Swiss Centre of Competence
for Deep Geothermal Energy
for power and heat production

Seismic Risk Mitigation for the Haute-Sorne EGS pilot project

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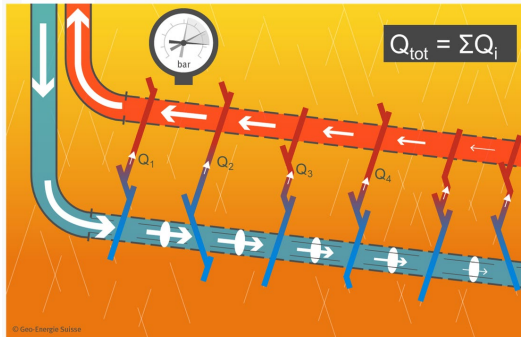
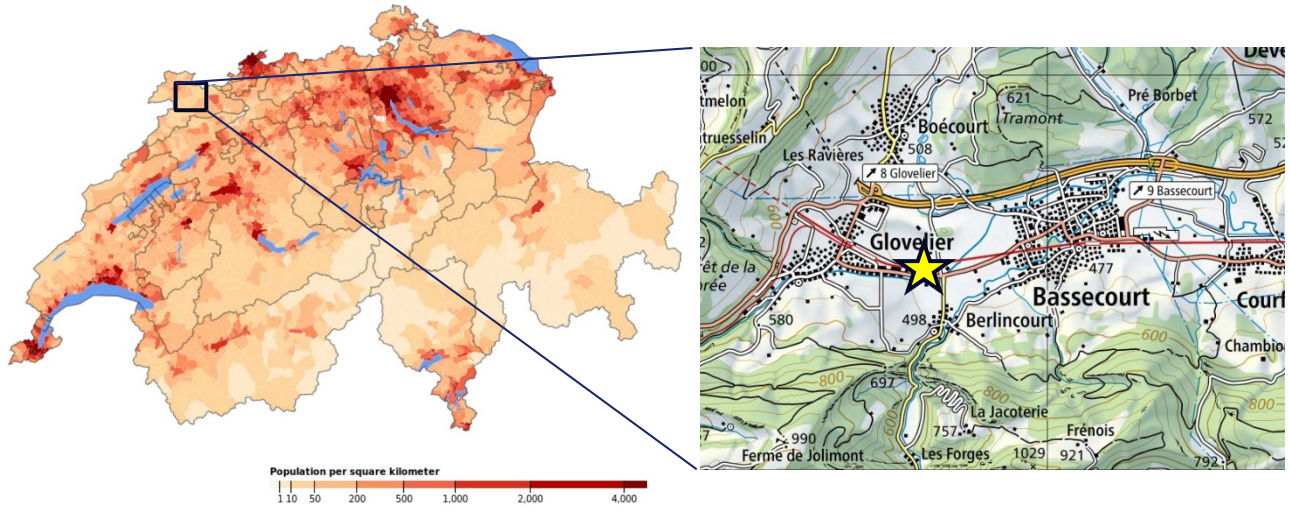
19.03.2025

The Haute-Sorne project

- Geothermal EGS project (multi-stage)
- 5 MW electric
- 2012 location decision and start of project development
- 2023 2D seismic
- 2024 drilling of the first well to 4km depth & 3D seismic
- 2025 stimulation test





Source: The Federal Statistical Office

Introduction

The history of geothermal in Switzerland and the need for state of the art risk analysis & mitigation

- Two deep geothermal projects at depths >4km
- Basel, 2006, petrothermal, Mw=3.2 stopped
- St. Gallen, 2013, hydrothermal, Mw=3.5 stopped
- significantly contributed to a better understanding of subsurface stimulation processes and associated risks
- also showed that a careful risk assessment beforehand and refined concepts to mitigate risks are necessary

