Geophysical Research Abstracts
Vol. 19, EGU2017-10203, 2017
EGU General Assembly 2017

Morphological and sedimentary evolution of the Yonne River following the first step in the removal of a medium-sized dam in the Morvan Massif (central France)

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The study focuses on the hydromorphological monitoring of the first stage of the removal of a medium-sized dam (7.9m high) located on the upper Yonne (central France). The reservoir of the Pierre Glissotte dam (40,000m3) was almost completely filled with sediment and the dam acted as an obstacle for biological and sediment continuity. For these reasons, the local water agency together with the private owner of the hydroelectric power plant created a project to renovate the hydroelectric installations while removing the main dam which limited the longitudinal continuity. To do so a small weir with no impact on the sediment flux has been maintained in the upstream part of the site, a fish pass has been installed and the main dam has been deconstructed in two steps, in order to limit the reinjection of the sand and fine sediment trapped in the reservoir.
This paper presents the project and the evolution of the river bed 15 months after the removal of the upper half of the dam. Recording the bed adjustment entailed a variety of methods (bedload tracking, hydrological recording, topographical surveys, aerial photographs, photogrammetry, etc.) and technologies (RFID, Diver sensor, UAV, total station, etc.) deployed to ensure a complete monitoring of hydrology, bedload transport, morphology and the grain-size of the riverbed. Several study reaches were chosen within and around the hydroelectric complex in order to investigate the riverbed adjustments in situations influenced by the dam a as well as in situations not subject to the dam's influence.
The dewatering of the reservoir did not go as planned and a lot of fine particles were only flushed out a number weeks after the work began, seriously damaging the biodiversity over several kilometers downstream of the dam. Consequently, the local authorities decided to accelerate the evacuation of the sediment. After 15 months, a new channel, 18 m wide and up to 4 m deep, was built and about 30 % of the sediment accumulated in the reservoir was re-injected into the fluvial system. The bed load, trapped in the upstream part of the reservoir, was very quickly remobilized and is still being evacuated. Tagged particles showed that pebbles and cobbles were frequently displaced and passed through the reservoir rapidly. Up to now, no proper sedimentary wave has been recorded downstream of the dam as the reinjected materials seem to be evacuated as they are released. Apart from in the former reservoir, no major morphological adjustments have been observed on the Yonne River bed.