# Study of groundwater fluxes and diagenetic processes to understand the biogeochemistry of two shallow lakes

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We have investigated the hydrological and biogeochemical processes influencing the shallow lakes of Lacanau and Carcans-Hourtin, SW France, including the groundwater, stream water and atmospheric inputs and the internal processes in the water column and the sediment. The biogeochemistry of these lakes was explored because of the land use, the permeable nature of their catchment area, the high concentration of DOC, and the accumulation of organic-rich sediments. Bottom sediments are sandy and permeable, but the flocculation of DOC in the water column induces the formation of a very organic-rich fluffy sediment that accumulates in deepest parts over about 25% of the bottom area. The study of diagenetic processes in such sediment is novel. Nutrients and redox compounds were also monitored every month in the lakes and in the catchment (stream and groundwater). Water mass balance suggests that groundwater fluxes through permeable sandy sediment are significant in these lakes. The nutrient cycles are mostly controlled by groundwater advection and diagenetic processes. Despite agricultural activities in the catchment area, the nitrogen cycle is not directly controlled by surface water inputs. The phosphorus cycle depends on seasonal variation of redox processes at the sediment-water interface. This redox front moves upward in the water column during periods of hypoxia, when wind is low for a few days. Near bottom, hypoxic events lead to higher fluxes of pore water nutrients (ammonia and phosphate), which could have a positive feedback on hypoxia. Processes that controlled carbon cycle were studied through the d13C signature of DIC. Results are interpreted in terms of primary production, CO2 degasing at the water-air interface and methane oxidation at the sediment-water interface. Our results are derived from the study of different reaction zones in the lakes and their watersheds. Nevertheless, we show that a complete mass balance of carbon and nutrients requires the study of all these compartments.