EGU22-11425
https://doi.org/10.5194/egusphere-egu22-11425
EGU General Assembly 2022

Soil CO_2 efflux along a soil warming gradient in subarctic grasslands in Iceland

Fabrizzio Protti Sanchez[1], Ivan Janssens[2], Bjarni D. Sigurdsson[3], Páll Sigurdsson[3], and Michael Bahn[1]
[1]Department of Ecology, University of Innsbruck, Innsbruck, Austria
[2]Department of Biology, University of Antwerp, Antwerp, Belgium
[3]Faculty of Environmental & Forest Sciences, Agricultural University of Iceland, Hvanneyri, Iceland

Cold and high-latitude terrestrial ecosystems, such as the arctic and the subarctic, store large amounts of carbon (C) in the soil. These ecosystems are already experiencing rapid rates of temperature increase compared to other regions of the Earth. It is expected that warmer conditions will increase soil CO_2 efflux by enhancing soil microbial and root respiration. However, our understanding of warming effects on soil C cycling is limited to short-term observations (1-5 y of warming) and under few discrete warming levels.

This study is embedded within the FutureArctic project, and we take advantage of geothermally heated subarctic grasslands in the ForHot research site in Iceland, with 13 years of a stable and constant soil warming gradient. The main objective of this research is to get deeper insights into how rising temperatures will affect soil carbon fluxes in subarctic grasslands ecosystems.

Using automated long-term soil chambers, we are continuously measuring soil CO_2 efflux rates along a soil warming gradient ranging from +0°C to ca. +14°C above ambient soil temperature. Furthermore, complementary manual soil CO_2 efflux measurements allow us to cover higher spatial variability and to assess how soil warming affects the main soil CO_2 source components (i.e., autotrophic, and heterotrophic respiration) via the trenching approach.

Here, we present preliminary results of the soil CO_2 efflux along a soil warming gradient in Iceland, including time series of the first year of the study. Overall, soil CO_2 efflux increased along the soil warming gradient. We found that heterotrophic respiration is the main source component of total soil CO_2 efflux. Both autotrophic and heterotrophic respiration increased with warming, however, the relative contribution of each source component was unresponsive to warming. Ongoing analysis of isotopic soil CO_2 in the automated measurements will allow the partition between biogenic and geogenic sources of soil CO_2 in the studied geothermal system and accurately describe the soil respiration response to warming.