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Discharge Uncertainty on Bridge Scour Process

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Floods are one of the most important factors on the bridge scour process. However, the uncertainty related to discharge is high due to the presence of clustering effects, the use of outdated rating curves, and the practical issue of measuring at extreme conditions. In this context, employing the best scour model with an uncertain discharge input leads to unreliable scour estimations. The goal of this research seeks to quantify the scour uncertainty due to the discharge uncertainty using stochastic tools and the BRISENT model [Pizarro et al., 2017] for discharge and scour analysis, respectively. To this aim, we examine several stations covering small and large temporal scales of the river discharge. These stations are selected under the criterion of ensuring low human influence on the natural process. The stochastic structure of discharge is modeled fitting the Hurst-Kolmogorov (HK) behavior in terms of the climacogram and a discharge generator was constructed based on the assumptions of homogeneity, stationarity, and ergodicity. Monte Carlo simulations of flood events coupled with the BRISENT model allow computing both the maximum scour depth for a fixed time interval (for instance, the bridge life) and the scour depth evolution over time. Results show that assuming a bridge life of 100 years and sufficient number of discharge simulations leads to a fixed non-exceedance scour probability distribution. Finally, the scour expected value is compared with two widely used in practice equilibrium scour predictive methods, i.e. (1) HEC-18 [Richardson and Davis, 2001], and (2) Chinese equation [Gao et al., 1993].

Keywords: Discharge Regime, Uncertainty, Climacogram, Bridge pier scour, BRISENT model.

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