Groundwater discharge as a driver of CH_4 emissions from Arctic lakes

UMEÅ UNIVERSITET

GRAB Grup de Recerca en Radioactivitat Ambiental de Barcelona

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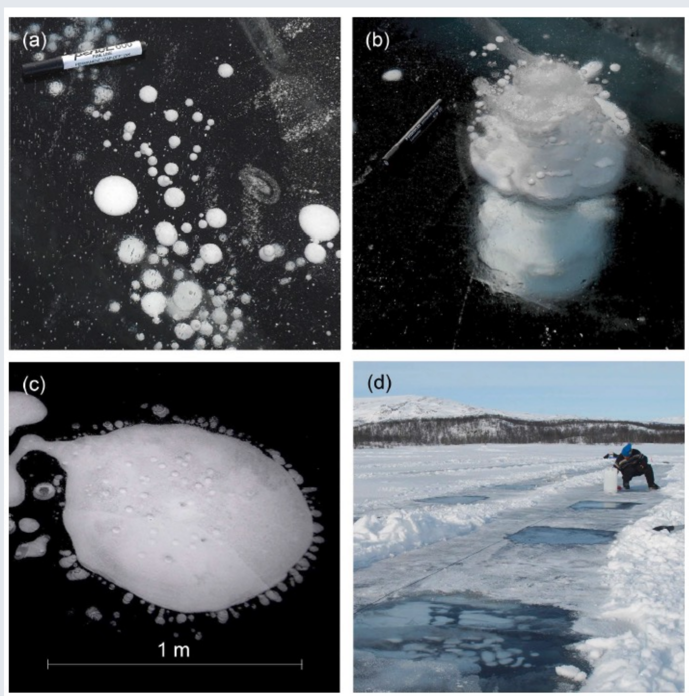
Arctic Lakes: A major source of atmosheric CH_4

Source: Nasa Goddard Media Studios
https://svs.gsfc.nasa.gov/13047

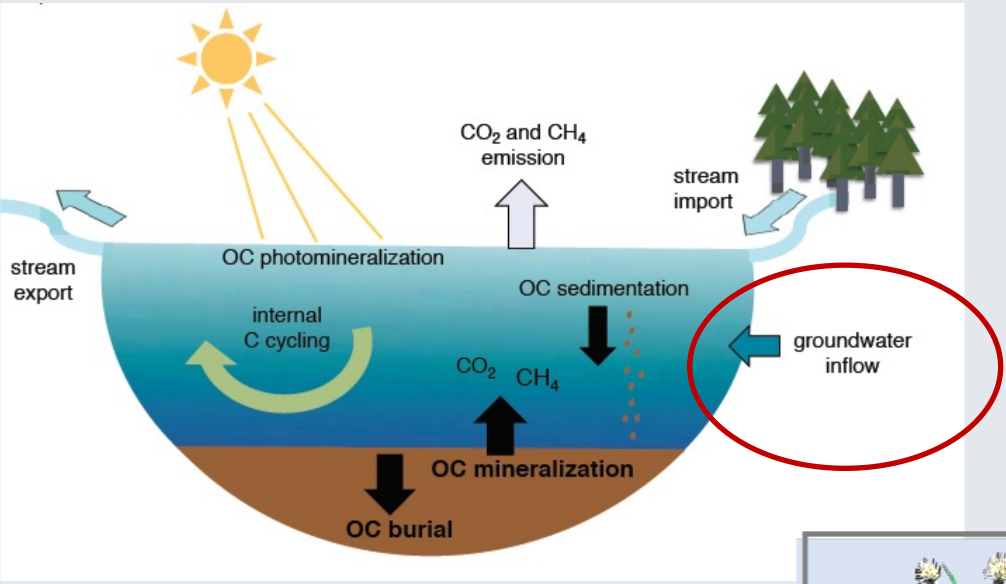


From Wik et al (J. Geophys Res 2011)

