Study on dissolved inorganic carbon (DIC) migration and transformation in a karst reservoir

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Introduction and method

Rivers are the most important conduit to transport DIC, organic carbon (OC) to the ocean, playing a critical role in the global carbon cycle [1]. However, As economy develops, more dams are required to be built for energy supply, which unfortunately affects the physical, chemical and biological processes of the carbon in the water and further the balance of aquatic ecosystem [2]. However, the carbon migration and transformation from river system to reservoir system is still unclear. In this study, we explored these processes using $\delta^{13}C_{DIC}$ techniques, which have already been proved to be a powerful tool in understanding the sources and fates of carbon in rivers and reservoirs [3,4].

Discussion of results

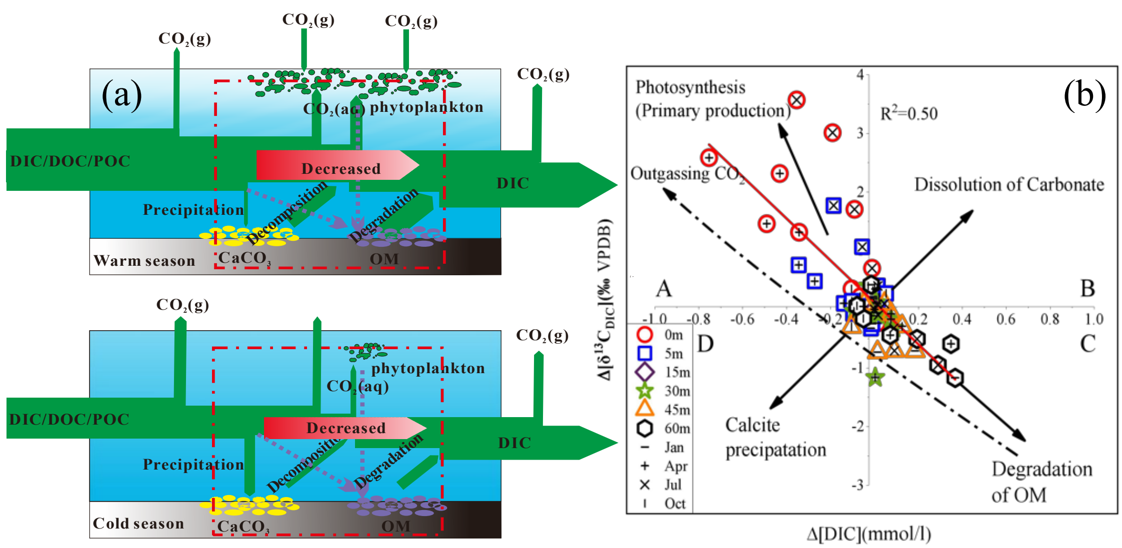

Figure 1: (a)The DIC production, consumption processes and fluxes in warm and cold season; (b)The Relationship between Δ[DIC] and $\Delta[\delta^{13}C_{DIC}]$ for the samples in the reservoir area.

The DIC concentration and $\delta^{13}C_{DIC}$ varied largely (1.99 to 3.45 mmol/L and -10.7‰ to -6.0‰, respectively) and were controlled by complex processes including outgassing of CO_2, primary production, and degradation of organic matter (Figure.1). Moreover, the actual degree of fractionation of $\delta^{13}C_{DIC}$ exhibited distinct patterns: July>April>October>January which suggests season effects is a vital factor leading to DIC change because of the differential intensity of photosynthesis. Eventually, the integration of above effects led to increase of DIC in the discharge water, which makes the discharge of the reservoir become a potential source of greenhouse gas emissions. Our results highlight that the carbon biogeochemical cycle in impounded rivers can be influenced by multiple processes through temporal and spatial DIC and $\delta^{13}C_{DIC}$ evidences, which holds a broad practical prospect to improve the accuracy of carbon budget calculations and the management of water quality for river-reservoir systems.

[1] Raymond et al. (2013) Nature,**503 (7476)**, 355. [2] Van Cappellen& Maavara. (2016) Ecohydrology & Hydrobiology, **16 (2)**:106-111. [3] Alling et al.(2012) GCA **95**, 143–159. [4] Aucour et al. (1999) Chemical Geology **159**, 87–105.