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# Gas transfer velocities of methane and carbon dioxide in a subtropical shallow pond

Shangbin Xiao
China Three Gorges University, College of Civil & Hydroelectric Engineering, Yichang, China (shangbinx@163.com)

Two diel field campaigns under different weather patterns were carried out in the summer and autumn of 2013 to measure $CO_2$ and CH4 fluxes and to probe the rates of gas exchange across the air-water interface in a subtropical eutrophic pond in China. Bubble emissions of CH4 accounted for 99.7Our data showed that the variation in gas exchange rate was dominated by differences in weather patterns and primary production. Averaged k600-$CO_2$ and k600-CH4 (the gas transfer velocity normalized to a Schmidt number of 600) were 0.65 and 0.55 cm/h in the autumn, and 2.83 and 1.64 cm/h in the summer respectively. No statistically significant correlation was found between k600 and U10 (wind speed at 10 m height) in the summer at low wind speeds in clear weather. Diffusive gas fluxes increased during the nights, which resulted from the nighttime cooling effect of water surface and stronger turbulent mixing in the water column. The chemical enhancements for $CO_2$ was estimated up to 1.94-fold in the hot and clear summer with low wind speeds, which might have been resulted from the increasing hydration reactions in water due to the high water temperature and active metabolism in planktonic algae. However, both the air and surface water temperatures decreased continually, and relatively lower temperature and overcast weather with occasionally light rain dominated the second campaign in the autumn. The concentration of dissolved oxygen (DO) in the surface water and U10 controlled gas transfer velocities of $CO_2$ and CH4 respectively in the cool autumn. When the surface water temperature was higher than the air temperature, higher $CO_2$ flux was observed because the water body was unstable and overturned quickly, inducing quick $CO_2$ emitted from plankton algae in surface water to the atmosphere.