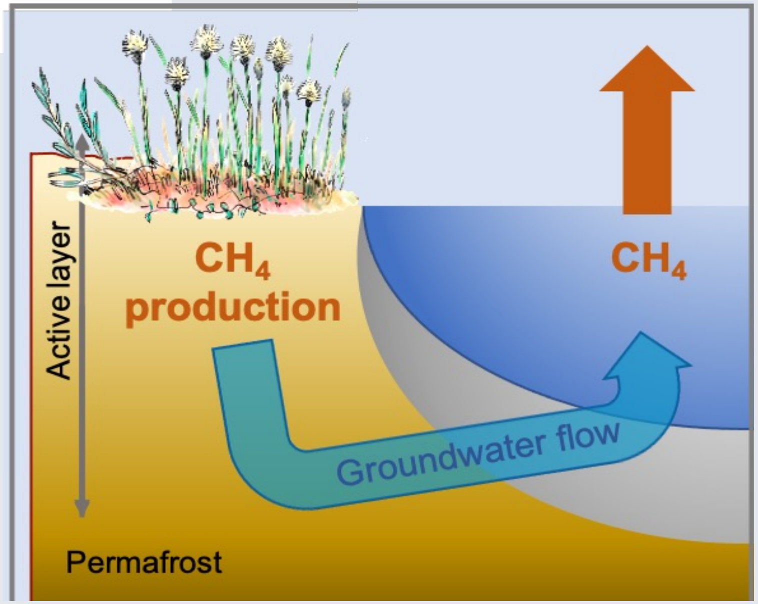
Lake Abraham, Alberta, Canada
University of Alaska, Fairbanks

Background

Internal vs external controls



From Chmiel 2015 (*Thesis*)



