High-resolution Characterization of the Induced Fracture Network Around Galleries in the Callovo- Oxfordian Clay using Discrete Fracture Network Inversion

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High-resolution characterization of the induced fracture network around galleries in the Callovo-Oxfordian Clay using discrete fracture network inversion

ANDRA French national radioactive waste management agency

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Ralf Brauchler[1*], Mohammadreza Jalali[1], Rémi de la Vaissière[2], Médéric Piedevache[3], Axayacatl Maqueda[1], Sacha Reinhardt[1]

1. Context and objectives

The Meuse / Haute Marne Underground Research Laboratory (URL) provides the location for an experiment designed to investigate the induced fracture network around open or sealed drifts.

- One of the aims of this experiment, called the OHZ-experiment, is to study the hydraulic properties of the induced fracture network in order to improve and validate the conceptual model of the fracture network as a function of the stress field.
- In the context of this experiment, many gas permeability tests were performed between nine closely spaced wells.

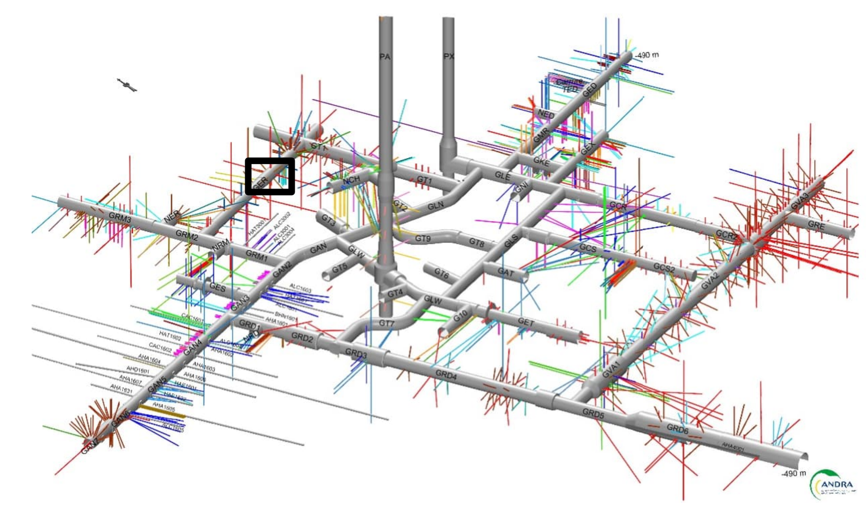


Figure 1: The Meuse / Haute Marne Underground Research Laboratory (de la Vaissière et al., 2015, J. Hydrol)

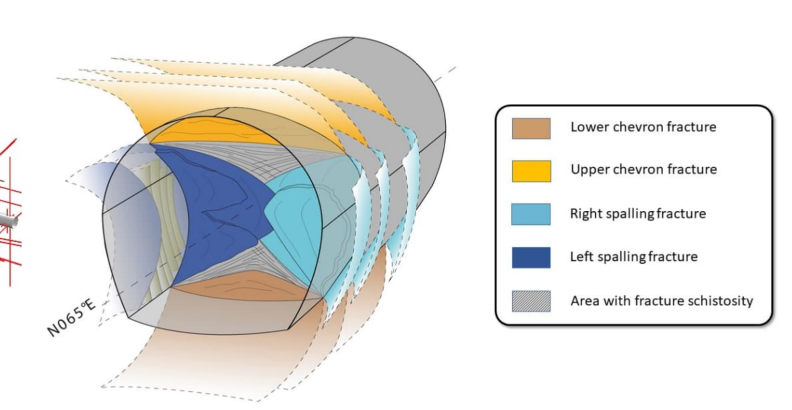


Figure 2: Conceptual model of the induced fracture network parallel to the horizontal minor stress direction (de la Vaissière et al., 2015, J. Hydrol)