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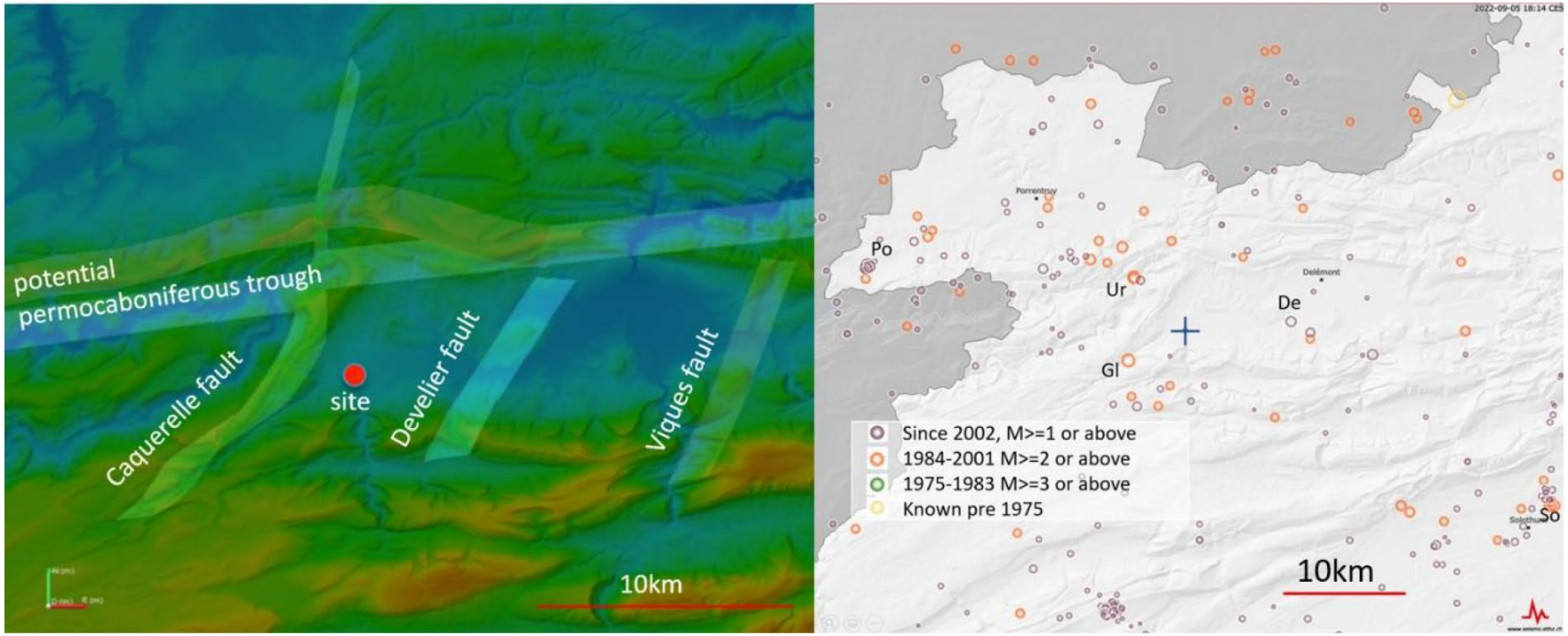
Risk assessment

- Faults and earthquake history



- Know where your (active) faults are
- Avoid large faults!
- Not all faults are problematic (slip tendency analysis, coulomb stress modeling)

