## Regional-scale 3D temperature distribution beneath the northern North Sea and adjacent areas of the continent according to lithosphere-scale 3D thermal modelling

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To understand the regional thermal pattern beneath the northern North Sea and adjacent areas of the Norwegian mainland, a 3D conductive thermal modelling has been performed in the framework of the Crustal Onshore-Offshore Project (COOP project). The lithosphere-scale 3D model has been used as a realistic approximation of the geometries of the sedimentary infill as well as of the underlying crystalline crust and lithospheric mantle during the 3D thermal modelling. Construction of the 3D model has been done by use of recently published/released structural data. Configuration of the 3D structural model has been validated by a 3D density modelling which has been carried out by use of the software IGMAS+ (the Interactive Gravity and Magnetic Application System). Based on the 3D density modeling, the crystalline crust of the study area consists of several layers. The obtained Moho is strongly uplifted beneath the Central and Viking grabens, whereas the lithosphere-asthenosphere boundary is relatively shallow beneath the western part of the model area.

The 3D thermal modelling has been made by using commercial software package COMSOL Multiphysics. For the upper boundary, time-dependent temperature at the Earth's surface and sea bottom has been used. This has been done by considering palaeoclimatic changes during the last 228,000 years. The lithosphere-asthenosphere boundary has been chosen as a lower thermal boundary which corresponds to the 1300 °C isotherm. Results of thermal modelling within the upper part of the 3D model indicate that the mainland is generally colder than the basin areas. This regional trend of temperature is mostly related to the low thermal conductivity of sediments which increases heat storage within the areas covered by thick sedimentary cover. The sediments-realted thermal effect is especially pronounced within the Central and Viking grabens, the East Shetland and Norwegian-Danish basins where the sedimentary cover is thickest. Furthermore, the effect of increased radiogenic heat production within the upper crust is prominent beneath the Horda Platform, where the highest geothermal gradient is modelled within the upper part of the 3D model.