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Sediment displacement evolution after dam removal in a mountain river (Oioki dam, Leitzaran River)

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Bedload sediment transport was monitored from 2016 to 2020 in the Leitzaran River, in a reach affected by the removal of 7-meters high dam (Oioki dam). The removal was accomplished in two phases, the 3 first meters were removed in September 2018 and the second phase (September 2019) involved the removal of the remaining 4 meters. The study area was divided into three subreaches: control (unaffected by the dam), upstream and downstream of the dam. A sample of 300 RFID-tagged stones were seeded every year (100 at each reach).. Prior to this, the grain-size distribution of the surface sediment was characterized using the Wolman method. Then, the grain-size chosen for the tracer stones was distributed according to three Wentworth intervals: that corresponding to the surface d_{50}, d_{50}+1 (immediate upper interval), and d_{50}-1 (immediate lower interval). It was not possible to follow completely, and the lower interval had to be dismissed as the sediment was very small or narrow to insert the tracer.

We conducted an extensive surveying field campaign every summer.

The number of retrieved tracers was relatively high, around 40-70% (considering all field campaigns), although with differences amongst the different sub-reaches. The obtained results were organized by displacements and volumes of sediment moved. The maximum (3,500 meters) and higher mean displacement (~1,550 meters) were registered in the hydrologic year 2019/20. These values are from the upstream reach of the dam and match simultaneously with (i) the whole removal of the dam, and (ii) the period showing a lower discharge (note the critical discharge for the movement of our particles is ~25-30 $m^3 \cdot s^{-1}$ (d_{50} = 64.0≥Ø<90.5 mm); mean discharge and peak flow from 2013 to 2020 were ~5.3 $m^3 \cdot s^{-1}$ and ~125.0 $m^3 \cdot s^{-1}$, respectively and at the end of the watershed).

We also estimated the bulk bedload volumes during the time spanned by this research and we report how the hydrologic year 2019/20 was the more active in terms of displaced volumes,

moving up to 27,500 tons in the upstream reach. In fact, this year also presents the maximum for the downstream reach.

At this moment, besides the raw data of displacements and volumes, our observations highlight how the fact that a copious load of sediment was made available with the dam removal seemed to be more determinant than the magnitude of the flow to get larger tracer displacements.