2. Experiment

Figure 3: Photograph of the tested boreholes

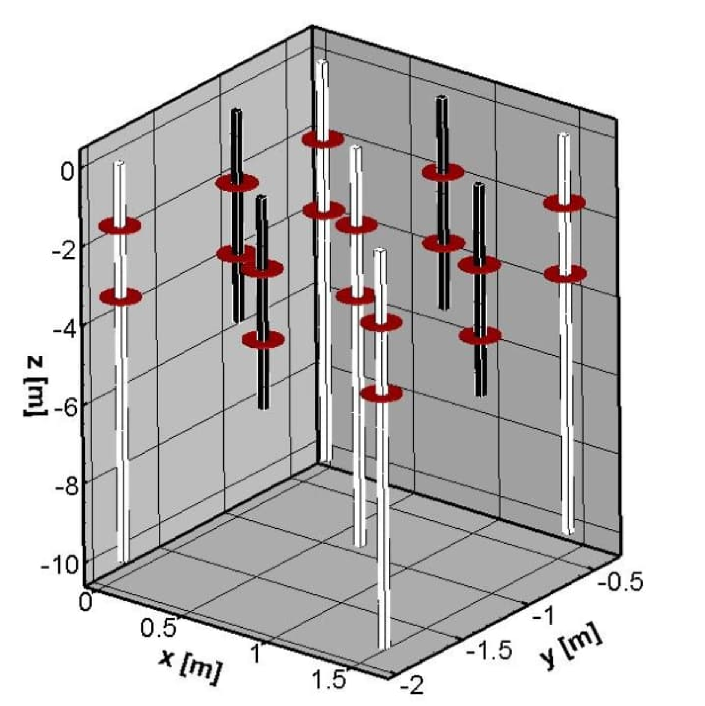


Figure 4: Relative position of the boreholes. The red discs indicate the interval midpoints

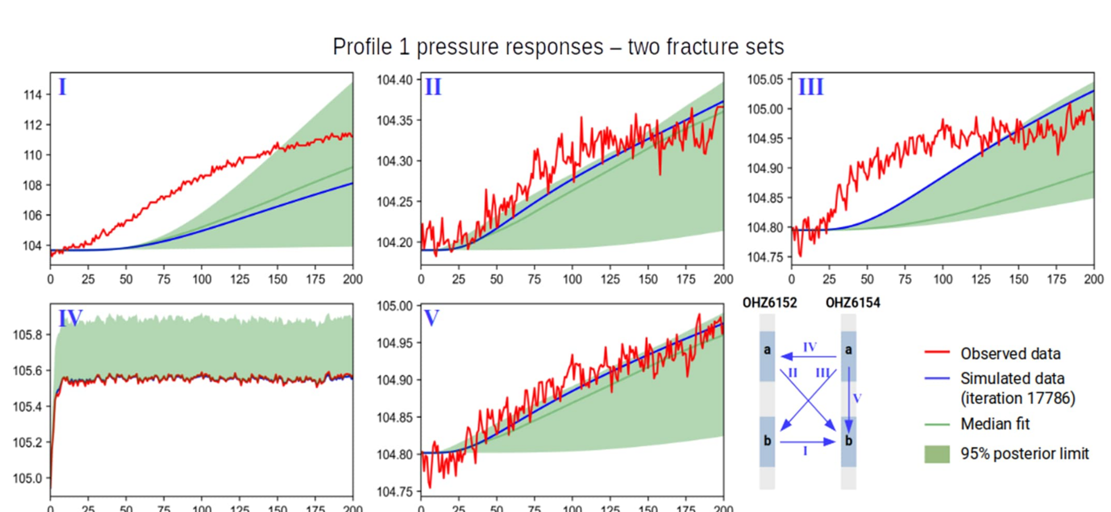


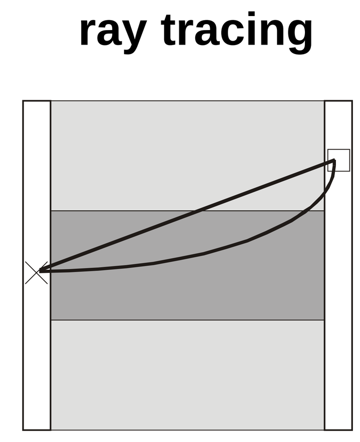
Figure 5: Example for measured and simulated interferences

