Seasonal changes of dissolved CH_4, CO_2 and N_2O in a subtropical reservoir, Guangdong, China

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Million dams have been built around the world to providing many services for people. However, recent shallow subtropical and tropical reservoirs have been argued as a source of the greenhouse gases (GHGs). The changes of dissolved GHGs is key to control their emissions processes from the reservoirs. In order to understand the generation and release process of dissolved gases such as N2O, CO2 and CH4 in the period with and without thermocline, the Lianhe Reservoir, a typical subtropical reservoir in southern China has been chosen. The field surveys have been conducted to measure DCO_2 (dissolved CO_2), DCH_4 (dissolved CH_4), DN_2O (dissolved N_2O) in September 2014, January 2015, June 2015 and September 2015.

The depths of reservoir changed from 25m to 30m depending on the operation for water supply. The thermocline forms in summer and disappears in winter. Accordingly, the vertical profiles of dissolved gases in summer were different from winter. DO value in the water column decreased with depth from 8.96mg/L to 0.15mg/L in summer, but was almost uniformly ranging from 7.41 to 8.59 mg/L in winter. In summer, concentrations of DCH_4, DCO_2 and DN_2O ranged from 0.49 μg/L to 795.10 μg/L, less than 0.001 mg/L to 1.32 mg/L and 1.06 μg/l to 3.47 μg/l, respectively. Also, concentrations of DCH_4, DCO_2 and DN_2O in winter changed from 0.43 μg/L to 0.85 μg/L, 0.81 mg/L to 3.50 mg/L and 0.85 μg/l to 3.09 μg/l, respectively. As a whole, the vertical distributions dissolved gases are affected by photosynthesis and associated biogeochemical processes. It was found that photosynthetic dominated the dissolved gasses in the top 5m think layer in the reservoir. Available sunlight becomes weaker with increase of depth, CO_2 concentration increased because respiration and metabolic activities of algae and DCH_4 concentration was highest in the bottom in summer. In the winter, the deep part of the reservoir changed from anaerobic environment to aerobic environment because DO was replenished in the overturn period, enhancing oxidation of methane to CO_2.

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