Asymmetric Warming Effects on Carbon Fluxes in The Tibetan Plateau Alpine Ecosystems

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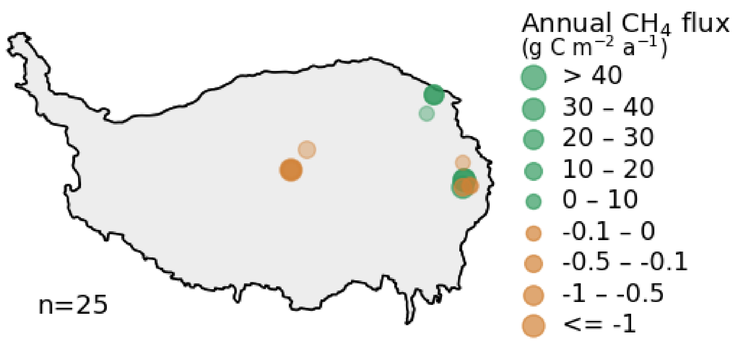
Background

- Net carbon exchange of terrestrial ecosystems with the atmosphere provides positive or negative feedback to the changing climate.
- Permafrost regions are among the largest carbon reserves in global terrestrial ecosystems, with the Tibetan Plateau being the largest high-altitude permafrost area in the world.



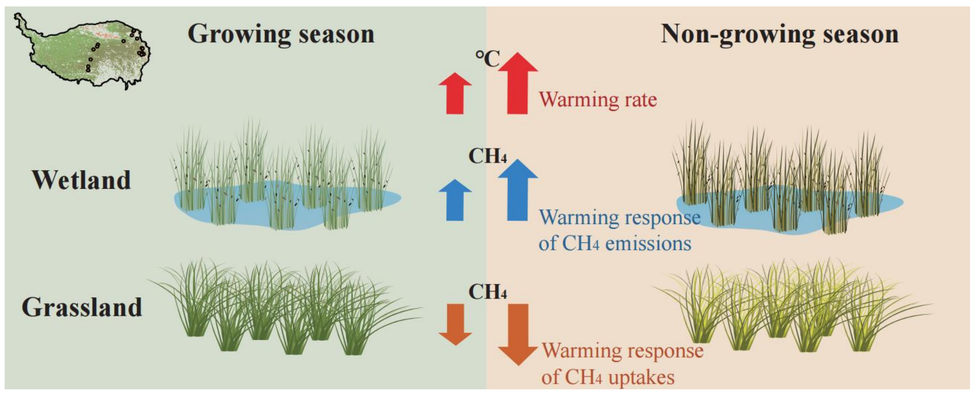
Alpine wetlands
~36% of China's natural wetlands area
fen, marshes, and peatlands
0.16-2.37 Tg C yr^{-1}
Methane source

Alpine grassland
~40% of China's grassland area
steppes and meadows
-0.55-0.10 Tg C yr^{-1}
Methane sink

More enhanced non-growing season methane exchanges under warming

Here, we demonstrated a stronger warming response of CH_4 exchanges during the non-growing season compared to the growing season on the QTP.

- Warming intensified CH_4 emissions in wetlands and uptakes in grasslands.
- The average reaction intensity in the non-growing season surpasses that in the growing season by 1.89 and 4.80 times, respectively.

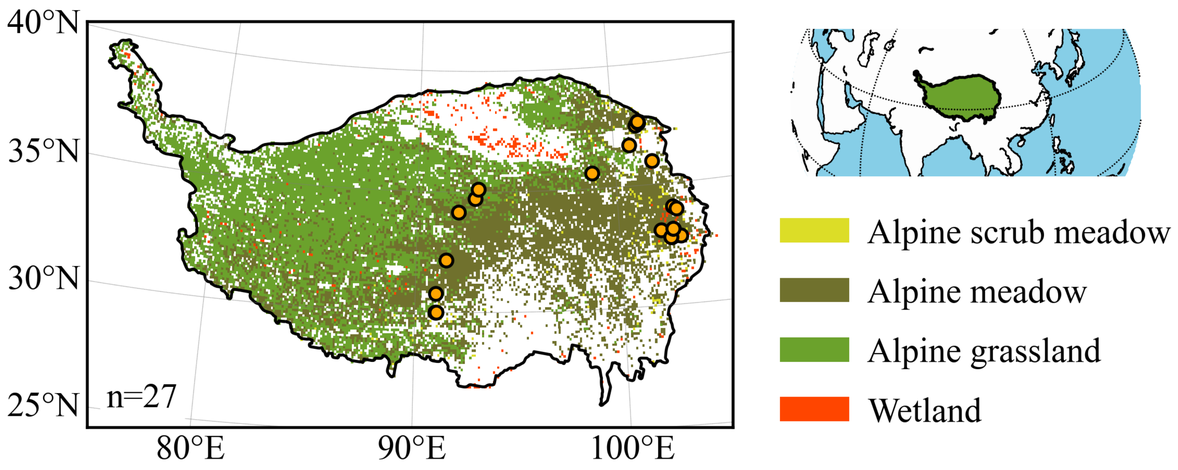


The methane budget of wetland and grassland on the QTP are still uncertain!