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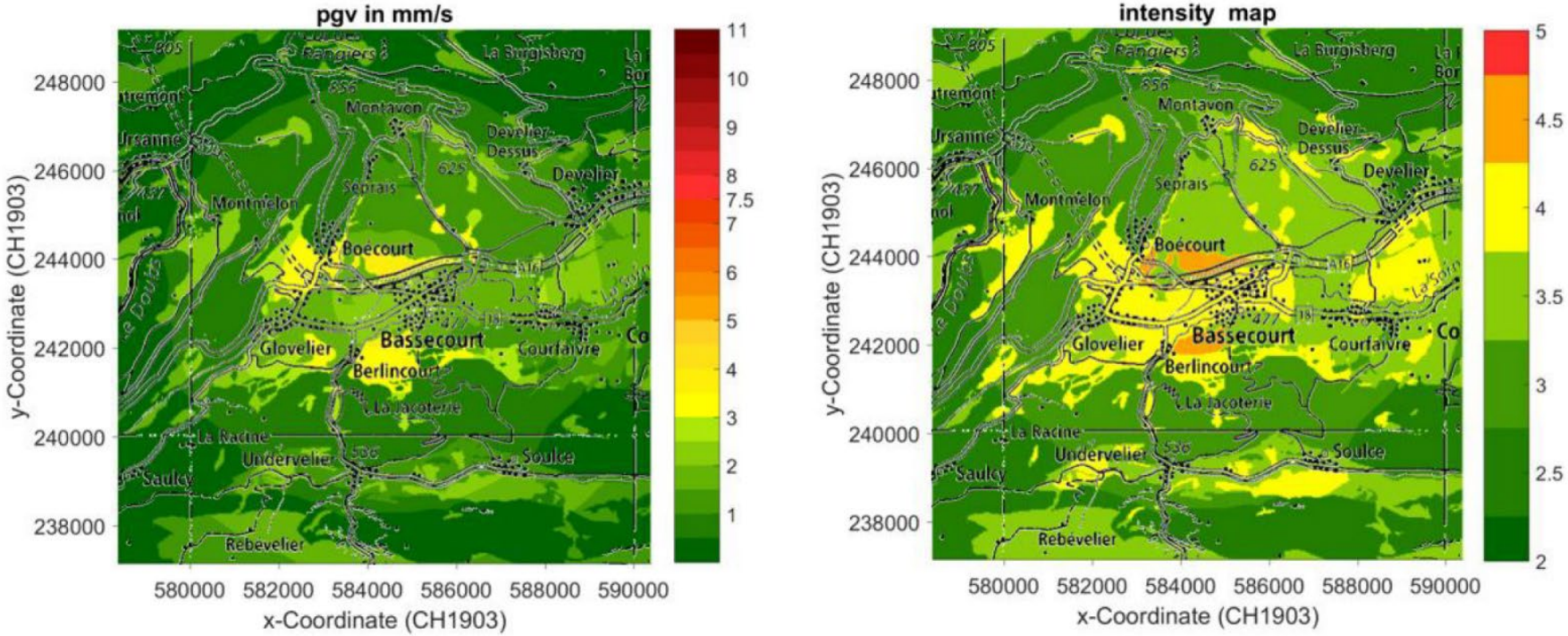
risk assessment – deterministic scenarios - TLS

- Earthquake scenarios – what groundmotion is acceptable?



- Vibration norm DIN 4150-3 or Swiss structure norms 260ff give a measure of acceptable ground motion
- Design your traffic light thresholds accordingly

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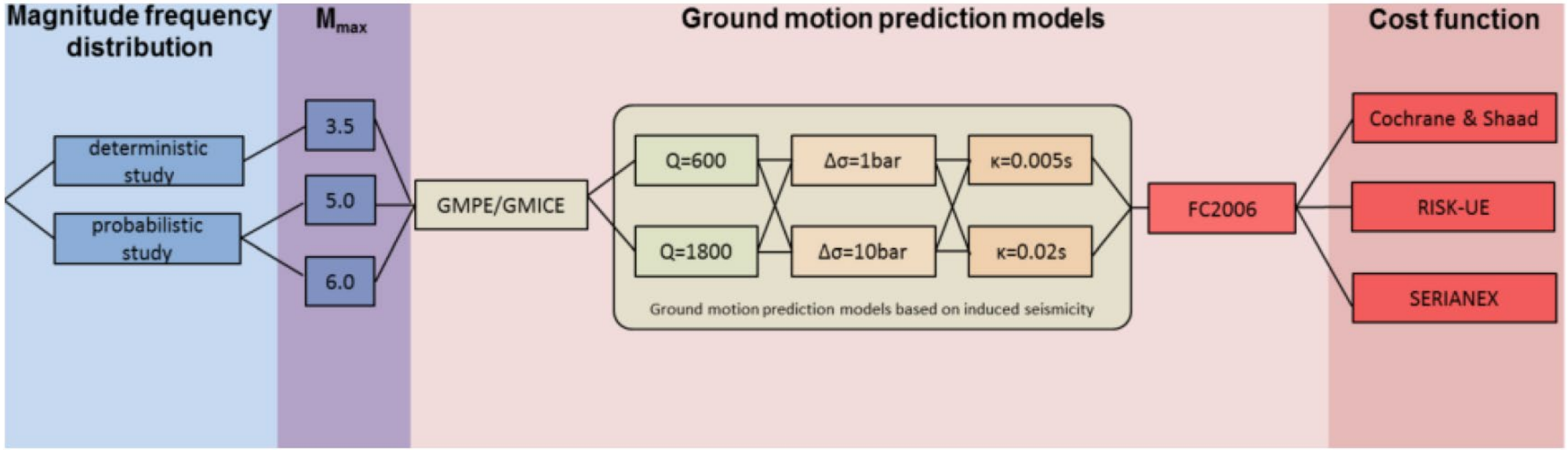
Risk assessment – probabilistic risk

