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Response of heterotrophic respiration and oxidation of atmospheric CH4 to changes in soil moisture and temperature in drylands across a global climate and ecosystem gradient

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Soil moisture and temperature collectively regulate the production and consumption of carbon in soils. With expected changes in both the soil thermal and hydrological regimes globally, experimental data on carbon turnover under these changes in contrasting ecosystems are important for constraining predictive models of soil carbon turnover. We investigated the effect of changes in soil water and temperature on heterotrophic respiration (Rh) and net methane uptake (MU) in soils from grassland ecosystems in Arctic, temperate and subtropical climates.
The temperature sensitivity of RH increased with decreasing mean annual temperature, but there was no indication of a site-specific response of Rh to changes in soil moisture. All sites displayed MU, primarily controlled by the soil water content with little temperature dependence. Thus, the optimum temperature for MU did not differ between sites despite the differences in the climate. However, the optimal soil water content for the relative maximum MU decreased with increasing mean annual temperature at the sites.
These results point to site-specific adaptation of the microbial community that governs the sensitivity of Rh to temperature, but not soil moisture and the dependency of MU to soil moisture alone. We would also like to discuss how this insight can be used to inform ecosystem models.