Carbon dioxide evasion and degassing from three rivers and streams on Qinghai-Tibetan Plateau

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Riverine systems act as important role for carbon exchange between terrestrial, atmospheric and oceanic ecosystems. Carbon dioxide (CO_2) evasion rates of 1.80±0.25 Pg C per year in rivers and streams was estimated with a large uncertainty [1], implying that the affecting factors and sources of riverine CO_2 are still not well known. In addition, the previously estimated CO_2 emission involved very little knowledge on CO_2 evasion in rivers and streams on Tibetan Plateau, which led to noticeable uncertainties for global CO_2 estimation.

For that, three rivers and streams of Duilongqu (DLQ), Golmud River (GR), and Bayin River (BR) were sampled to investigate CO_2 concentration, emission fluxes and influence factors. The chosen rivers and streams differed a lot on climate characteristics, elevation drop, lithological feature, and vegetation cover. The pCO_2 in BR, GR, and DLQ averaged 3125 μatm, 9871 μatm, and 1632 μatm in the surface water, suggesting rivers and streams represented as obvious sources of CO_2 with respect to atmosphere. The calculated CO_2 emission fluxes averaged 53 mmol $m^{-2}d^{-1}$, 190 mmol $m^{-2}d^{-1}$, and 24 mmol $m^{-2}d^{-1}$ in DLQ, GR and BR, respectively, showing moderate evasion rates when compared with other rivers worldwide. The $\delta^{13}C_{DIC}$ value of BR, GR and DLQ averaged -1.5‰, -2.8‰, and -5.6‰. The $\delta^{13}C_{DIC}$ value of BR and GR is close to carbonate-rock weathering isotopic value, much higher than that in rivers reported before, while soil organic matters seems to play an important role in DIC production in DLQ. Correlation analysis and mixed model methods suggested that DIC in GR, BR and DLQ were significantly affected by snowmelt water, groundwater, and lithological distribution.

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[1] Raymond *et al*., (2013) *Nature*, **503 (7476)**: 355-359.