- Risk tree



- 72 branches
- Calculations for damage, injuries & fatalities

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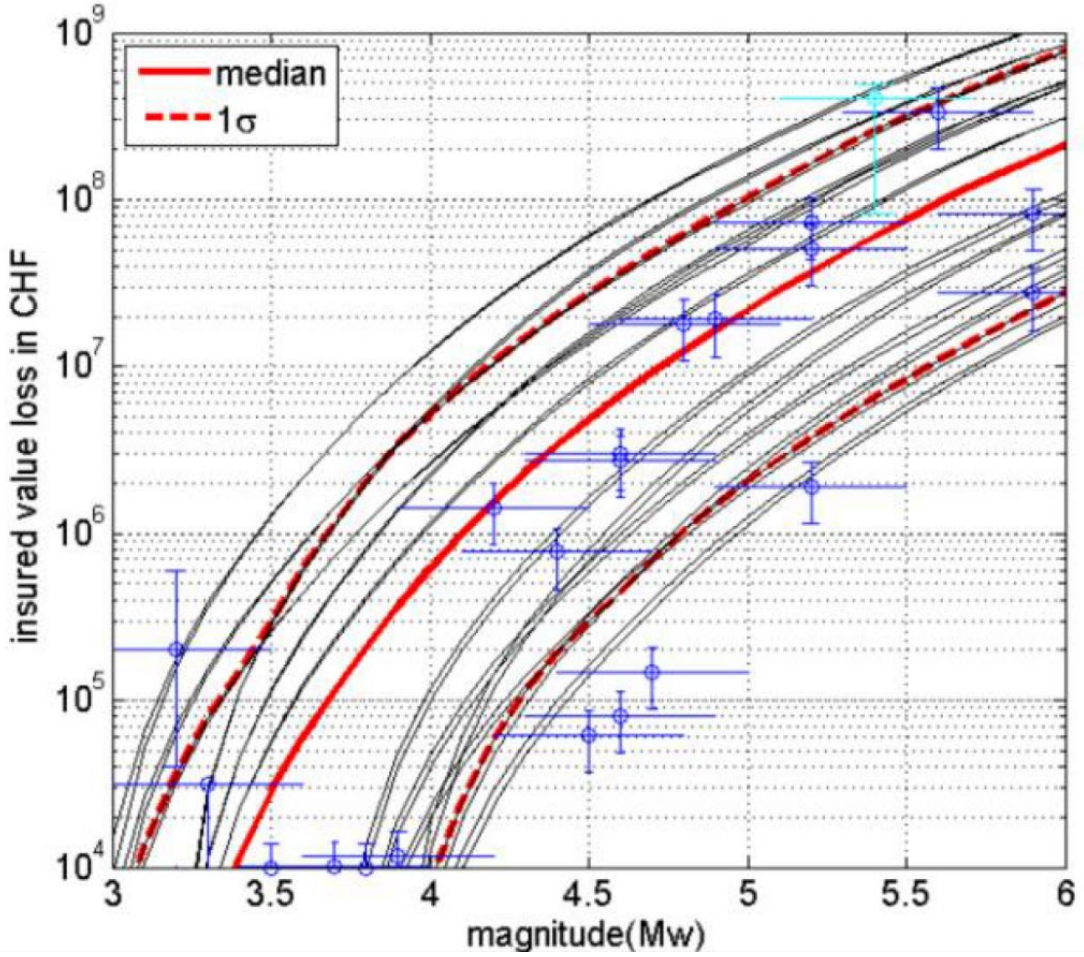
Risk assessment – validation

