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Bridge scour risk: how to take into account hydrologic uncertainty?

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Although the dynamic of bridge scouring is well known and several studies are available in the literature for predicting the maximum scour depth at bridge crossings, scour of bridge foundation is still the number one cause of bridge collapses and damages during river floods. This study aims at analyzing this well-known issue, traditionally approached through deterministic methods, by means of a statistical approach. Because a significant part of the uncertainty inherent to bridge scour analysis is due to the randomness of the flow series, a probabilistic approach, such as the one here presented, can provide a valuable framework to assess the likelihood that certain scour conditions will be exceeded during the lifetime of the bridge. This work presents a site specific technique that takes into account hydrologic uncertainty associated to randomness of hydrologic conditions and does not include uncertainties associated with other input parameters. To accomplish this goal, a stochastic model is used to generate many replicates of synthetic river flow sequences of the same length as the expected lifetime of the bridge. These series, having the same statistical properties as the available record of streamflow observations, are then used as input data into an empirical scour model (the SRICOS-EFA method is here used as the reference method) that predicts the scour depth versus time over the period of interest, around a bridge pier in cohesive soils and unsteady flow conditions. The final scour depth is that reached at the end of the specified period. Through a Monte Carlo procedure, a large sample of final scour depth values are generated and treated as random variables that are then

used to determine the final scour depth probability distribution.