Geophysical Research Abstracts
Vol. 21, EGU2019-8250, 2019
EGU General Assembly 2019

Sediment Mobility and Bed Material Transport Estimation in a Gravel-Bed River Downstream of a Dam

Andrea Brenna (1), Nicola Surian (1), and Luca Mao (2)

(1) Department of Geosciences, University of Padova, Padova, Italy (andrea.brenna@phd.unipd.it), (2) School of Geography, University of Lincoln, Lincoln, UK (LuMao@lincoln.ac.uk)

The impacts induced by dam on large gravel-bed rivers have been studied for long time considering the morphological and bed alteration responses, but relatively poor knowledge exists about the modifications occurring in terms of coarse transport regime. Using data collected by a tracers-based monitoring carried out in a 4-km long study-sector of the Parma River (Northern Apennines, Italy) located downstream from a dam representing a zero coarse-flux boundary, we applied a virtual velocity approach for estimating the bed material load at four river cross-sections. The virtual velocity approach represents one of the few available and reliable alternatives for estimating the bed material transport in wide rivers characterized by coarse channel-material.

Monitoring was carried out over 17 months (January 2016 – May 2017) during which nine competent events occurred, the highest one with a recurrence interval of 2.1 years. Field data, elaborations and estimate results provided new insights about the impacts of the dam on coarse material mobility and sediment regime. A longitudinal gradient of the dam effects has been recognized along the study sector. Sections located closer to the zero-flux boundary are characterized by more evident impacts due to deficit of coarse sediment input from upstream. Sediment dynamic is strongly altered, especially in the high armored main channel, and the overall bed material load is extremely low, ranging between $0.4*10^3$ m^3 and $1*10^3$ m^3 during the 17-months calculation period at 90 - 110 m wide sections. A partial recovery of sediment mobility was recognized at the sections located further from the dam where both partial and full transport occur at different water discharges and estimates provide higher sediment yield (about $4*10^3$ m^3 during the 17-months calculation period at 120 - 140 m wide sections). The presence of a zero-flux sediment boundary (i.e. the dam) was able to induce significant alterations also in terms of partial transport contribution, relations between bed material flux and hydrological characteristics of the competent event and contribution of different geomorphic units to the total coarse transport.

Our results highlight the impacts that dams can induce on coarse material dynamics and sediment transport in large gravel-bed rivers, which are the primary control factors of morphodynamic response in terms of channel reorganization (e.g. morphology) and streambed features alteration (e.g. grain size, structure). The new insights achieved from the selected case-study are likely to be applicable to many other rivers experiencing channel adjustments due to the interruption of longitudinal coarse-sediment transfer.