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3D geological modeling of the transboundary basin Berzdof-Radomierzyce in Upper Lusatia (Germany/Poland)

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The accuracy of three-dimensional (3D) models depends on their data density and quality. Regions with a complex geology can be a challenge to model, especially if detailed models are required to support a further economic exploitation of a region. In this research, a 3D model was created based on the region's complicated geological condition.

The focus area, the Berzdorf – Radomierzyce basin, located in Upper Lusatia on the Polish – German border to the south of the city of Görlitz – Zgorzelec, is such a region. The basin is divided by the volcanic threshold into the western part (Berzdorf basin) and its eastern extension (Radomierzyce basin). The connection between both parts is the so called "lignite bridge". The deposit in the Berzdorf has been exploited from 1830 until 1997. In contrast, the Radomierzyce deposit has never been exploited and is still considered as a prospective deposit for the operating Turów coal mine, which is located only around 15 km from the deposit.

To represent the geology of the area a 3D modeling of the transboundary deposit was carried out. Moreover, some strategies to overcome numerical interpolation instability of the geological model with many faults were developed. Due to the large amount of data and its compatibility with other software the 3D geomodeling software Paradigm GOCAD was used. A total number of 10,102 boreholes, 60 cross sections and geological maps converted into digital format – were implemented into the model. The data density of the German part of the area of interest was much higher than the data density of the Polish part.

The results demonstrate a good fit between the modeled surfaces and the real geological conditions. This is particularly evident by matching the modeled surfaces to borehole data and geological cross sections. Furthermore, simplification of the model does not decrease the accuracy and the applied techniques lead to a stable and reliable model. The geological model can be used for planning and full-scale mining operations of its eastern part (Radomierzyce). In addition, the detailed geological model can serve as a basis for the hydrogeological and the heat transfer models of the Berzdorf – Radomierzyce basin, in order to identify points were geothermal energy can be best exploited. It can aid towards improving the planned geothermal installations in the region.