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Carbon dioxide and methane temporal dynamics in an urban river

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Rivers are a significant conduit for carbon (C) transport and transformation. Most rivers are a source of carbon to the atmosphere as either carbon dioxide (CO_2) or methane (CH_4) with greenhouse gas emissions from fluvial systems accounting for a significant proportion of annual global emissions. It is crucial to identify the sources and controls of fluvial CO_2 and CH_4emissions as climate induced hydrological change continues.

The River Kelvin flows through several different land use types (e.g., hills, grassland, pasture, forest, urban centers), draining an area of roughly 352 km^2. Variable land use types make the Kelvin River catchment an ideal natural laboratory to understand land use controls on fluvial carbon transport. Weekly sampling is being undertaken at Kelvingrove Park in the catchment's urban center, where close (1.2 km) to the River Clyde Estuary, discharging a terrestrial C load into the marine environment. So far we understand that 1) the mean concentration of dissolved CO_2 ([CO_2*]) at the study site was 47.26 $\pm$ 14.76 μM while the mean $\delta^{13}CO_2$ was -17.96 $\pm$ 4.03 ‰ , the mean dissolved CH_4 ([CH_4]) was 4.01 $\pm$ 1.91 μM while the mean $\delta^{13}CH_4$ was -48.81 $\pm$ 7.86 ‰ , and the mean dissolved inorganic carbon (DIC) was 1.43 $\pm$ 0.65 mM while the mean δ^{13}C-DIC was -16.98 $\pm$ 2.08 ‰ , respectively; 2) fluvial [CO_2*] and [CH_4] are oversaturated, thus a potential C source of efflux to the atmosphere; 3) [CH_4] and DIC were both greater in summer than in spring and autumn, but [CO_2*] did not show similar pattern; 4) $\delta^{13}CO_2$, $\delta^{13}CH_4$, and δ^{13}C-DIC varied little over the past three seasons, indicating that dissolved C in the River Kelvin is from the same sources; and, 5) respiratory CO_2 appears the main source of [CO_2*] in River Kelvin. Detailed studies of C dynamics in fluvial systems are essential to have a thorough knowledge of not only C emissions from surface rivers but also the potential impacts of land transfer to the oceans.