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Flume experiment based analysis of fine sediment infiltration into gravel-beds

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Gravel bed rivers provide valuable habitat for a multitude of organisms, many of which are dependent on the porous nature of the river substrate (eg. insect larvae and salmonids eggs). Agricultural land use and other anthropogenic activities can lead to increased fine sediment delivery to water courses and associated fine sediment infiltration into the gravel bed, promoting clogging of pore space and habitat degradation. This problem is well established. However, current quantitative understanding of the processes involved remains poor.

Here we report the results from a series of laboratory flume experiments designed to illuminate the mechanisms controlling the infiltration, deposition and remobilisation of fine sediments within gravel bed rivers. Experiments were carried out in a 10 m long, 0.6 m wide flume with a 0.2 m thick gravel bed. Data were collected to quantify variations in mean velocity, turbulence characteristics, fine sediment concentration and composition, bed roughness and bed substrate. Rates and patterns of fine sediment storage were quantified using sediment traps placed within the bed substrate, and by continuous monitoring of suspended sediment concentration within the water column. Fine sediment was analysed to determine the size distribution of both the suspended particles (including flocs and aggregates) and the primary particles of which they are composed. Turbulent velocity profiles were obtained above each of the sediment traps using an array of ADVs (Acoustic Doppler Velocimeters). Flume data are used to test a multiple size class suspended sediment transport model suitable for future application in natural rivers.