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## Groundwater discharge as a driver of methane emissions from Arctic lakes

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Methane (CH<sub>4</sub>) emissions from Arctic lakes are significant and highly sensitive to global warming. Groundwater inputs to lakes could be substantial and constitute a link between CH<sub>4</sub> from melting permafrost to emissions via lakes. Yet, groundwater CH<sub>4</sub> inputs and associated drivers are hitherto poorly understood. In this study, we disclose temporal and spatial patterns of groundwater CH<sub>4</sub> inputs to Arctic lakes in the discontinuous permafrost zone in northern Sweden. Results show that groundwater discharge is a major source of CH<sub>4</sub> to the lakes. Spatial patterns across lakes suggest that groundwater inflow rates are primarily related to lake morphology and land cover. Groundwater CH<sub>4</sub> inputs and atmospheric CH<sub>4</sub> emissions from lakes were higher in summer than in autumn, reflecting changes in hydrological and biological drivers. This study reveals the large role and the drivers of groundwater discharge in lake CH<sub>4</sub> cycling, which may be further exacerbated with the ongoing climate change, as rising temperatures, increasing precipitation, and permafrost thawing are likely to increase groundwater CH<sub>4</sub> inputs to lakes.