/C 2100S (Analytik Jena, Germany).
2. UV-visible absorption spectra was measured using a double-beam scanning spectrophotometer (UV-5500PC, Shanghai).
3. Excitation-emission matrices (EEMs) fluorescence spectra was scanned using a fluorescence spectrophotometer (F-7000 FL Spectrophotometer, Japan).
4. The modified laboratory incubations were conducted for 56 days at the temperatures of 20°C and 30°C.



Results

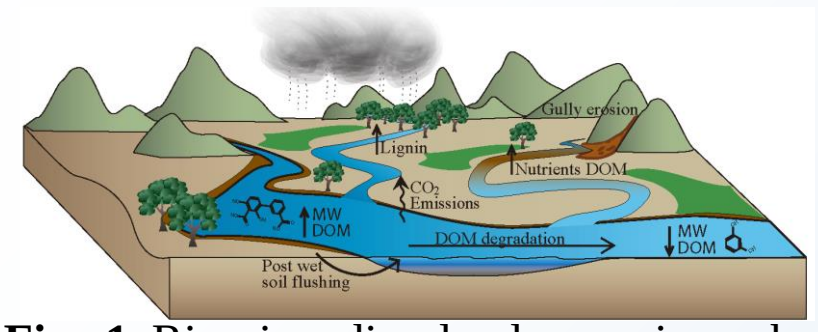


Fig. 1 Riverine dissolved organic carbon dynamic and fate in response to CO_2 outgassing

1. Optical parameters were the useful indicators for the CO_2 sources and DOM biodegradation
2. Ultraviolet humic-like component contributes to riverine dissolved organic matter biodegradation

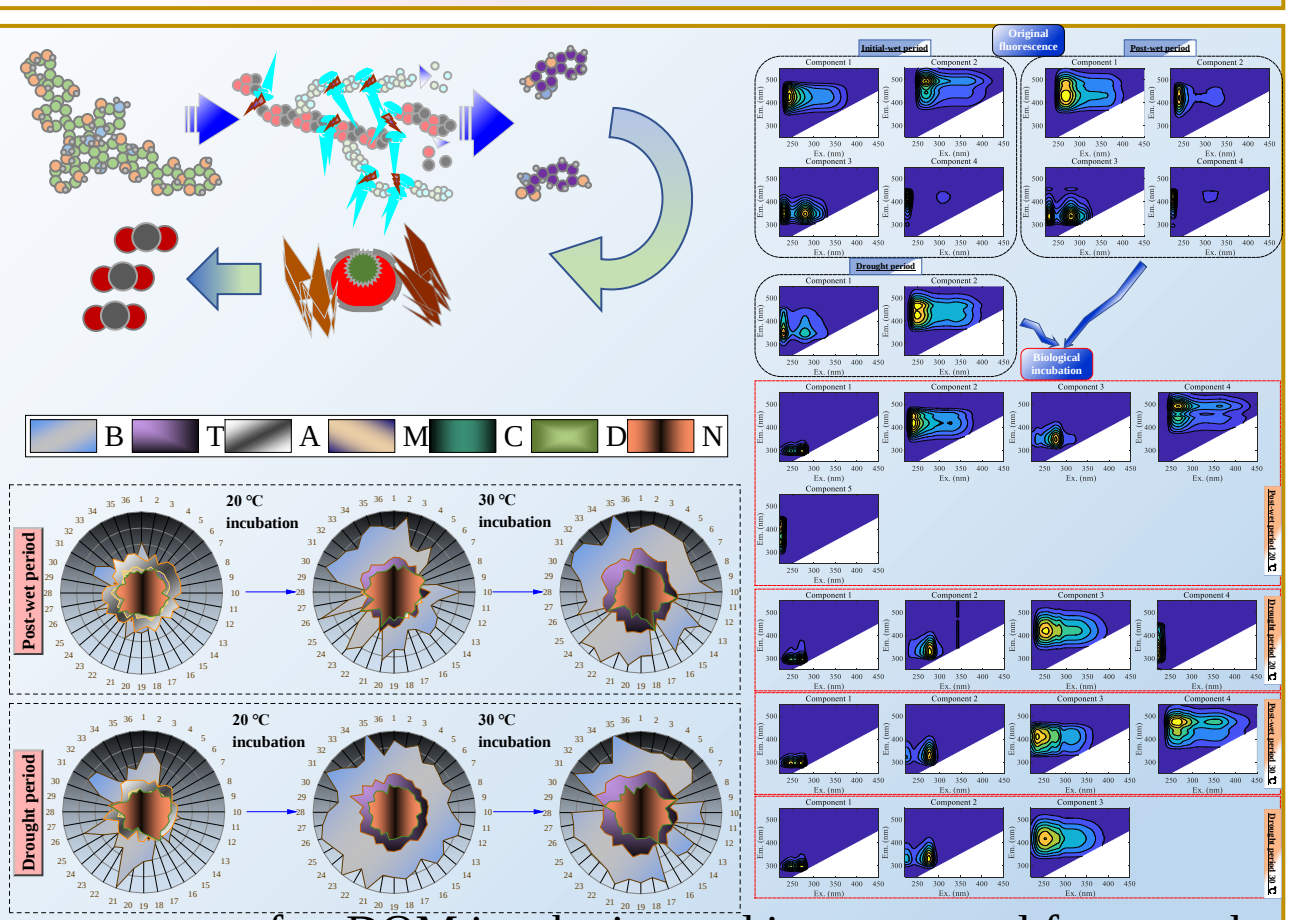


Fig. 2 Changes of dissolved organic carbon components after DOM incubation and its conceptual framework

Reference

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3. Ni maofei, et al. Linking riverine partial pressure of carbon dioxide to dissolved organic matter optical properties in a Dry-hot Valley Region[J]. Sci Total Environ, 2020.