THE ROLE OF THE HYPORHEIC FLOW ON THE STABILITY OF AN ERODIBLE BED: A LABORATORY APPROACH USING PARTICLE IMAGE VELOCIMETRY

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The study of river dynamics usually assumes a turbulent stream on a simplified impermeable bed. However, it is known that up to one third of the total discharge can occur through the erodible bed and especially in mountain rivers context. This hyporheic flow must play an active role on the stability of the erodible bed. The question then arises: How does the hyporheic flow affect the stability of the bed and therefore the bedload transport? Part of the reason of this lack of understanding lies in the difficulty to actually measure the hyporheic flow in natural situations. Laboratory conditions and new measuring techniques bring new perspectives to shed light to this problem. Using PIV-LIF method (Particle Image Velocimetry âĂŞ Laser Induced Fluorescence) we investigate this phenomenon on an erodible bed.

The experiment is conducted in a 2-m-long and 3.4-cm-width flume with 4-mm-diameter glass beads in turbulent stream conditions. Thanks to a gate we are able to force or not the hyporheic flow in the granular bed.

Interestingly, the presence of hyporheic flow affects the bed load transport in a way that less shear stress is needed to initiate the movement of particles. The PIV-LIF results show us that the presence of a hyporheic flow modify the velocity profile and the turbulence. With the hyporheic flow the velocity becomes higher around the grains that are on the bed and facilitate the movement. Experiments are under way to determine the effect of the bed slope on the exchange between the hyporheic and the surface flow. This measurements also shows the important role of the outlet boundary condition in classical flumes since the usual impermeable wall changes the hydraulics conditions upstream.