3. Deterministic Inversion

line integral (geophysical travel time tomography):

$$t = \int_{x_1}^{x_2} \frac{ds}{v(s)}$$

eikonal solver + ray tracing



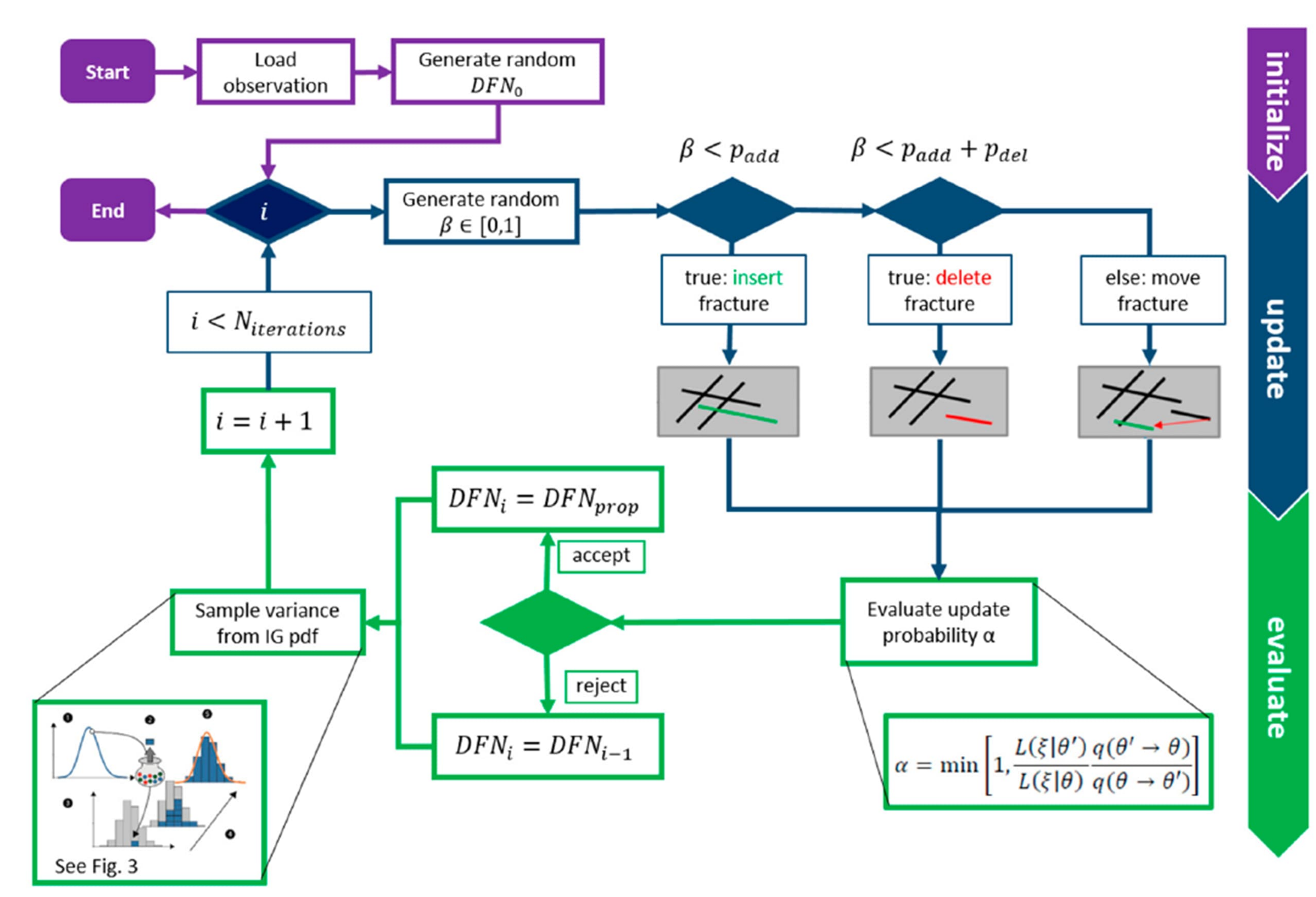
line integral (hydraulic travel time tomography):

