EGU22-8903, updated on 18 Aug 2022
https://doi.org/10.5194/egusphere-egu22-8903
EGU General Assembly 2022

Qualification of the efficiency of a dam dredging by mapping the sediment plume with adcp acoustic backscatter

Alexandre Hauet, Hélène Scheepers, Dominique Lepa, and Bruno Capon
EDF-DTG, Saint-Martin-Le-Vinoux, France

EDF is the largest producer of hydroelectricity in Europe and France, with about 640 dams and an installed capacity of about 20GW. Sedimentation in dam reservoirs is a paramount issue for EDF, including impacts on electricity generation, on dam stability, on spillway discharge capabilities and operation of bottom gates, and on the sediment starvation downstream.

This study focusses on EDF's dam of Chambon, in the French Alps. In order to guarantee the proper operation of the Chambon dam's outlet bottom gate (the main safety device) between 45 and 55,000 m3 of fine sediments upstream of this gate have to be cleaned out and thus create a stable release zone. The dredging was conducted by a dilution-pumping method that consists in pumping the sediment deposited in the area upstream the bottom gate, and released them upstream the power-plant intake so that they can transit through the turbines and return to the river downstream to be diluted. The outlet of the pipe dredge was stalled several meters in front of the water intake in order to entrain the fine sediment plume while allowing sand and gravel (which can create serious damage to the turbine) to settle before the intake.

To verify the efficiency of this method, and to ensure that the fine sediments were well entrained in the power-plant intake, adcp measurements were conducted to map the acoustic backscatter intensity that reflects the sediment concentration. A TRDI RioGrande 600 kHz was used, tilted by 20° in order to point the Beam 1 to the Nadir and avoiding side-lobe perturbation close to the bottom. The acoustic backscatter from Beam 1 is used as a proxy of sediment concentration, in a qualitative approach (without estimating the sediment concentration in g/L), in order to map areas of no-, low- or high- sediment concentration.

The measurements show that the release of sediment from the dredging nozzle is highly variable over time, and causes sediment puffs which are diffused towards the free surface and laterally downstream. The sediment plume is homogenized in the body of water, then plunges towards the power-plant intake where it is entrained.