



Variability of methane in the epilimnion of Lake Kivu

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We report a data-set of methane (CH₄) concentrations in the surface waters of Lake Kivu obtained during four cruises (March 2007, September 2007, June 2008, April 2009) covering the two main seasons, rainy (October to May) and dry (June to September). Spatial gradients of CH₄ concentrations were modest in the surface waters of the main basin. In Kabuno Bay (a small sub-basin), CH₄ concentrations in surface waters were significantly higher than in the main basin. Seasonal variations of CH₄ in the main basin were strongly driven by deepening of the mixolimnion and mixing of surface waters with deeper waters rich in CH₄. On an annual basis, both Kabuno Bay and the main basin of Lake Kivu were over-saturated in CH₄ with respect to atmospheric equilibrium (7330% and 2510%, respectively), and emitted CH₄ to the atmosphere (39 mmol m⁻² yr⁻¹ and 13 mmol m⁻² yr⁻¹, respectively). The source of CH₄ to atmosphere was two orders of magnitude lower than the CH₄ upward flux. The source of CH₄ to the atmosphere from Lake Kivu corresponded to ~60% of the terrestrial sink of atmospheric CH₄ over the lake's catchment. A global cross-system comparison of CH₄ in surface waters of lakes shows that both Kabuno Bay and the main basin are at the lower end of values in lakes globally, despite the huge amounts of CH₄ in the deeper layers of the lake. This is related to the strongly meromictic nature of the lake that promotes an intense removal of CH₄ by bacterial oxidation.