$$\sqrt{t_{peak}(x_2)} = \frac{1}{\sqrt{6}} \int_{x_1}^{x_2} \frac{ds}{\sqrt{D(s)}} \qquad \sqrt{t_{\alpha,d}} = \frac{1}{\sqrt{6 f_{\alpha,d}}} \int_{x_1}^{x_2} \frac{ds}{\sqrt{D(s)}}$$

Vasco et al., 2000, WRR

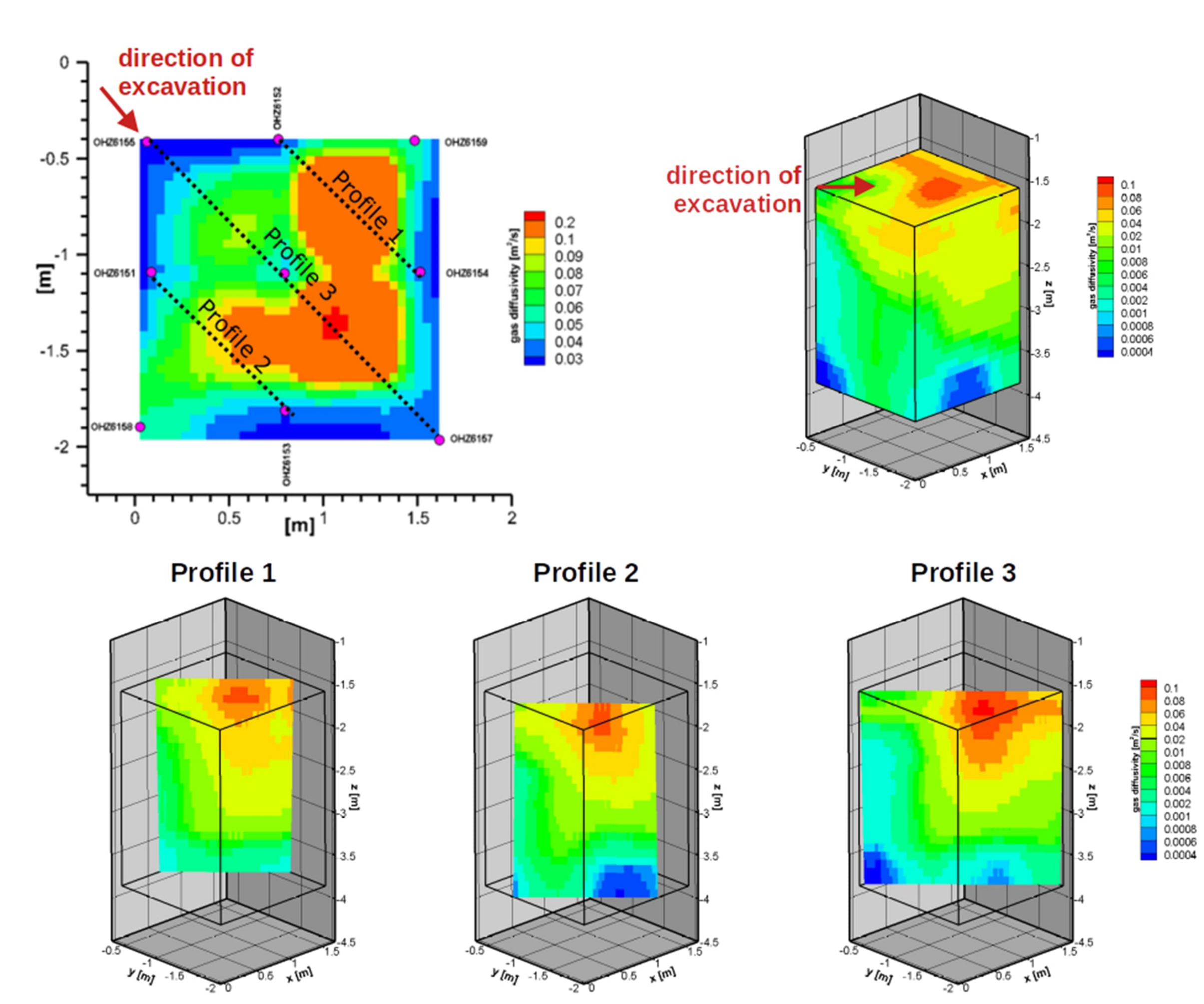
Brauchler et al., 2003, WRR

4. Stochastic DFN Inversion

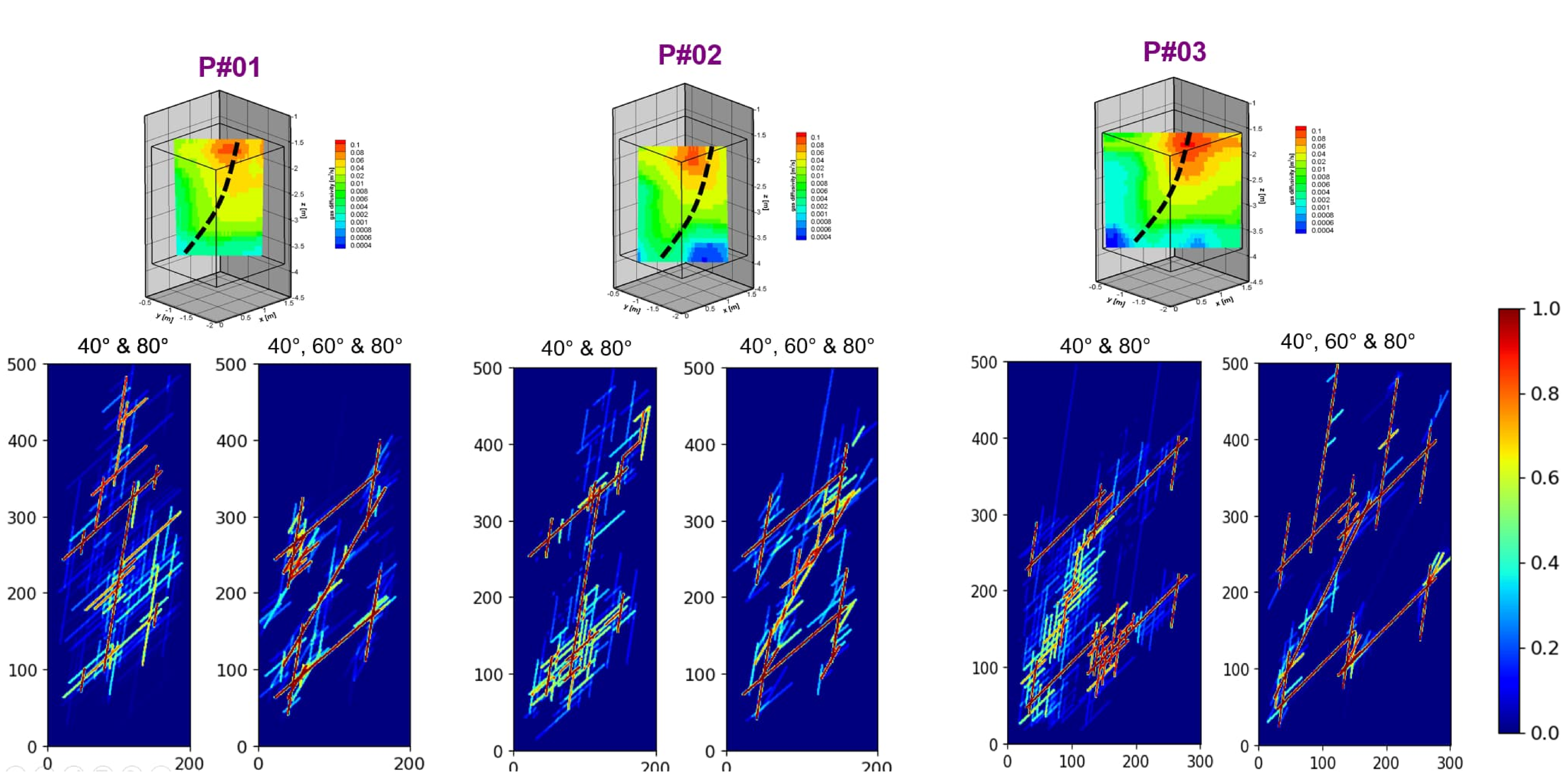