- Validation with published data from re-insurances



- Good agreement with reality

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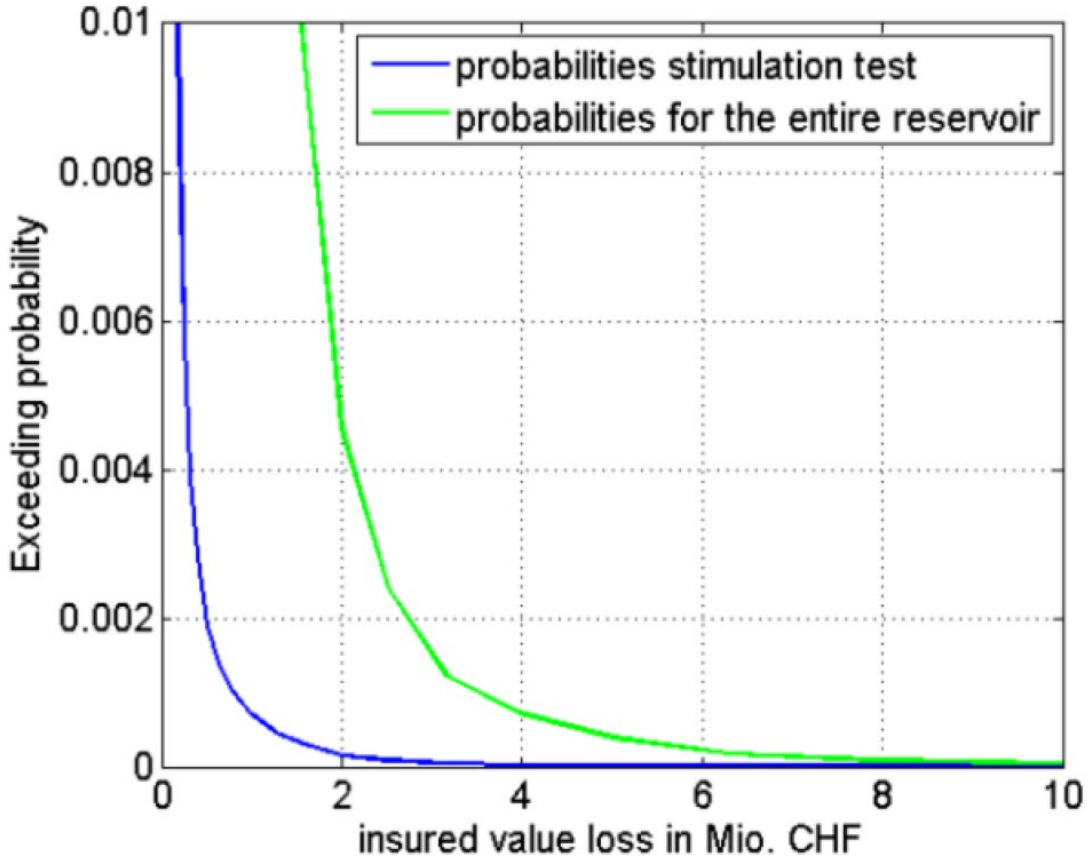
Risk assessment – probabilistic risk

