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Integrating methods for a better understanding of morphodynamics in gravel bed drivers

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River channel geometry and bed composition adjust toward a new configuration when water and/or sediment supply are changed. In natural streams this situation is often reached during flood events, a state that unbalances preceding equilibrium conditions. These events determine the disturbance regime (frequency and magnitude) experienced by a given fluvial reach and, consequently, will affect habitat availability with associate ecological responses. Field measurements during these conditions are not always easy and require the integration of modelling approaches for a better quantification of channel processes.

In this paper we present the research design of the project MorphSed (www.morphsed.es). Specifically, we introduce a methodology that integrates four main blocks with the objective to quantify channel morphodynamics in gravel bed rivers. Each bloc has a series of key variables and specific methods and techniques to obtain and post-process field data. Block 1: Surface Modelling. The integration of remote sensing techniques and ground-based topographic surveys allow the reconstruction of dense and precise point clouds at multiple temporal scales. These point clouds are processed in order to develop Terrain Models that can be used to characterize channel morphology, to parameterize hydraulic models and to study topographic changes associated to flood events. Special attention is paid on the assessment of topographic data quality. Block 2: Sediment Transport. Suspended sediment and bedload transport can be directly or/and indirectly monitored or measured. Here we integrate simple turbidity records to study suspended sediment transport and the inverse morphological approach to assess flood-based bed material transport. Additionally, we present how acoustic Doppler current profilers (aDcps) can provide spatial distributed measurements of bedload following well-developed early approximations. Block 3: Flow and Channel Hydraulics. In this block we integrate measurements of flow stage, gauging and hydraulic modelling for a better quantification of flow discharge and channel hydraulics at multiple spatial scales. Special attention is paid to options to acquire field data to validate hydraulic models. Block 4: Geomorphic Change Detection. Here we introduce how the Terrain Models obtained at multiple temporal scales can be compared and analysed in order to assess channel changes and to look at the main mechanisms control channel evolution at multiple temporal scales. The integration of these four blocks offers the opportunity to acquire and analyse data relevant to river morphodynamics and, consequently, may provide insights into how fluvial systems behave.