Ringel et al., 2019, Geosciences

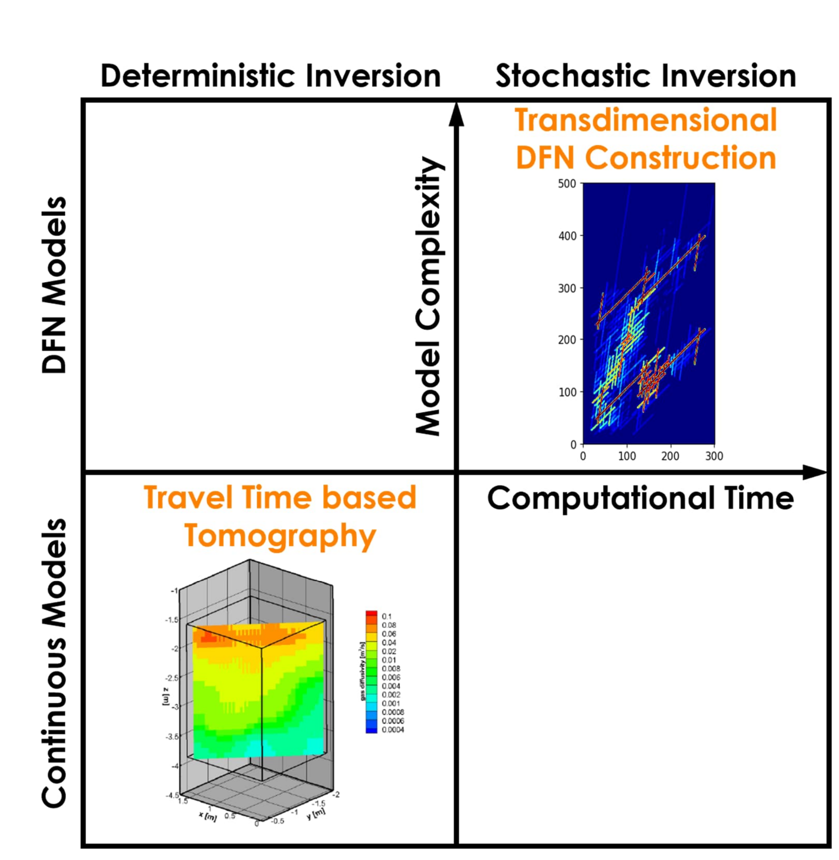
5. Deterministic results



6. Stochastic results



7. Conclusions



6. References

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[1]AFRY Switzerland Ltd, Herostrasse 12, 8048 Zurich, Switzerland

[2]Andra, Direction Recherche & Développement, Service Mécanique des Fluides et des Solides, Route Départementale 960, 55290 Bure, France

[3]Solexperts SA, Technopôle Nancy-Brabois10, allée de la forêt de la Reine 54500 Vandoeuvre les Nancy

IGD-TP Symposium on the Role of Optimisation in Radioactive Waste Geological Disposal Programme, Zurich, September 20-22, 2022