- Coupling earthquake scenarios with probabilities



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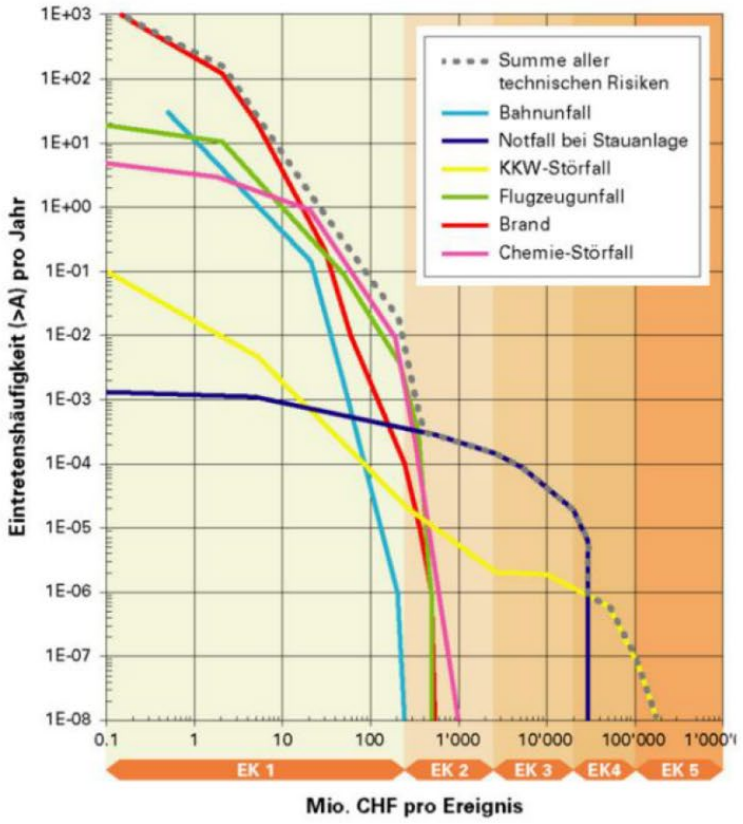
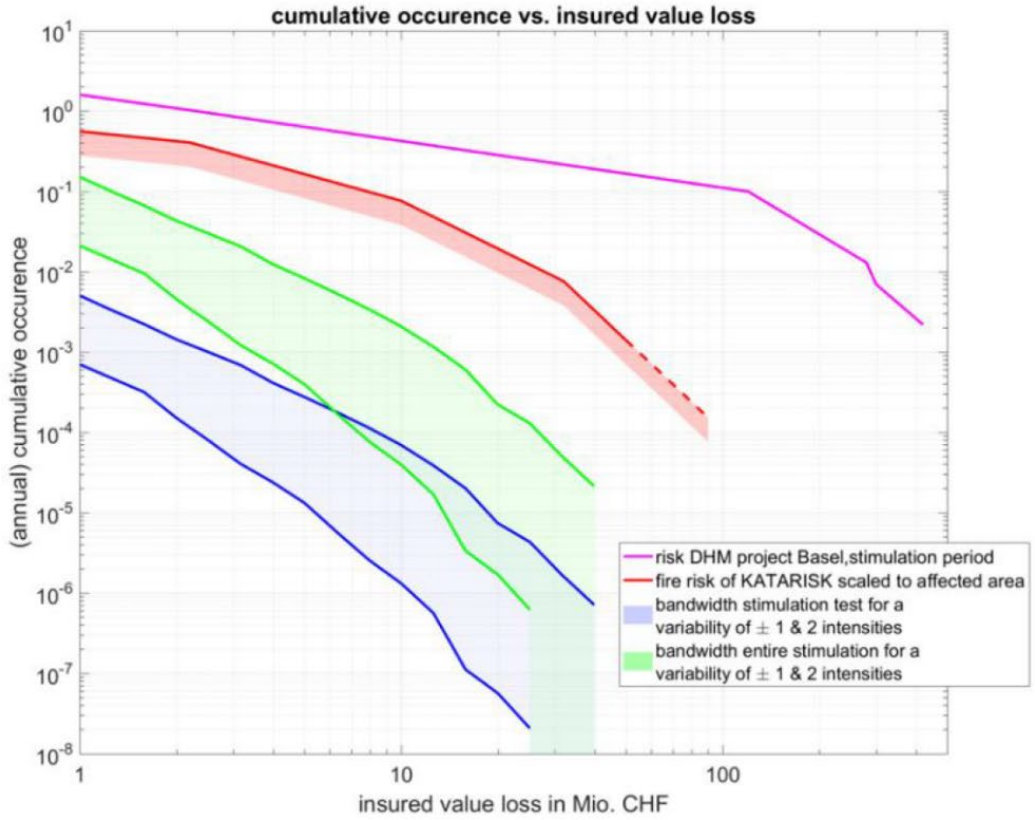
Risk assessment – probabilistic risk

- What risk is acceptable?





