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A 3D Geological Model of the North German Basin

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The deep subsurface in Germany is receiving increased attention as a valuable commodity, not least due to discussions on new technologies such as carbon dioxide capture and storage, storage of renewable energy (e.g. compressed air or hydrogen), and an increasing demand for geothermal energy. Today's options related to production and storage of conventional as well as renewable energy involve potential conflicts of use and necessarily stimulate the discussion on the need of a subsurface planning policy. This growing focus on the deep subsurface raises the need for more detailed and up-to-date geological information, also in 3D.

In Germany, the responsibility for geoscientific issues on the subsurface, including e.g. the compilation of basic geological information, is a matter of the federal states and their state geological survey organisations. The Federal Institute for Geosciences and Natural Resources (BGR), however, is an institution advising the German Federal Government. The German state geologic survey organisations (GSOs) and BGR cooperate on issues spanning beyond the federal state level.

Geology is inherently a 3-dimensional issue and today's computing technology allows the development of large scale 3D geological models. Several German federal states have already developed regional 3D geological models of their area of responsibility (infogeo.de). However, harmonised basin-scale 3D geological models beyond the federal state level are still sparse in Germany and only available for the Upper Rhine Graben (geopotenziale.org) and Molasse Basin (geomol.eu).

In 2014, BGR and the GSOs of the north German federal states started the project "Subsurface Potentials for Storage and Economic Use in the North German Basin (TUNB)". The primary intention is the construction of a consistent and harmonised 3D model of the entire North German Basin (NGB) consisting of 13 model horizons (Permian to Tertiary level), within a period of six years. The GSOs of the north German federal states construct 3D geological models of their areas of responsibility as components for the NGB 3D model. BGR constructs the 3D model of the exclusive economic zone in the German North Sea sector. All models will be harmonised across national and as far as possible across international borders (Netherlands, Denmark, and Poland). BGR coordinates all efforts and will finally merge the individual regional models into one basin-scale, consistent and harmonised model of the entire NGB.

Existing atlases for the western and eastern part of the NGB, previously existing regional 3D models, and exploration data are the basic information available for the construction of the NGB 3D geological model. However, distribution and quality of the exploration data is highly heterogeneous. Moreover, as the atlases and existing regional 3D models are based on e.g. different velocity models and the horizons are based on different interpretation and modelling concepts, inconsistencies occur, particularly along

the boundary of the existing atlases and regional 3D models that need to be revised and extended. In addition, younger exploration data that have not been considered in the existing atlases and models need to be implemented.

The presentation will cover general challenges and approaches of the project. First results and findings include a focus on a pilot region, where five federal states lie in close proximity to each other at the former inner German border, which also marks the boundary between the two atlases. All harmonisation and modelling concepts are tested within this pilot region.