Background

Spatial and temporal patterns in groundwater discharge rates in Arctic lakes

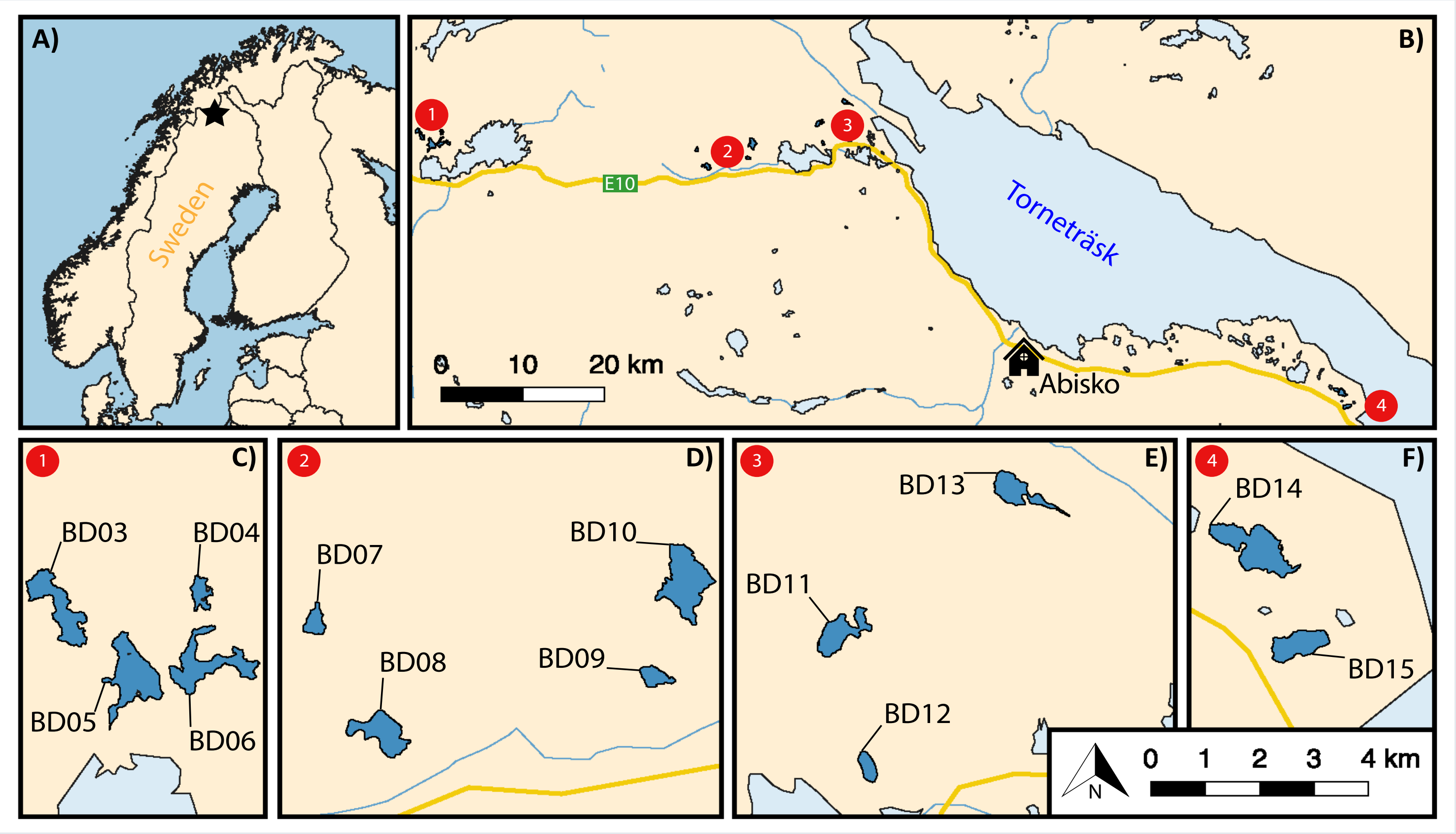


Figure by Marc Diego-Feliu

Objectives

Sampling and methods

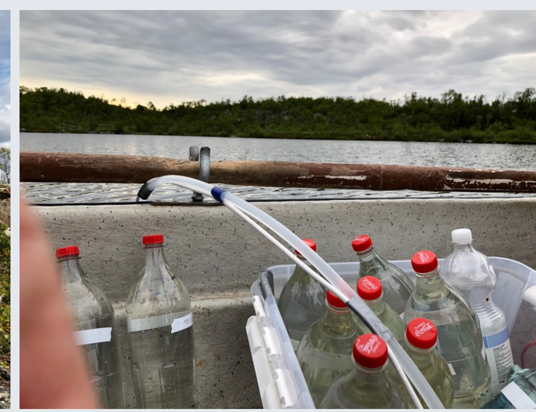
Water chemistry

- DIC, CH_4
- Radon (^{222}Rn)
- Radium (^{226}Ra)

