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Sediment depositions upstream of open check dams: new elements from small scale models

Guillaume PITON (1,2), Jules LE GUERN (1,3), Costanza CARBONARI (1,4), Alain RECKING (1,2)

(1) Irstea, centre de Grenoble, UR ETGR, St Martin d'Hères, France, (2) Univ. Grenoble Alpes, F-38041 Grenoble, France, (3) Univ. François Rablais, F-37000 Tours, (4) Univ. Studi di Firenze, 4 - 50121 Firenze

Torrent hazard mitigation remains a big issue in mountainous regions. In steep slope streams and especially in their fan part, torrential floods mainly result from abrupt and massive sediment deposits. To curtail such phenomenon, soil conservation measures as well as torrent control works have been undertaken for decades. Since the 1950s, open check dams complete other structural and non-structural measures in watershed scale mitigation plans[1]. They are often built to trap sediments near the fan apexes.

The development of earthmoving machinery after the WWII facilitated the dredging operations of open check dams. Hundreds of these structures have thus been built for 60 years. Their design evolved with the improving comprehension of torrential hydraulics and sediment transport; however this kind of structure has a general tendency to trap most of the sediments supplied by the headwaters. Secondary effects as channel incision downstream of the traps often followed an open check dam creation. This sediment starvation trend tends to propagate to the main valley rivers and to disrupt past geomorphic equilibriums. Taking it into account and to diminish useless dredging operation, a better selectivity of sediment trapping must be sought in open check dams, i.e. optimal open check dams would trap sediments during dangerous floods and flush them during normal small floods.

An accurate description of the hydraulic and deposition processes that occur in sediment traps is needed to optimize existing structures and to design best-adjusted new structures. A literature review[2] showed that if design criteria exist for the structure itself, little information is available on the dynamic of the sediment depositions upstream of open check dams, i.e. what are the geomorphic patterns that occur during the deposition?, what are the relevant friction laws and sediment transport formula that better describe massive depositions in sediment traps?, what are the range of Froude and Shields numbers that the flows tend to adopt?

New small scale model experiments have been undertaken focusing on depositions processes and their related hydraulics. Accurate photogrammetric measurements allowed us to better describe the deposition processes[3]. Large Scale Particle Image Velocimetry (LS-PIV) was performed to determine surface velocity fields in highly active channels with low grain submersion[4]. We will present preliminary results of our experiments showing the new elements we observed in massive deposit dynamics.

REFERENCES

1.Armanini, A., Dellagiacoma, F. & Ferrari, L. From the check dam to the development of functional check dams. Fluvial Hydraulics of Mountain Regions 37, 331–344 (1991).
2.Piton, G. & Recking, A. Design of sediment traps with open check dams: a review, part I: hydraulic and deposition processes. (Accepted by the) Journal of Hydraulic Engineering 1–23 (2015).
3.Le Guern, J. Ms Thesis: Modélisation physique des plages de depot : analyse de la dynamique de remplissage.(2014) .
4.Carbonari, C. Ms Thesis: Small scale experiments of deposition processes occuring in sediment traps, LS-PIV measurments and geomorphological descriptions. (in preparation).