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Effect of simulated climate warming on C cycle in peatlands

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Due to the wet and anoxic specific environmental conditions, which reduce the decay of organic matter (OM), peatland ecosystems act as an important C sink. Peatlands contain about one-third of the world's soil C stock even only accounting for 3–5% of total terrestrial surface area. If the environmental conditions, which favor the C sink function change, these disturbed ecosystems may switch to C source function. The stored OM in peatlands is recalcitrant but may have higher intrinsic temperature sensitivity. Consequently, peat organic C is expected to be sensitive to global climate change. Thus, it is crucial to know the fate of C stored in peatlands to better assess their potential feedback to the changing climate.
To study the response of peatlands to climate change, a 2 year mesocosms (peat cores of 40 cm long x 30 cm wide) experiment (from La Guette peatland, France – acidic fen) under experimental warming were performed using open-top chambers (OTCs). The aim of the present work is to assess the effect of a temperature increase on the C cycle of a peatland experiencing a vegetation change (increasing percentage cover of vascular plants). To do so, CO_2 and CH4 fluxes were monitored, and physicochemical characteristics of peat water were studied in three different depths of peat soil (5, 15 and 30 cm) through analysis of pH, conductivity, dissolved organic carbon (DOC), total nitrogen (TN) and aromaticity. The monitoring is planned to last until June 2020 and at the end of the experiment, mesocosms will be taken out and microbial biomass, structure and activity as well as whole OM pool will be studied to understand the interactions between rhizosphere and soil OM. The experiment started from end of July, 2018. From this date, the mean air temperature at the ground surface was 1.04 oC higher in OTCs comparing to the control plots. Soil temperature at 5 cm depth was also significantly higher than the control (1.32 oC higher in OTCs), while no significant differences were found at 15 and 30 cm depth of mesocosms. Gross primary production (GPP), ecosystem respiration (ER), net ecosystem exchange (NEE) and CH4 emissions in both warming treatments and controls were higher during the growing season than in winter. DOC, TN and aromaticity were also higher during the growing season. In total, during the first five months monitoring, no significant differences between warmed plots and controls were observed.