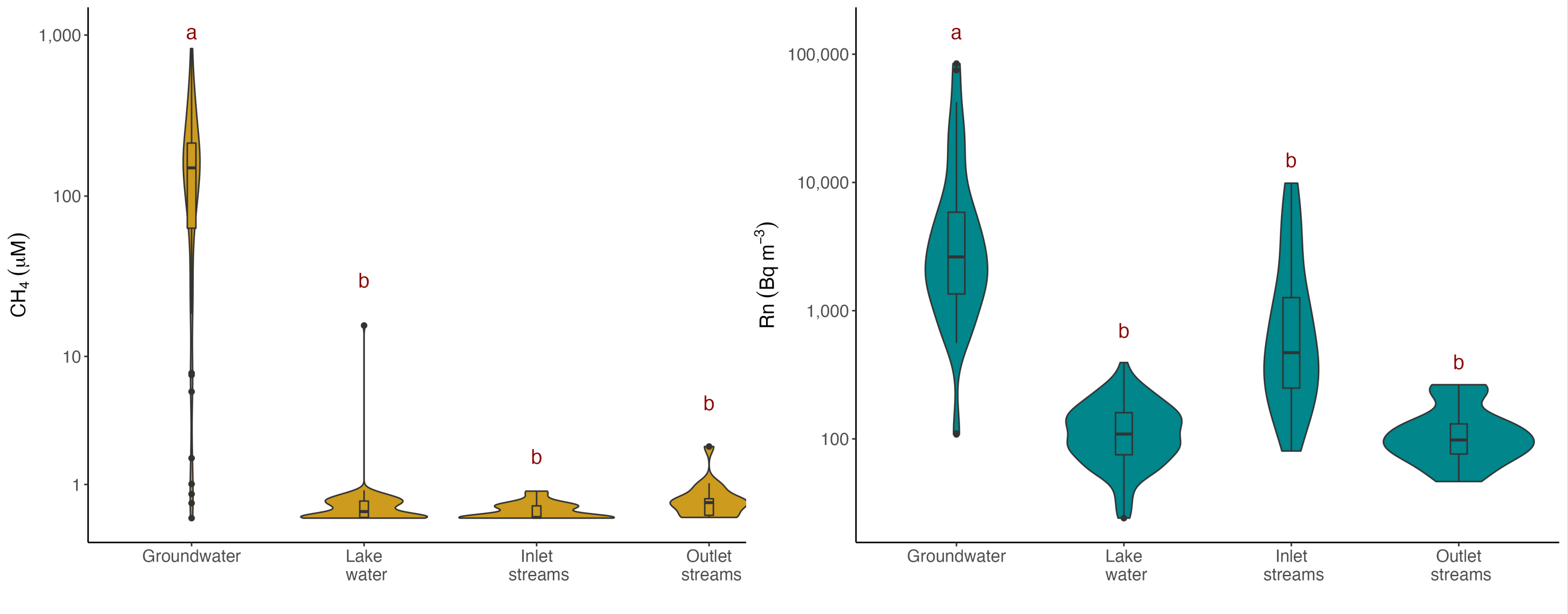
Physicochemical parameters

- Temperature, pH, conductivity
- Oxygen
- Stream discharge





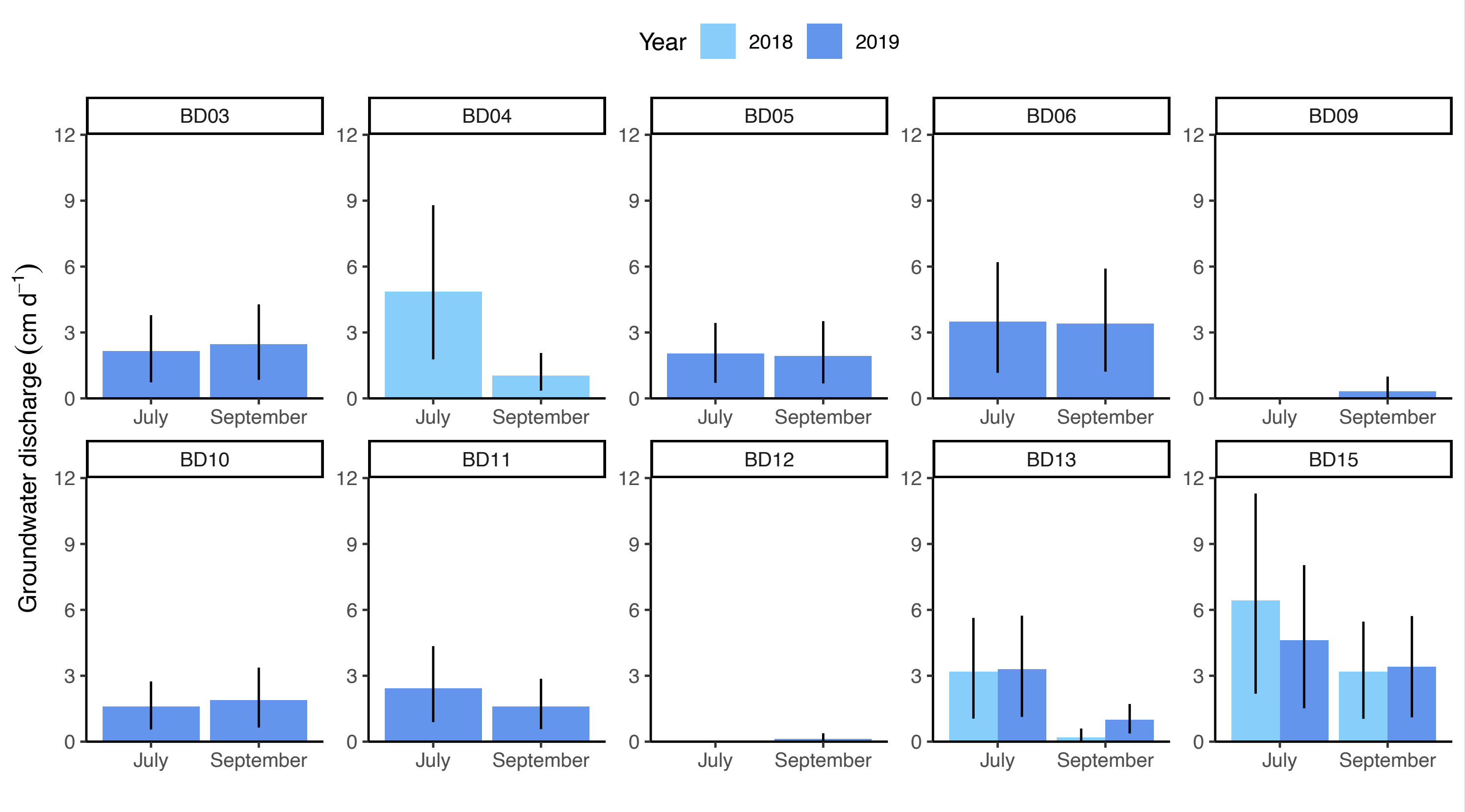
CH_4 and ^{222}Rn concentrations in water samples



