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Uncertainty quantification and global sensitivity analysis with dependent inputs: Application to the 2D hydraulic model of the Loire River

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Hydraulic models are increasingly used to assess the flooding hazard. However, all numerical models are affected by uncertainties, related to model parameters, which can be quantified through Uncertainty Quantification (UQ) and Global Sensitivity Analysis (GSA). In traditional methods of UQ and GSA, the input parameters of the numerical models are considered to be independent which is actually rarely the case. The objective of this work is to proceed with UQ and GSA methods considering dependent inputs and comparing different methodologies. At our knowledge, there is no such application in the field of 2D hydraulic modelling.

At first the uncertain parameters of the hydraulic model are classified in groups of dependent parameters. Within this aim, it is then necessary to define the copulas that better represent these groups. Finally UQ and GSA based on copulas are performed. The proposed methodology is applied to the large scale 2D hydraulic model of the Loire River. However, as the model computation is high time-consuming, we used a meta-model instead of the initial model. We compared the results coming from the traditional methods of UQ and GSA (*i.e.* without taking into account the dependencies between inputs) and the ones coming from the new methods based on copulas. The results show that the dependence between inputs should not always be neglected in UQ and GSA.