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3D basin and petroleum system modelling in the North Sea Central Graben - a Dutch, German, Danish cross-border study

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A Geological Analysis and Resource Assessment of selected Hydrocarbon Systems (GARAH) is carried out as part of the overarching GeoERA project. Here, we report results on the first public 3D basin and petroleum system model developed in a cross-border area of the Dutch, Danish and German North Sea Central Graben. This pilot study reconstructs the thermal history, maturity and petroleum generation of potential Lower, Middle and Upper Jurassic source rocks and assesses potential unconventional resources in a first phase. The 3D pilot study incorporates new aggregated and combined layers of the three countries. Results of the study feed back into the 3DGEO-EU project of GeoERA.

Eight key horizons covering the whole German Central Graben and parts of the Dutch and Danish North Sea Central Graben were selected for building the stratigraphic and geological framework of the 3D basin and petroleum system model. The model includes depth and thickness maps of important stratigraphic units as well as the main salt structures. Petrophysical parameters, generalized facies information and organic geochemical data from well reports are assigned to the different key geological layers. Further, the model is calibrated with temperature and maturity data from selected offshore wells as well as from publications. The time span from the Late Permian to the Present is represented by the model, including the most important erosional phases related to large-scale tectonic events during the Late Jurassic to Late Cretaceous. Additionally, salt movement through time expressed as diapirs and pillows is considered within the 3D basin and petroleum system model. Simulations depict that unconventional petroleum resources (oil and natural gas) are present in varying amounts in the source rocks across all three countries.

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