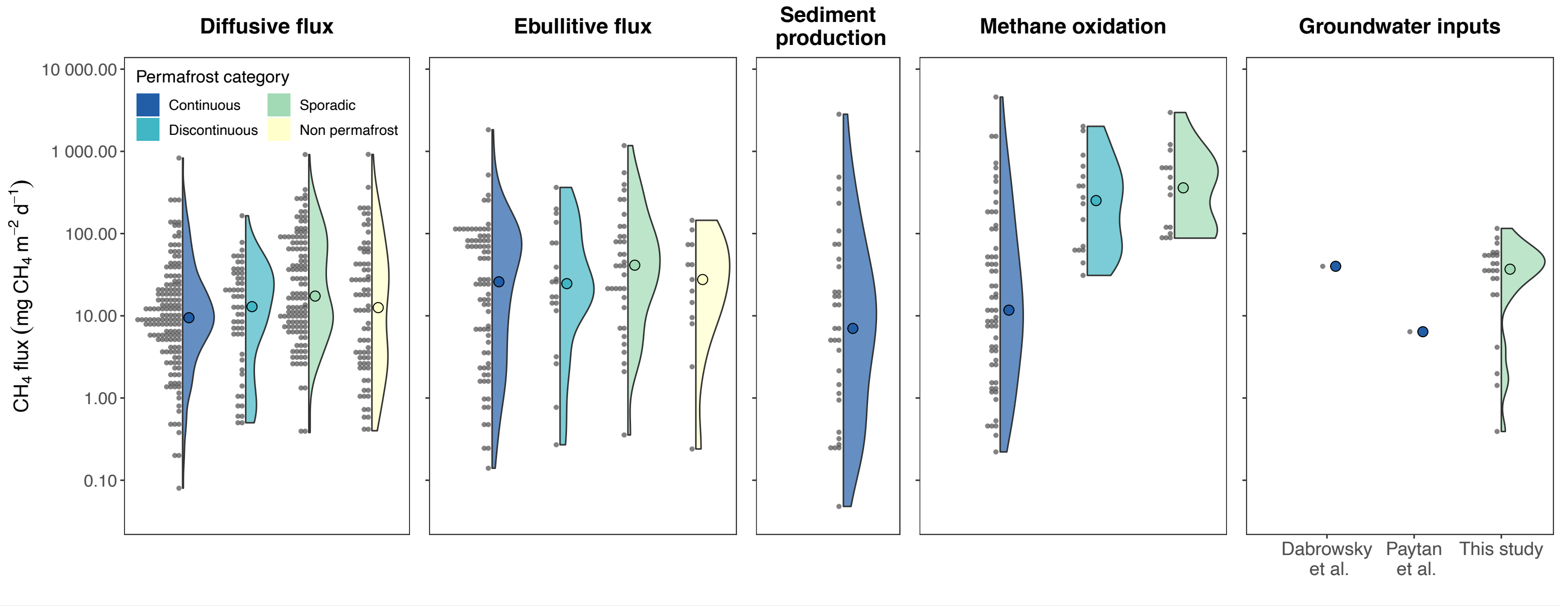
Results

Groundwater input rates

- Groundwater inflows varied between lakes (0.18 – 6.4 cm d^{-1})
- Higher groundwater inflows in summer (1.6 – 6.4 cm d^{-1}) compared to autumn (0.18 – 3.4 cm d^{-1}).



