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Discharge and Strickler coefficient uncertainty propagation in a one-dimensional free surface hydraulic model

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The design of dykes for the protection of nuclear power plants against extreme floods (1.000 years return period flood and more) requires hydraulic simulations (1D or 2D).

A major difficulty is that some uncertainties naturally affect not only the hydrological analysis giving the actual discharge value to simulate (Q), but also the actual values of Strickler friction coefficient (Ks), which is calibrated with real data and extrapolated. Here these uncertainties are both evaluated permitting full-scale uncertainty propagation through the one-dimensional free surface hydraulic model. The selected inputs of the model (Q and Ks) are described through a statistical distribution obtained via data analysis and model fitting. Monte Carlo generation is used to produce statistical sample of inputs values to impose in 1D model. Finally, the flood level uncertainty observed as simulation result is analysed via statistical analysis. Multiple interpretations of the results may be considered according to the probabilistic uncertainty modelling of the combination of aleatory and epistemic hydrological uncertainties. This full sensitivity analysis allows us to rank the relative importance of hydrological versus hydraulic uncertainties. An application to a real case study is given and discussed.