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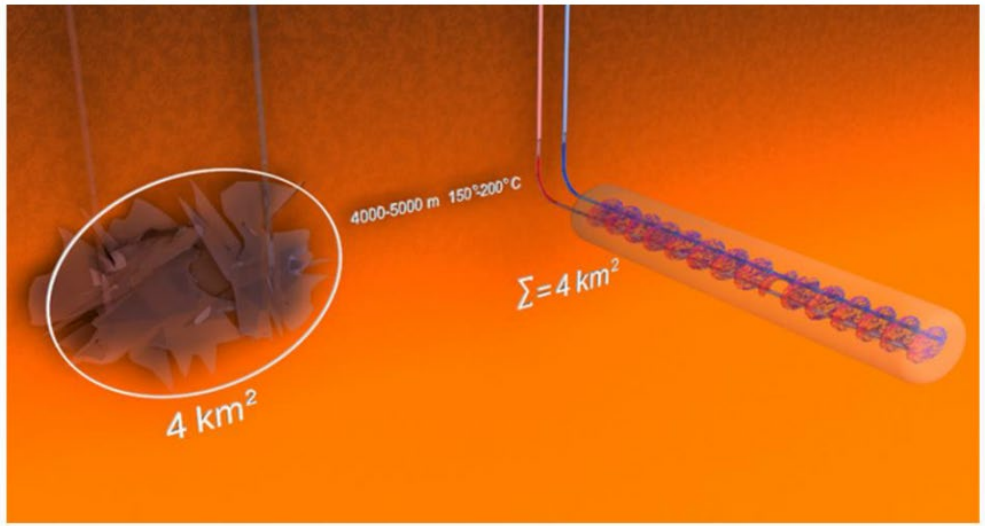
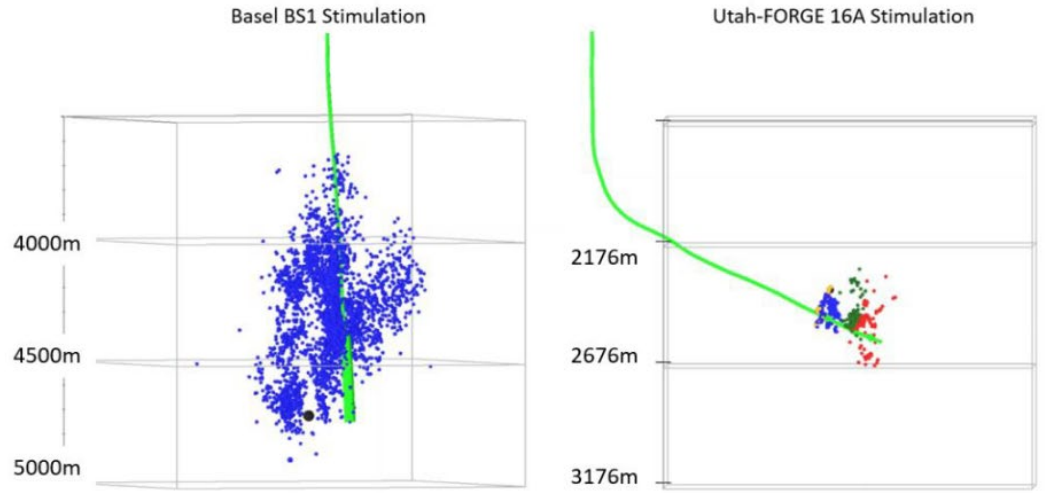
Mitigation measures

- split the required area for an underground heat exchanger into many smaller engineered segments at a safe distance from larger faults.





