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Coupling of dissolved silicon and carbon in temperate wetlands

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Wetlands play a key role in the global carbon (C) cycle particularly disturbed by climate change or human activities which leads to the degradation of these environments. Dissolved Si is a nutrient limiting biological development in many continental and coastal hydrosystems and is therefore coupled to C cycle at the local (watershed) and global (land-ocean-atmosphere) scales. The Si cycle depends on both organic (e.g. phytoliths) and inorganic (e.g. silicates weathering) pools and is poorly constrained in the critical zone, especially in wetlands. Determining how local and global hydrological disturbances influence the C and Si cycles in wetlands is essential to better predict their trajectories.

The objective of this study is to better understand the coupling between the Si and C cycles in wetlands. In particular, by identifying whether the sources of Si and C in wetlands are produced/remobilized in-situ (by the degradation of organic matter or the alteration of sediments) or from an external source in the watershed.

We monitored the hydrological, sediments and hydrochemistry (major elements, dissolved organic carbon) in two temperate wetlands in center France: The La Guette peatland ('SNO Tourbières' observatory), a restored peatland, and the La Beulie pond which is part of a peri-urban basin ('SNO Observil' observatory). These records allow to quantify the Si and C solid and dissolved fluxes in both sites and to identify the relationship between their respective budget and the hydrological seasonal dynamic. Preliminary results show that, surprisingly, Si concentration is lowly variable in all environments and along the year, while DOC concentration and water mineralization exhibit large variation. These results suggest that both wetlands act as a significant source of Si to the hydrological network whose the origin is currently unknown. The future analyses of Si isotopes ($d^{30}Si$) coupled to Ge/Si of monitored hydrosystems and of each potential Si sources in both wetlands (peat, Organic rich sediments, local soils, adjacent surface water, clays) while be precious tools to trace both the biotic or abiotic sources of the Si released and the degree of fractionation processes.