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Control of the extraction procedures on the response of DOC concentration and composition to soil temperature increase

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Dissolved organic carbon (DOC) leached from soils is a crucial component of the terrestrial C cycling and a major source for DOC export at the landscape scale by stream and river waters. In the context of global warming, it is necessary to understand how changes in soil temperature will impact the DOC dynamic in soils, but this remains a matter of debate. We conducted a series of experiments in order to study both biological and physical processes involved in soil DOC production and mobilisation at different temperatures. Two experiments of DOC extraction were conducted at different temperatures: (i) soil solution percolation through a soil column and (ii) soil solution agitation in jars, which are both commonly used in the literature. The organo-mineral horizon of a wetland soil was incubated during 14 days at temperature ranging from 4 to 30 ˚C. Along with DOC concentrations, changes in DOC composition were assessed by monitoring the natural stable carbon isotopic composition of (δ^{13}C) and the specific ultra violet absorbance (SUVA) of DOC. The results showed strong differences between the two extraction procedures in term of DOC response to temperature rise, both in concentration and composition. DOC released by percolation through soil column displayed a strong concentration increase with increasing temperature. Whatever the temperature, a low SUVA and relatively high δ^{13}C values indicated a release of molecules with lower aromaticity and lower molecular weight the two first days than after. On the contrary, DOC extracted by agitation in jars showed minor changes in both concentrations and composition along the incubation. The difference observed between soil leaching and batch incubation can mainly be explained by the extraction procedures. Indeed, the percolation procedure favors transfer from the micro-porosity to the macro-porosity pool between two successive leaching, whereas agitation procedure releases DOC produced and accumulated in the whole soil. Furthermore, agitation extraction leads to the disruption of soil micro-aggregates, resulting in the mobilisation of organic carbon that was not previously in the dissolved phase and forcing the mobilisation of the immobile DOC pool (micro-porosity), whereas percolation only mobilised the mobile DOC pool located in the soil macro-porosity.