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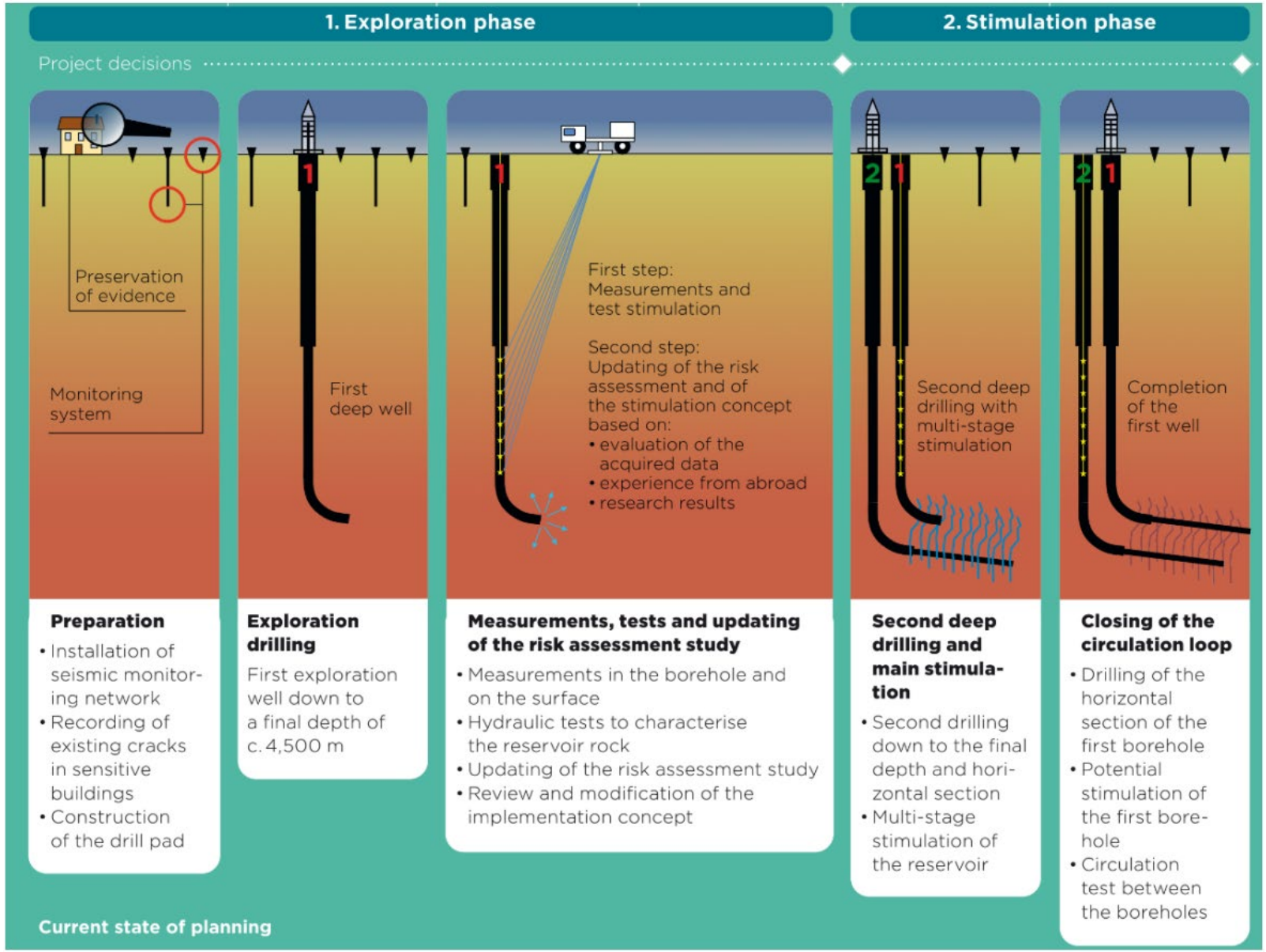
Mitigation measure – stepwise realization process



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Further mitigation measures

- 2D, 3D seismic, VSP, ambient noise methods
- monitoring network
- Stimulation test
- Traffic light system (TLS)
- Adaptive traffic light system (ATLS)
- Bow-tie
- multidisciplinary team, expert panel
- Fissure protocols

APPROVED

INSURED

- Stimulation test May 2025
- Update of risk study

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