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The influence of increasing riverbank vegetation density on bed shear stresses and transport of bed material

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Riverbank vegetation can significantly influence the hydrodynamics of the river, such as flow velocity and bed shear stress, as well as affecting geomorphic processes across it. The aim of this study is to report preliminary results from extensive set of experiments aiming to better establish the link between flow and solid transport processes at the vicinity of the riverbank. A set of laboratory experiments is conducted in a recirculating flume with a series of acrylic panels mounted on the side of the flume at an angle to simulate the riverbank, and a large number of acrylic rods placed on top of it simulating riparian vegetation. Ten different vegetation configurations are examined, for the range of vegetation densities found in natural river systems. Three of these are configured in linear arrangement; another three of them in staggered; and the other four follow a random configuration at chosen densities. Turbulent flow is measured across the channel using acoustic Doppler velocimetry (ADV) along a dense measurement grid. The measurements covered the whole cross-section of the channel at the main measurement plane, as well as the riverbank region. The results reported include mean streamwise flow velocity and turbulent intensity profiles, bed shear stresses, momentum transfer at the riverbank region. These are associated with transport metrics obtained using an instrumented tracer particle entrained from different release locations (both from the centerline of the main channel and the near bank region).
The results show that the flow velocity at the riverbank reduces with increasing densities of riparian vegetation, while they increase at the main channel. Likewise, the bed shear stresses increased at the main channel, and decreased within the vegetated riverbank, which is replicated by the observations from the particle transport experiments.