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Role of vegetation on flow hydrodynamics and erosion processes

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Investigations concerning river ecology are ever more oriented toward quantitative information based on the study of the linkages between physical processes and ecological response in rivers. Particularly, vegetation is a key factor to analyze the interrelated system of flow, sediment transport, and morphodynamic in rivers. In fact, several studies show that the effects of vegetation on flow velocity are significant and are of crucial importance for stabilizing sediments and reducing erosion along the channel. It has been generally agreed that vegetation increases flow resistance and modifies sediment transport and deposition (Tsujimoto 1990).
Vegetation is flexible in varying degrees and it oscillates in the flow changing position. Furthermore, the response of vegetation to the flow can change in time. Thus, vegetation has a complex effect on flow roughness and the study of the hydrodynamic conditions is complex. Most experimental investigations have been performed in laboratory channels with flexible vegetation, realized by using artificial filaments (Kutija and Hong 1996; Ikeda and Kanazawa 1996). Peculiar characteristics of flow turbulence structure have been determined, revealing the generation of periodic organized vortices whose center is located slightly above the top of the vegetation layer (Ghisalberti and Nepf 2002). However, in order to correctly analyze the plant behavior, it is important to ensure that the its biomechanical proprieties are adequately reproduced .
In this paper the flow over real flexible vegetation is experimentally studied. The local flow velocities, for different vegetation concentrations and varying the discharge, have been measured in selected sections of the laboratory flume. By using the measured data, the turbulent intensity distribution is examined and the spectral analysis is operated. The formation of turbulence structures inside the vegetated layer is verified, providing some insight into the mechanisms of sediment transport.

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