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Impacts of anthropogenic management of flooding on the seasonal variation of nitrogen fluxes in estuarine wetlands

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The anthropogenic farming and industrial activities have considerably disrupted natural estuarine ecosystems over time. Intertidal wetlands are among the most affected, representing essential exchange zones between the aquatic and terrestrial environments with an ecological role in carbon storage and a filtering effect regarding pollutants. However, while under natural conditions, these environments are characterized by daily flooding linked to tides and floods, the estuaries adjustment for anthropogenic purposes has often disconnected wetlands from the river bed. Within the Seine estuary, some wetlands are still governed by a natural system daily flooded by tides. However, modification of the river bed in order to facilitate navigation has also resulted in artificial management of flooding of some other wetlands, regulated by valves. These changes in flooding gradients may impact the biogeochemical cycles and ecological functionalities as organic carbon storage and filter effect for nutrients.

In this context, the aim of this study was to estimate how anthropogenic management of flooding in wetlands impacts ecological functioning, in particular nitrogen cycling and fluxes. To this end, the flooding gradients of two wetlands, one subjected to natural daily flooding and the other subjected to controlled flooding were investigated during two contrasting seasons. The quality and quantity of soil carbon (total C and N, $\delta^{13}C$, $\delta^{15}N$) were determined at four sites along each gradient. In addition, nitrogen (nitrate and ammonium) fluxes were measured using core incubations. We hypothesized that managed sites might favor the carbon storage following the elimination of the daily flood regime and would therefore show better nitrate elimination capacity than naturally flooded sites.