

Publication

An inter-regional assessment of concentrations and delta C-13 values of methane and dissolved inorganic carbon in small European lakes

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Methane (CH₄) and carbon dioxide emissions from lakes are relevant for assessing the greenhouse gas output of wetlands. However, only few standardized datasets describe concentrations of these gases in lakes across different geographical regions. We studied concentrations and stable carbon isotopic composition (delta C-13) of CH₄ and dissolved inorganic carbon (DIC) in 32 small lakes from Finland, Sweden, Germany, the Netherlands, and Switzerland in late summer. Higher concentrations and delta C-13 values of DIC were observed in calcareous lakes than in lakes on non-calcareous areas. In stratified lakes, delta C-13 values of DIC were generally lower in the hypolimnion due to the degradation of organic matter (OM). Unexpectedly, increased delta C-13 values of DIC were registered above the sediment in several lakes. This may reflect carbonate dissolution in calcareous lakes or methanogenesis in deepwater layers or in the sediments. Surface water CH₄ concentrations were generally higher in western and central European lakes than in Fennoscandian lakes, possibly due to higher CH₄ production in the littoral sediments and lateral transport, whereas CH₄ concentrations in the hypolimnion did not differ significantly between the regions. The delta C-13 values of CH₄ in the sediment suggest that delta C-13 values of biogenic CH₄ are not necessarily linked to delta C-13 values of sedimentary OM but may be strongly influenced by OM quality and methanogenic pathway. Our study suggests that CH₄ and DIC cycling in small lakes differ between geographical regions and that this should be taken into account when regional studies on greenhouse gas emissions are upscaled to inter-regional scales.

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