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Hydro-sedimentary, biogeochemical and geomorphological characterization and dynamics of the Sélune River

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Abstract:

Physical obstacles constituted by dams affect diversely the fluxes of water, sediment and biogeochemical elements as well as the geomorphology of the Selune River. To identify, quantifiy and understand these effects and the consequence of future dams removal, observations were conducted combining a continuous monitoring of water, suspended solids (SS) and biogeochemical fluxes, a geomorphological diagnosis, and some indicators of the potential morphogenic dynamics of the channel.

The sediment and biogeochemical fluxes were determined over 3 years in 2 stations, one upstream and one downstream from the dams, equipped with sensor for measuring discharge, turbidity, and physico-chemical parameters continuously (dt≤1h). Weekly and storm samples were conducted in both stations to measure concentrations in SS, phosphorus (P), dissolved nitrogen (mainly as NO_3) and silica (Si). The geomorphological diagnosis targets the signal of a sediment deficit of bedload (channel incision and pavement) based on spatially analyzed variables (full edge channel width, bank height, length profile, grain size). These measurements were supplemented by the calculations of the specific stream power and measurement of the mobility of bed load from RFID transponders.

Event dynamics of river concentrations between the two stations emphasized the buffering effect of dams with a retention of SS and P. Biological consumption in the reservoirs modifies the seasonal dynamics of Si and dissolved P concentrations but not of NO3 concentration. The composition and granulometry of SS indicates a seasonal and biogenic origin downstream from the dams that differs from SS entering the dams. Annual biogeochemical loads increase with water flux with higher loads downstream for dissolved elements and lower loads for SS and P.
No downstream propagation signal from incision or paving could be detected despite significant specific streampowers (between 30 and 45w.m-²) and an average mobility of coarse sediments of about 1m per year. This lack of signal can be explained by the very strong anthropisation of the channel and its banks (old fisheries, old mills, bank protection, etc.) as well as potentially by the sedimentary redesign of channel bed areas linked to the spawning of migratory fish (lamprey and salmon).