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# Preliminary stochastic investigations of pore water induced loss of host rock integrity in radioactive waste disposal

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Numerical studies on integrity of the geological barriers in heat generating radioactive waste disposal remain a challenging topic involving modelling of thermal, hydraulic and mechanical (THM) processes within complex geometries, as well as particularly long simulation time intervals . Due to this, unfeasible computational complexity emerges for many three-dimensional problems, resulting in the need of further model assumptions and simplification for many types of simulation. To make use of results of such simulations reliably as a tool in the decision-making process, uncertainties introduced by the modelling have to be addressed in the framework of safety assessment.

Consequently, the system describing partial differential equations are dependent on a set of parameters, each parameter possibly subject to uncertainty resulting from reduced knowledge or imprecise measurement. The treatment of uncertainties introduces additional dimensions into the physical system, resulting in a dramatic increase of computational complexity for each parameter considered uncertain.

For general applicability, the method chosen for uncertainty quantification should be problem-independent, i.e. an arbitrary set of stochastic input data is propagated through the physical system, while the output is again a freely selectable quantity of interest. To this end, sampling-based methods like Monte-Carlo methods and stochastic collocation seem to be favourable.

Since a full stochastic model is never computable, it is amenable to include only the most sensitive parameters into stochastic analyses, retaining all other parameters as deterministic, in order to spend available computational power efficiently. With aim of finding such a suitable set of stochastic parameters, preliminary studies of simplified two-dimensional models with less complex geometries and a less complex TH-process seem to be appropriate.

In this contribution, a simplified two-dimensional model of a radioactive waste disposal in clayey rock is proposed, as a starting point, and its results of the thermal induced increase in pore water pressure is compared with more sophisticated and established models for a set of deterministic input parameters. It will be demonstrated that the simplified two-dimensional model is suitable for first stochastic investigation of pore water induced tensile or shear failure.

Subsequently, the results of different stochastic simulations for this model are presented, giving

rise to a better understanding of stochastic modelling as well as stochastic post-processing in discretized problems for computational safety assessment of radioactive waste disposal. In detail, sensitivity of the quantity of interest to changes in the input parameters can be studied and in addition, worst-case scenarios within the parameter interval can be found. Given known probability density functions for each input parameter, probability of occurrence of each scenario as well as expected values and variances can be calculated.