






Numerical modelling of CO₂ storage in sandstone reservoirs below the German North Sea Sector – Part 2

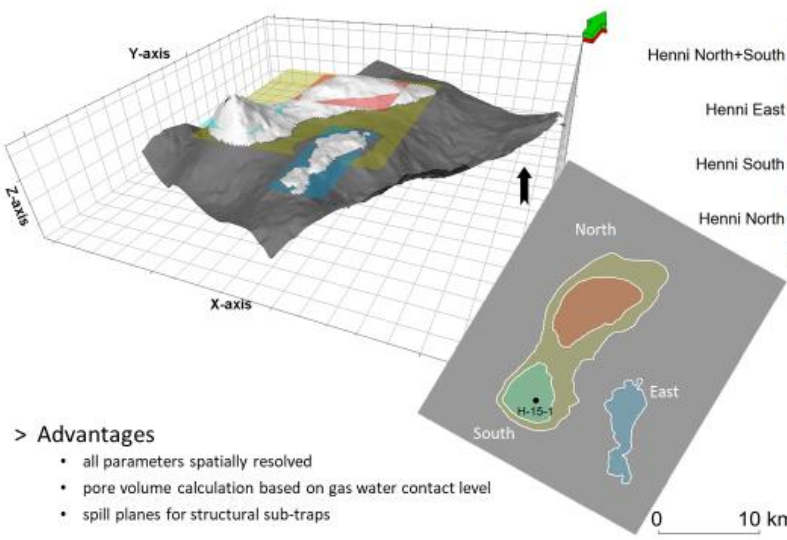
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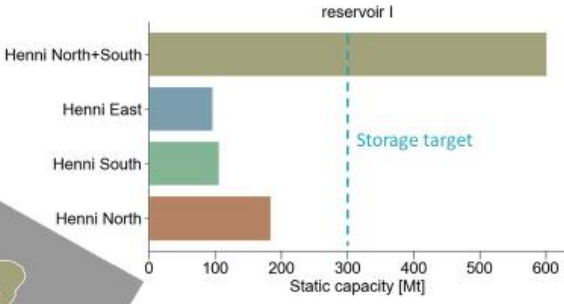





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Static capacity estimation from the reservoir model as a basis for injection scheme development





Sub-site	Static capacity [Mt]
Henni North+South	~580
Henni East	~100
Henni South	~120
Henni North	~180
Storage target	300

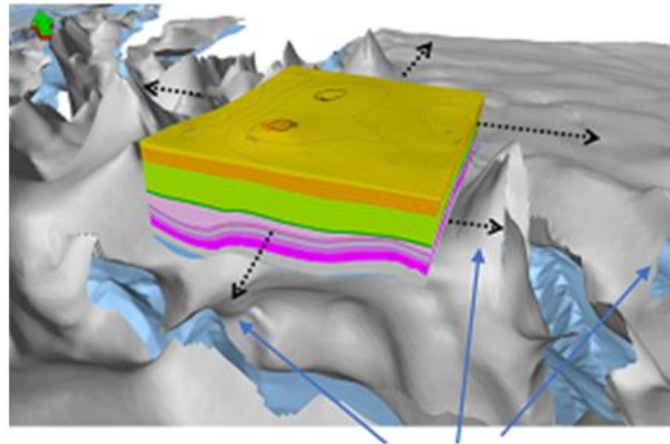
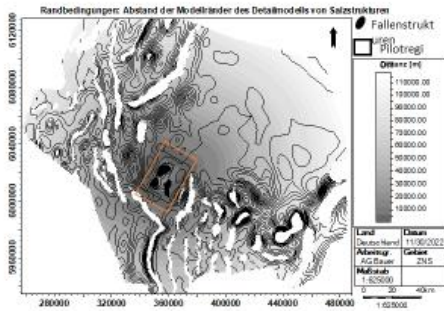
$M_{CO_2} = \rho_{CO_2}(P_{res}, T_{res}) V_{trap} n(z) \epsilon_{efficiency}$

> Advantages

- all parameters spatially resolved
- pore volume calculation based on gas water contact level
- spill planes for structural sub-traps

