Editorial

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Scour is a popular topic in *Water Management*. Out of a total of 402 papers published since March 2004, 23 included the word ‘scour’ in the title (data from Thomson Reuters’ Web of Knowledge). Among them, eight papers appeared in the last 2 years with analyses concerning not only the scour around bridge piers and abutments (Borghei *et al.*, 2012; Chreties *et al.*, 2013; Khan *et al.*, 2012; Mohammadpour *et al.*, 2013; Salamatian *et al.*, 2013), but also other phenomena of local scour under various flow conditions (Dehghani *et al.*, 2013; Ghodsian *et al.*, 2012; Oliveto, 2013). The present issue contributes to the theme substantially with four papers dealing with localized scour around structures, while the fifth paper gives an insight on genetic programming as an alternative tool to study flood routing in a branched river.

A shared introduction can be made for the four papers dealing with scour around obstacles (submerged structures, bridge piers, abutments) in erodible bed conditions. These are commonly divided into clear-water, when sediments are transported only in the region where the flow field is affected by the obstacle, and live-bed, when sediments are transported everywhere. In both cases, scour can jeopardize the stability of structures and produce catastrophic failures, making it a relevant problem for engineering practice. Unfortunately, the available formulas for the prediction of scour depth are affected by a significant degree of uncertainty, and further studies are required to have more reliable tools.

The first paper (Sarkar, 2014) reports on the scour produced by submerged structures for different values of the submergence factor (i.e. the ratio of the flow depth above the structure to the total depth). Experiments were performed considering prismatic structures and including different factors as variables: shape (circular and square) and dimensions (diameter or side, depth) of the obstacles, flow velocity and sediment size (both uniform and non-uniform). The flow field around the obstacle was measured and the temporal evolution of the scour was interpreted by means of an exponential law, whereby both the maximum scour depth and the time scale were determined and analysed in terms of dimensionless relationships. In particular, it was found that the scour decreases when the submergence ratio increases, because of a reduction of the horseshoe vortex, and in the case of non-uniform sediments.

With the aim of providing a more reliable formula for predicting scour at bridge abutments, the second paper (Etemad-Shahidi and Rohani, 2014) revisits the results of previous small-scale experiments with a statistical approach. The authors analysed the

discrepancy of the existing formulas to show their sensitivity to the main variables (abutment type, shape and length, sediment mean size and standard deviation, flow velocity) for both live-bed and clear-water conditions. By means of a piecewise multiple linear regression technique, the authors developed new formulas characterized by an improved accuracy. Among other results, they confirmed that scour depth decreases for non-uniform sediments (reported also by Sarkar (2014)). The paper proposes design formulas that allow for the explicit choice of a safety factor, thus making a step further in the consideration of bridge failure conditions.

The practical relevance of the problem of monitoring scour for the stability of bridges is one of the inspiring elements of the analysis proposed by Chang *et al.* (2014) in the third paper. The paper describes a multi-lens monitoring system that can recognize bed elevation changes along a bridge pier by means of an image recognition process and can automatically switch among the different lenses. The system was set up in laboratory conditions and three existing time-dependent scour models were tested with data assimilation to provide real-time predictions of scour evolution. Installing the system in critical sites with a lead time of around 3 hours would allow for real-time warning of bridge safety and could reduce damages produced by failure. Practical problems of the monitoring system with live-bed conditions during floods are discussed.

In the fourth paper, Soltani-Gerdefaramarzi *et al.* (2014) tackle the problem of reducing scour at piers by proposing an active system. The authors analysed the combined effect of jet injection through pier and bed suction. Both methods are known to reduce scour by means of different effects: suction increases the effective weight of bed particles, and thus the sediment stability, while jets generate kinetic energy to control flow separation, and hence the thickness of the boundary layer, and decrease the horseshoe vortex effect. The laboratory experiments presented in the paper refer to clear-water conditions and suggest that these techniques can be effective in reducing the scour depth.

The final paper covers a very different topic. Orouji *et al.* (2014) compared the performances of different categories of models in simulating flood routing in branched rivers during floods. The authors considered the classical physical based approach of Saint-Venant equations as a reference, and analysed two simplified hydrologic approaches: an extended version of the Muskingum method and genetic programming. With the Silakhor River (Iran) as a case-study, the paper shows that genetic programming produced better results than those of the Muskingum method, and

comparable with the solution of Saint-Venant equations, while asking for a lower amount of input data.

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