Geophysical Research Abstracts
Vol. 21, EGU2019-18614, 2019
EGU General Assembly 2019

Impact of warming on carbon flow in the plant-soil system of an arable ecosystem

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Carbon cycling in terrestrial ecosystems provides a feedback mechanism to climate change by releasing or sequestering additional atmospheric CO_2. The C balance in soils is mainly determined by the input of plant C and the release of soil organic C (SOC) as CO_2, which are both sensitive to global warming. We were, therefore, interested in the impact of soil warming on C cycling in an arable soil. We hypothesized that warming will 1) increase C flow from maize into soil and 2) increase heterotrophic respiration of SOC, resulting in an accelerated C turnover but an unaltered C balance. We used the Hohenheim Climate Change (HoCC) experiment, which was established in summer 2008 on an arable field and increases soil temperature by 2.5°C in 4 cm depth. The experimental plots were planted with maize (Zea mays) in 2018. The C flow from maize into SOC, microbial biomass and CO_2 was measured using the difference in 13C signature between maize and C3 plant derived SOC. Preliminary results indicate that warming increased soil respiration, but had only minor effects on the [U+F064]13C value of the respired CO_2. Similarly, the [U+F064]13C values of extractable organic C and microbial biomass C were only slightly affected by warming. These first results indicate that warming could increase soil derived C loss by heterotrophic respiration while C input via the root system of maize is not affected. If confirmed by the final data evaluation, this bears the risk of a net soil C loss from the investigated arable system, leading to a positive feedback of climate warming.