- Injection in at least two sub-sites required
- Henni N & S used

Dynamic reservoir model development



Hydraulic barriers in storage formation

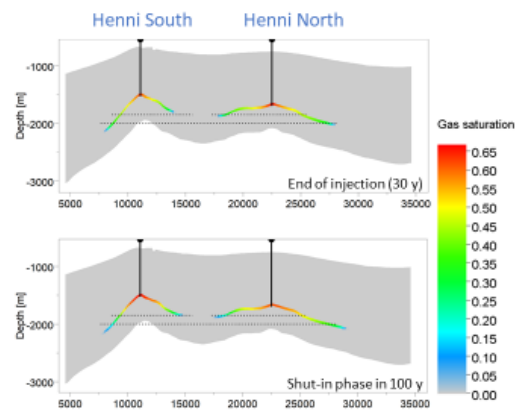
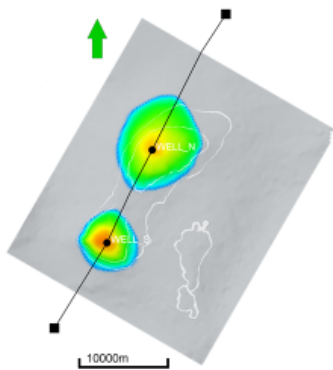
Fluid flow boundary conditions account for the large scale geological setting outside of model area

- Estimation of storage pressure response
- Large scale fluid migration

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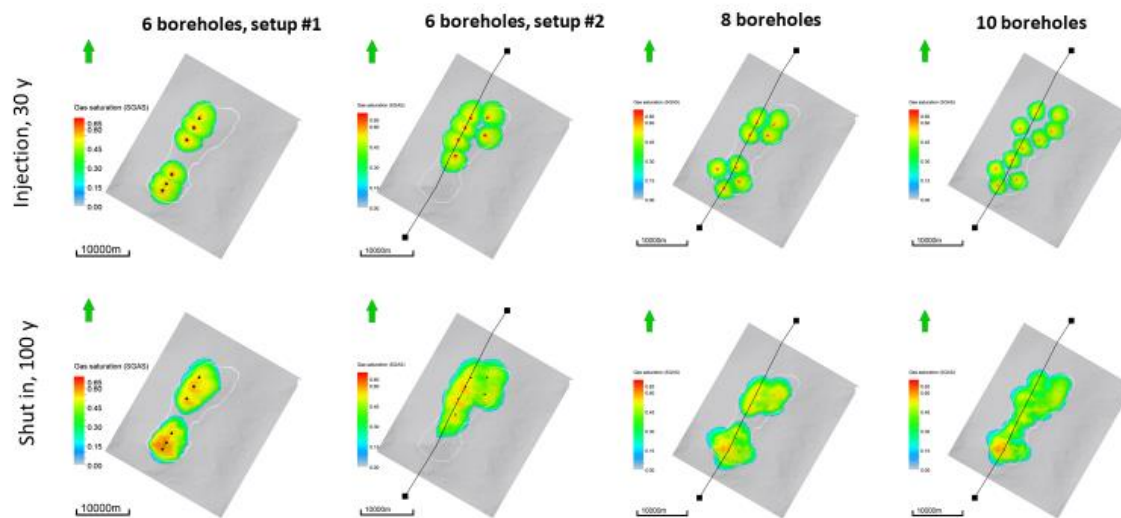
Preliminary dynamic reservoir simulation results

- Injection of 10 MT CO₂ per year for 30 years in Middle Buntsandstein formation using 2 boreholes



- Unreasonable well flow rates
- Overpressure limit violations
- Target injection rate not achieved
- Storage target of 300 MT not achieved

Preliminary reservoir simulation results



Preliminary reservoir simulation results



Findings:

- Significant overpressure due to well superposition
- Missing of injection target due to borehole rate limitations
- Target rate and storage target can be achieved by increasing borehole number and/or borehole spacing and/or screen depths
- Long term CO₂ movement after injection ends
- Interplay of storage safety and storage efficiency due to storage processes triggered

Next steps in second project year:

- Updated reservoir model site A from BGR
- Derivation of accurate pressure limitations for site A
- Identification of rate limitations and deduction of optimal injection schemes for site A
- Quantification of large-scale and long-term hydraulic effects for site A