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Management and analysis of high resolution multibeam sonar surveys for geometry characterization of riverbed material

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The geometric characterization of riverbed material is fundamental piece of information for the management of river basins because it allows, for example, the determination of bed-load and hydrodynamics roughness and the study of geo-morphological phenomena. However information such the grading curve are not easily achievable by means of traditional field sampling methods, mostly intrusive, and to the hydraulic conditions of rivers that may have high water levels and strong flows.

Multibeam sonars represent an important alternative to traditional survey methods. Nowadays, thanks to advanced scientific knowledge, it is possible to make full use of an equipment increasingly accurate and precise. State of the art solutions have dimensions compact enough to be installed on remotely piloted vehicles and allow to obtain high resolution digital surface models of river beds. The feasibility of having models of such quality and the possibility to conduct surveys more frequently, allowing the monitoring of sedimentation and erosion phenomena as well as the dynamics of the armouring layer, have motivated the development of advanced and innovative technology to analyse these models.

The aim of this work is the development of a workflow that provides an effective method to characterize riverbed material. In order to achieve this target we start from an advanced and original survey technique, that allows to obtain high resolution digital surface models, and use an appropriate post-processing procedure.

We introduce first some results obtained from the analysis of digital surface models produced in laboratory or relative to well known site. In particular advanced techniques for the study of 3D model and the detection and geometric characterization of forms are investigated.

Then we present some data acquired at high resolution (few centimeters) with a multibeam sonar mounted on a remote controlled vessel. Field surveys were conducted in real fluvial environment with the aim of produce qualitative and quantitative information about the surface layer of riverbed.

Even considering some sources of uncertainty that may be present from field survey to modeling, the obtained results show how it is possible to identify and geometrically characterize several of the forms present on the surfaces analyzed.