Geophysical Research Abstracts
Vol. 15, EGU2013-11343-1, 2013
EGU General Assembly 2013

Effect of flexible vegetation on localized erosion processes

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The knowledge of the hydraulic characteristics of flow over vegetation is very important to support the management of fluvial processes. The effects of vegetation on flow velocity are significant and of crucial importance for stabilizing sediments and reducing erosion along the channel. But, because of the temporal changing of roughness due to natural vegetative growth, the response of vegetation to the flow can change in time. Thus, vegetation has a complex effect on walls roughness and the study of the hydrodynamic conditions of flow is difficult. Many theoretical and experimental investigations have been performed in order to analyze both the mean flow and turbulence structure of open-channel flow (Nezu and Rodi 1986; Ghisalberti and Nepf, 2002). Recent experimental runs carried out in laboratory channels with flexible vegetation, realized by using artificial filaments (Kutija and Hong 1996; Ikeda and Kanazawa 1996), investigated some peculiar characteristics of flow turbulence structure and revealed the generation of periodic organized vortices whose center is located slightly above the top of the vegetation layer. Ghisalberti and Nepf (2002) confirmed the formation of such vortices, highlighting that, in the case of flexible vegetation, the vortex-driven oscillation of velocity drives coherent vegetation waving, producing a spatially and temporally variable drag force.
In this paper, attention is paid to the influence of vegetation on the erosion processes both on the bed and on the channel banks. Experiments were carried out both in a straight channel and in a meandering channel, both constructed at the Department of Civil, Environmental, Aerospatial and of Materials (DICAM) – University of Palermo (Italy). The formation of turbulence structures inside the vegetated layer is verified, providing some insight into the mechanisms of sediment transport.

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