Geophysical Research Abstracts
Vol. 19, EGU2017-16746, 2017
EGU General Assembly 2017

Soil warming increases metabolic quotients of soil microorganisms without changes in temperature sensitivity of soil respiration

Sara Marañón-Jiménez (1,2), Jenniffer L. Soong (2), Niki I. W. Leblans (2), Bjarni D. Sigurdsson (3), Steven Dauwe (2), Erik Fransen (4), and Ivan A. Janssens (2)

(1) Department of Applied Physics, University of Granada, Spain (smaranon@ugr.es), (2) Centre of Excellence PLECO (Plant and Vegetation Ecology), University of Antwerp, Belgium, (3) Agricultural University of Iceland, Borgarnes, Iceland, (4) StatUa Center for Statistics, University of Antwerp, Belgium

Increasing temperatures can accelerate soil organic matter (SOM) decomposition and release large amounts of CO_2 to the atmosphere, potentially inducing climate change feedbacks. Alterations to the temperature sensitivity and metabolic pathways of soil microorganisms in response to soil warming can play a key role in these soil carbon (C) losses. Here, we present results of an incubation experiment using soils from a geothermal gradient in Iceland that have been subjected to different intensities of soil warming (+0, +1, +3, +5, +10 and +20 °C above ambient) over seven years. We hypothesized that 7 years of soil warming would led to a depletion of labile organic substrates, with a subsequent decrease of the "apparent" temperature sensitivity of soil respiration. Associated to this C limitation and more sub-optimal conditions for microbial growth, we also hypothesized increased microbial metabolic quotients (soil respiration per unit of microbial biomass), which is associated with increases in the relative amount of C invested into catabolic pathways along the warming gradient.

Soil respiration and basal respiration rates decreased with soil warming intensity, in parallel with a decline in soil C availability. Contrasting to our first hypothesis, we did not detect changes in the temperature sensitivity of soil respiration with soil warming or on the availability of nutrients and of labile C substrates at the time of incubation. However, in agreement to our second hypothesis, microbial metabolic quotients (soil respiration per unit of microbial biomass) increased at warmer temperatures, while the C retained in biomass decreased as substrate became limiting.

Long-term (7 years) temperature increases thus triggered a change in the metabolic functioning of the soil microbial communities towards increasing energy costs for maintenance or resource acquisition, thereby lowering the capacity of C retention and stabilization of warmed soils. These results highlight the need to incorporate the potential changes in microbial physiological functioning into models, in order to accurately predict future changes in soil C stocks in response to global warming.