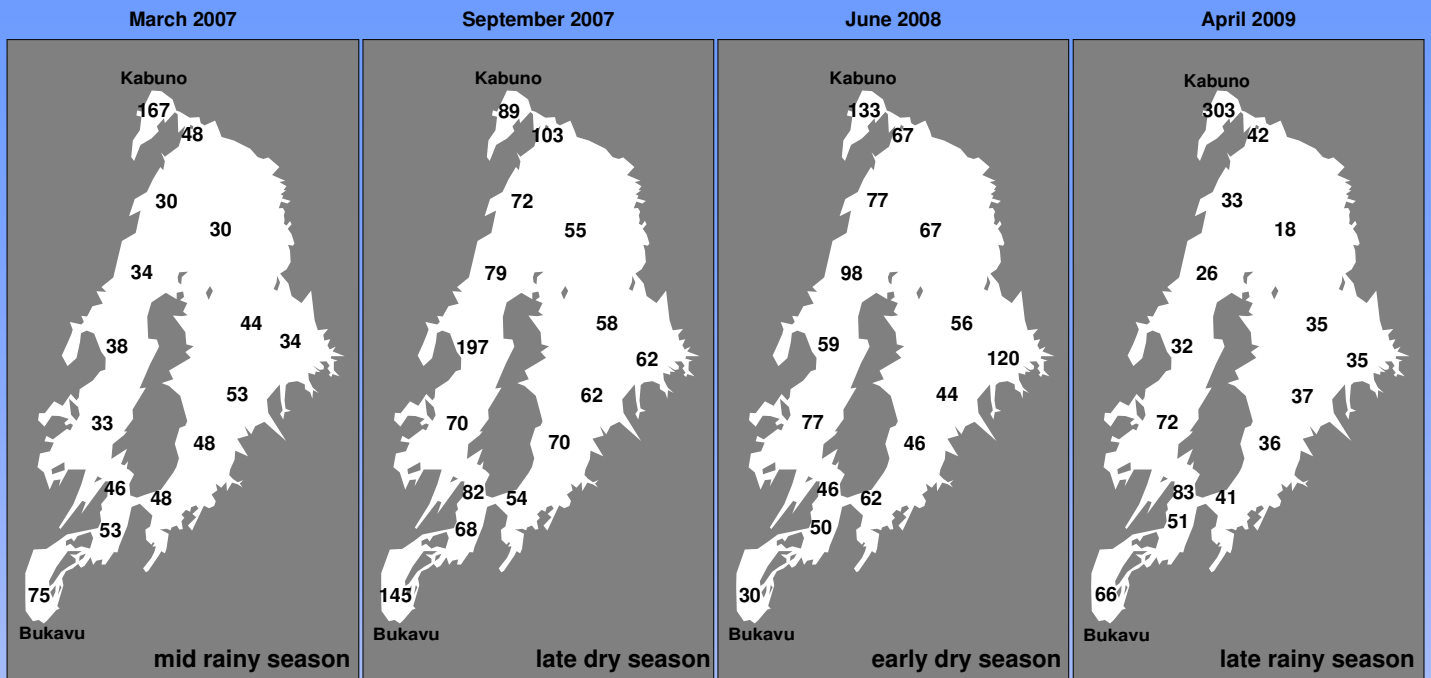


# Variability of methane in the epilimnion of Lake Kivu

Borges A.V.<sup>1</sup>, G. Abril<sup>2</sup>, B. Delille<sup>1</sup>, S. Bouillon<sup>3</sup>, J.-P. Descy<sup>4</sup> & F. Darchambeau<sup>1</sup>

<sup>1</sup> Université de Liège (BE), <sup>2</sup> Université de Bordeaux 1 (FR), <sup>3</sup> Katholieke Universiteit Leuven,

<sup>4</sup> Université de Namur (BE) \* alberto.borges@ulg.ac.be



We report a data-set of methane concentrations ( $\text{CH}_4$ ) in the surface waters of Lake Kivu obtained during four cruises covering the two main seasons (rainy and dry). Spatial gradients of  $\text{CH}_4$  concentrations were modest in the surface waters of the main basin. In Kabuno Bay (a small sub-basin),  $\text{CH}_4$  concentrations in surface waters were significantly higher than in the main basin. The likely higher contribution of deepwater springs in Kabuno Bay than in the main basin increases the upward flux of solutes and might explain the higher  $\text{CH}_4$  concentrations we observed in Kabuno Bay than in the main basin. Seasonal variations of  $\text{CH}_4$  in the main basin were strongly driven by deepening of the mixolimnion and mixing of surface waters with deeper waters rich in  $\text{CH}_4$ . On an annual basis, both Kabuno Bay and the main basin of Lake Kivu were over-saturated in  $\text{CH}_4$  with respect to atmospheric equilibrium (7330% and 2510%, respectively), and emitted  $\text{CH}_4$  to the atmosphere (39  $\text{mmol m}^{-2} \text{yr}^{-1}$  and 13  $\text{mmol m}^{-2} \text{yr}^{-1}$ , respectively). A global cross-system comparison of  $\text{CH}_4$  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  $\text{CH}_4$  in the deeper layers of the lake (concentrations  $10^6$  higher than in surface). This is related to the strongly meromictic nature of the lake that promotes an intense removal of  $\text{CH}_4$  by bacterial oxidation. Indeed, the average  $\text{CH}_4$  oxidation rate (2628  $\text{mmol m}^{-2} \text{yr}^{-1}$ ) in the main basin of lake Kivu is 200 times higher than the average  $\text{CH}_4$  emission to the atmosphere in the main basin.