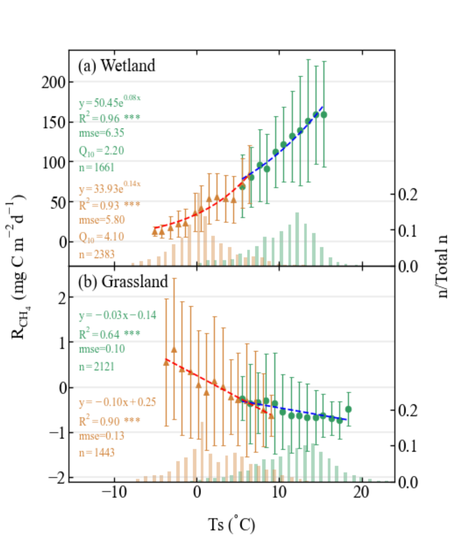
- What is the general seasonal pattern of temperature dependencies of CH_4 fluxes from wetlands and grasslands on the QTP?
- How does the seasonality affect CH_4 source/sink in wetlands and grasslands on the QTP with soil warming?

Analyzing 9,745 daily observations and employing four methods:

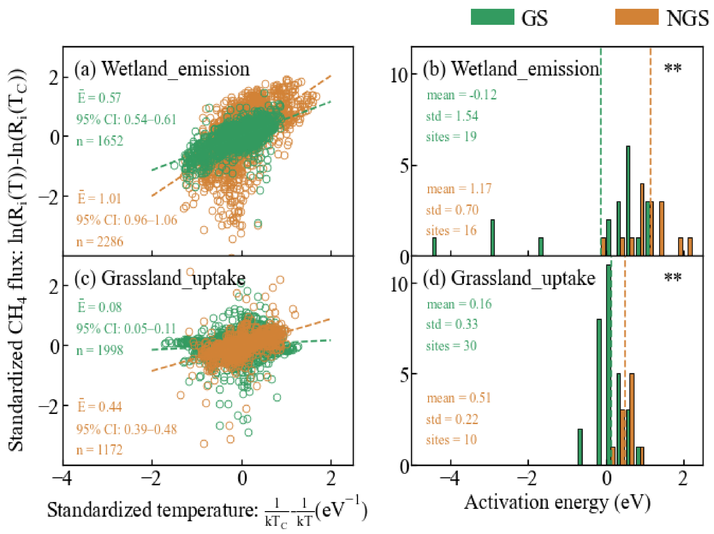
- regression fitting of temperature-CH_4 flux,
- temperature dependence calculations,
- field-based and model-based control experiments



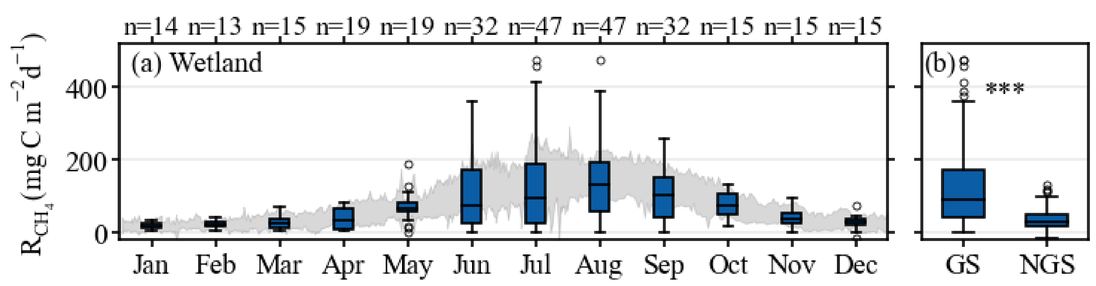
Locations and vegetation types of the 27 sites on the QTP.

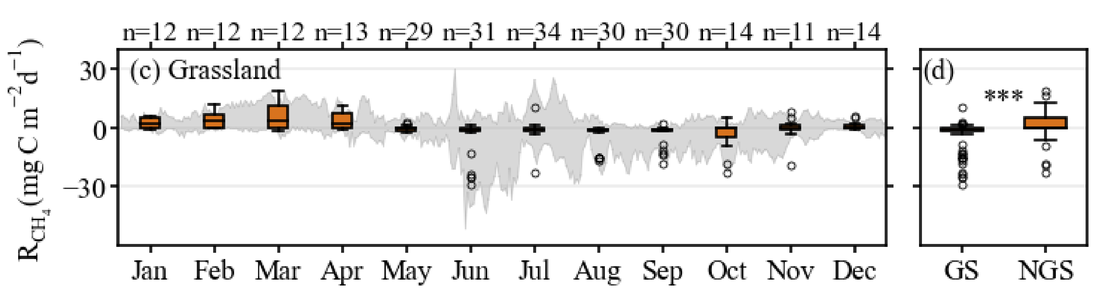


Variations of daily CH_4 fluxes with daily mean soil temperature.



Temperature dependence of the CH_4 flux.





Seasonal variations and magnitudes of the CH_4 fluxes.

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