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Green field exploration in the NE German basin: A case study from the Beeskow-Birkholz anticline

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In the frame of green field exploration a 3D structural-geological model of the NW striking Beeskow-Birkholz anticline in the Northeast German Basin is developed to better understand the location of fault zones and to quantify volumes of potential reservoir rocks. The focus is on formations of the Middle Bunter (Lower Triassic), which could be used as combined reservoir for CO_2 injection and geothermal production. Injection into the Lower Triassic could induce brine migration from the saline aquifers into freshwater aquifers. The 3D structural-geological model is the basis for dynamic models and geomechanical fault stress models to simulate scenarios following the injection of CO_2 or water at different locations at the anticline.
The exploration of the Middle Bunter is planned in iterative steps: First, a preliminary model ranging from the Carboniferous basement to the Quaternary is developed based on existing isobath charts and isopach maps from the geological atlas Brandenburg. In addition, high resolution data from the Cenozoic have been available. The model includes the main 15 stratigraphic units of the NE German Basin. The stratigraphic standard section of the Birkholz anticline has been used as reference to generate a realistic thickness distribution of geological units. Well log data of four boreholes from the study area helped to calibrate the model. The preliminary 3D model includes the NW striking Guben-Fuerstenwalde fault zone and the NW striking Lausitzer Abbruch (fault zone) in a simplified configuration as four discrete fault planes. The Volpriehausen (thickness 80m), Detfurth (thickness 60m) and Hardegsen (thickness 40m) formation of the Middle Bunter are the potential reservoir formations. Their effective thickness is much smaller. The lithology of the Middle Bunter consists of a basal sandstone with an alternating sequence of mudstones and silty-sandy sections. Since no boreholes with core material are available from the region, analog outcrops have been selected based on facies maps. This represents the second step of the green field exploration. Eight outcrops are sampled to determine porosity, permeability and geomechanical parameters, which will be used for coupled reservoir models and fault stress models. In a third step, 11 existing 2D seismic sections are re-interpreted to refine the preliminary 3D geological model. This process is still ongoing. Whereas the preliminary 3D model visualizes the regional geological constraints, the refined 3D geological model will better quantify the fault pattern affected by the anticline caused by halokinesis. Finally, two models in different scales are planned - a regional model with a size of 42x42km and a core model 15x20 km in size. Both models will have a vertical thickness of 3.5 km.