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Assessment of different scour models on the Markovian scour increment framework

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Scour is responsible for the failure of many bridges worldwide. In many situations, the scour hole at the bridge foundations may result from the incremental erosion caused by successive floods of low-medium and high intensity. The accumulated scour caused by a series of floods may produce critical scour depth not attained during a single extraordinary flood event. Recently, a framework for probabilistic assessment of clear-water scour around bridge piers has been developed by Tubaldi et al. (2017), allowing to consider memory effects under multiple floods through a Markovian approach. In the present study, we follow such methodology with the aim to quantify the epistemic uncertainty associated with the model employed to describe the temporal scour evolution under a single flood. In particular, three different time-dependent scour formula were considered, namely the Melville and Chiew (1999) model, the model of Oliveto and Hager (2002), and the BRISENT model [Pizarro et al., 2017]. A numerical bridge-channel model was considered, and the estimates of the scour depth obtained with these formula for a design life time of 100 years were compared with those obtained by considering two widely used equilibrium scour formula, namely the HEC-18 [Richardson and Davis, 2001] and the Chinese equation [Gao et al., 1993]. Results show that the exceedance probability of scour is highly sensitive to the choice of the time-dependent scour model, while the scour depth after 100 years can still be lower than the equilibrium scour depth.

Keywords: Scour accumulation, Bridge piers, Multiple floods, Markov process, Uncertainty.

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