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Theoretic-Experimental study on the morphological behaviour of rivers with steep slopes

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The main objective of the theoretical and experimental research that is being carried out is to comprehend exhaustively the behaviour of high mountain rivers to predict the morphological behaviour of these channels, the behaviour of resistance to flow (considering the influence of solid transport and its interaction with the flow) and, finally, the sediment that will be transported. All this while maintaining the dynamics balance between energy dissipation, state of flow regime and fluvial morphology. The study of these aspects of high mountain physics should influence the way in which flood and risk studies should be evaluated in these areas.

One of the main topics to be addressed is the turbulence produced by a highly energetic flow (steep slope) in a bed of coarse grain size with a low relative submergence (high roughness and small water depths). This generated turbulence has great implications; therefore theories about resistance coefficients, as well as the consideration of a constant dimensionless Shield coefficient might be no longer valid.

The study that is being carried out is on fluvial morphodynamics and not on fluvial dynamics. The difference between one and the other is that in addition to solid transport, the morphological changes suffered by the channel must be taken into account.

The hypothesis made in this investigation is that in mobile-bed rivers with steep slopes, channel hydraulics and bed morphology interactions avoid Froude number to exceed the unity According to Grant (1997), competent, high-gradients streams with beds ranging from sand to boulders typically achieve an equilibrium adjustment between the flow, sediment transport and channel morphology at or near critical flow. Thus, critical flow condition itself may be both a threshold condition and a state of flow regime.

A new approach of threshold motion is implemented due to the presence of turbulence. Fernandez (2019) considers as a responsible for incipient motion of particles the Reynolds shear stress (-u'w') and, in order to take into account the duration of the applied force, the impulse applied by the hydrodynamic forces is also deemed, so both deterministic and stochastic views are applied in order to esteem how the structure of turbulence is organized in steep rough beds. The criterion considers that there is a certain critical impulse (Icr) that when overcome by the impulse exerted by the flow (Ii) sets the particle in motion.

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