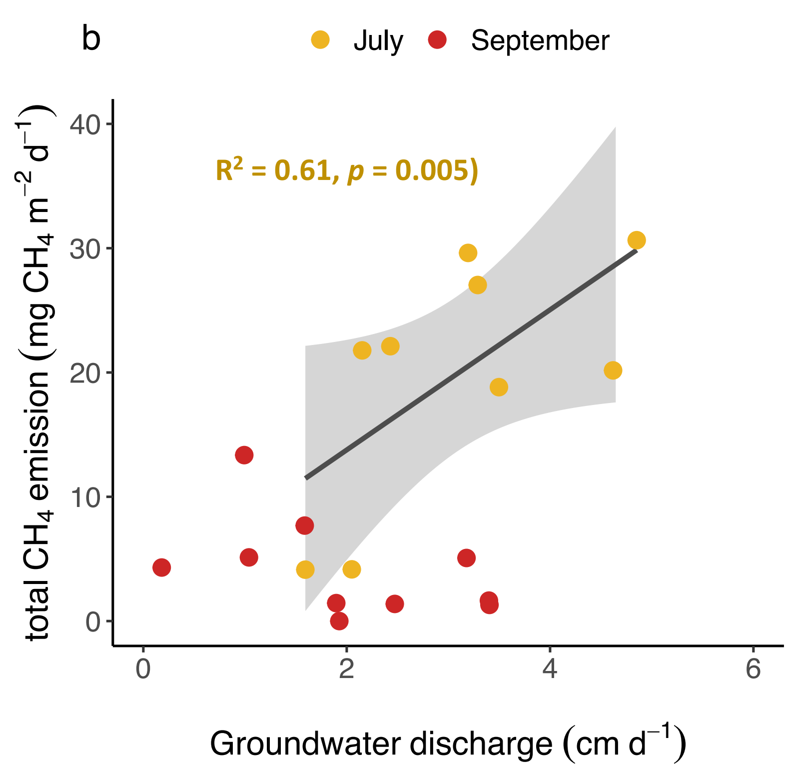
Groundwater-derived CH_4 inputs



Results

Temporal patterns

- The impact of groundwater discharge on lake CH_4 emissions varied seasonally.

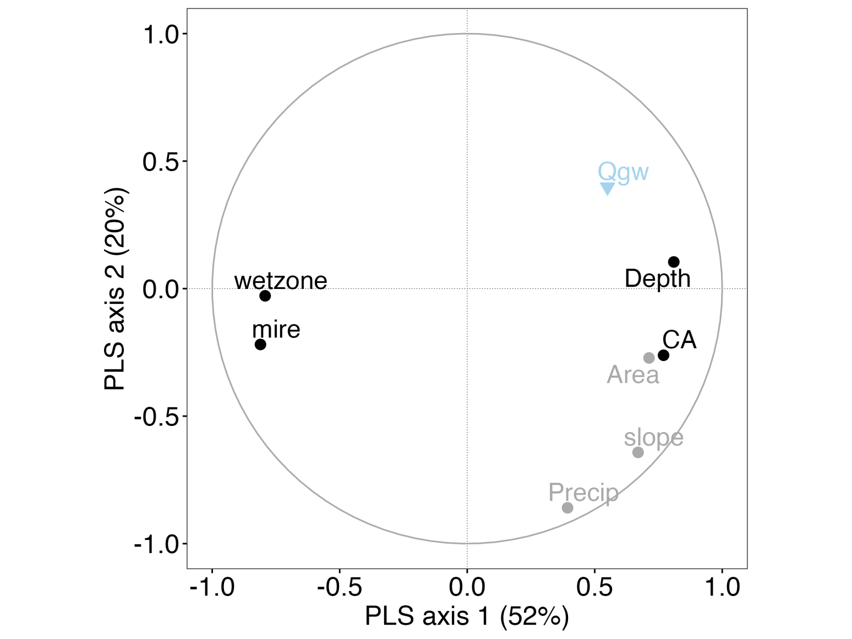


- Snow melt increases groundwater recharge compared to the frozen period.
- Active layer deepening and deeper flow pathways may reduce the potential for CH_4 export.

Results

Spatial patterns

- Groundwater inflow (Q_{gw}) increases with:
  - Lake mean depth (Depth)
  - Catchment area (CA)
  - Percentage of wet zones and open mires (wetzone, mire)



Results

Thanks!

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