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Quantifying induced effects of subsurface renewable energy storage

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New methods and technologies for energy storage are required for the transition to renewable energy sources. Subsurface energy storage systems such as salt caverns or porous formations offer the possibility of hosting large amounts of energy or substance. When employing these systems, an adequate system and process understanding is required in order to assess the feasibility of the individual storage option at the respective site and to predict the complex and interacting effects induced. This understanding is the basis for assessing the potential as well as the risks connected with a sustainable usage of these storage options, especially when considering possible mutual influences.

For achieving this aim, in this work synthetic scenarios for the use of the geological underground as an energy storage system are developed and parameterized. The scenarios are designed to represent typical conditions in North Germany. The types of subsurface use investigated here include gas storage and heat storage in porous formations. The scenarios are numerically simulated and interpreted with regard to risk analysis and effect forecasting. For this, the numerical simulators Eclipse and OpenGeoSys are used. The latter is enhanced to include the required coupled hydraulic, thermal, geomechanical and geochemical processes. Using the simulated and interpreted scenarios, the induced effects are quantified individually and monitoring concepts for observing these effects are derived.

This presentation will detail the general investigation concept used and analyze the parameter availability for this type of model applications. Then the process implementation and numerical methods required and applied for simulating the induced effects of subsurface storage are detailed and explained. Application examples show the developed methods and quantify induced effects and storage sizes for the typical settings parameterized.

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