Temperature dependency of anaerobic microbial activities in a tropical vs. temperate soil
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Introduction

- Increased temperature and rainfall are predicted in regions associated with human-induced climate change, especially in the tropics.
- Wetter soils are more likely to experience periodic low redox events.
- Anaerobic processes like methane (CH$_4$) production and iron (Fe) reduction are more favorable in lower redox environments.

Research question: How can simultaneous variations in redox and temperature affect soil biogeochemical processes including:
- Carbon dioxide (CO$_2$) respiration
- Methane (CH$_4$) production
- Iron (Fe) reduction

Methods

- Microcosms were gas sampled every day for week 1, every third day for weeks 2-4.
- Sampled for Fe(II) and total Fe at the end of each week, and microbial biomass at the end of first and fourth weeks.
- Gas samples analyzed for CO$_2$, CH$_4$, N$_2$O on e.) Agilent GC. Fe measured using ferrozine spectrophotometry.
- DOC measured on f.) O-I Analytical TICTOC analyzer.

Results

CO$_2$ Respiration

- Sum of 3-hour period CO$_2$ fluxes measured over course of experiment in PR and CA soils.

Anaerobic Processes

- Sum of 3-hour period CH$_4$ fluxes measured over course of experiment in anoxic PR and CA soils.

Conclusions

- Anaerobic processes (CH$_4$ production, Fe reduction) do not follow temperature sensitivity responses exhibited by CO$_2$ respiration.
- Standardization of CO$_2$ respiration by microbial biomass increases Q$_{10}$ values, suggesting temperature sensitivity of soil biogeochemical processes is influenced by both biomass size and rate.
- Variability in temperature sensitivity of CH$_4$ production and Fe reduction may be attributable to C availability, or a temperature threshold for anaerobic microbial activity.
- If PR pattern holds true in other tropical soils, anaerobic conditions may be able to limit loss of SOM and soil GHG production in warmer, wetter climate.

Future Research

- Repeat experimentation with altered venting procedure, may correct for fluxing variability.
- Expand sample size to include tropical forest soils from other field sites.
- Introduce artificial C inputs to PR mesocosms to determine if temperature sensitivity of methanogenesis may be function of C availability.

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References

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