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## DoE-based history matching for probabilistic integrity analysis – a case study of the FE-experiment at Mt. Terri

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For the performance assessment of nuclear waste repositories, a thorough analysis of the uncertainty and sensitivity of the underlying processes is necessary. Whereas a detailed experimental investigation of the final repository site is infeasible due to numerous reasons, the verification and validation of the numerical tools under realistic conditions using experimental data of underground research laboratories are all the more important.

One of such experiment is the FE-experiment at the URL site in Mt. Terri - a full-scale multiple heater test in the Opalinus clay in Switzerland which simulates “as realistically as possible, the construction, waste emplacement, backfilling and early post-closure evolution of a spent fuel/vitrified high-level waste disposal tunnel according to the Swiss repository concept.” [H. Müller et al. 2017]

In our contribution, we present an application of design-of-experiment-based history matching as an approach to reduce and investigate parameter uncertainties in finite-element models for repositories of high-level radioactive waste [Buchwald 2020]. We combine experimental data from the FE-experiment at the Mt. Terri site in Switzerland with thermo-hydro-mechanical modeling using the open-source package OpenGeoSys. The parameter space was reduced by an initial parameter screening to find heavy hitters and an experiment-matching procedure using Monte-Carlo sampling on a Gaussian proxy model to fit modeling responses. The resulting parameter bounds were used in a subsequent uncertainty quantification and global sensitivity analysis based on the proxy model demonstrating the impact of parameter sensitivities.

### Participation

In-Person

### References

- Müller, H. R., Garitte, B., Vogt, T., Köhler, S., Sakaki, T., Weber, H., ... & Vietor, T. (2018). Implementation of the full-scale emplacement (FE) experiment at the Mont Terri rock laboratory. In Mont Terri rock laboratory, 20 years (pp. 289-308). Birkhäuser, Cham.
- Buchwald, J., Chaudhry, A. A., Yoshioka, K., Kolditz, O., Attinger, S., & Nagel, T. (2020). DoE-based history matching for probabilistic uncertainty quantification of thermo-hydro-mechanical processes around heat sources in clay rocks. *International Journal of Rock Mechanics and Mining Sciences*, 134, 104481.

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**Primary author:** Dr BUCHWALD, Jörg (Helmholtz Centre for Environmental Research - UFZ)

**Co-authors:** Dr KAISER, Sonja (TU Bergakademie Freiberg); Dr WANG, Wenqing (Helmholtz Centre for Environmental Research - UFZ); Prof. KOLDITZ, Olaf (Helmholtz Centre for Environmental Research - UFZ); Prof. NAGEL, Thomas (TU Bergakademie Freiberg)

**Presenter:** Dr BUCHWALD, Jörg (Helmholtz Centre for Environmental Research - UFZ)

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