Criteria of fault selection for geomechanical models

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Numerical modelling is an important method in the improvement of the understanding of a variety of geological processes such as the reactivation of faults and seismicity, orogeny or volcanism. Furthermore, it can be crucial for geotechnical activities such as geothermal use of the underground, oil and gas production or the use of dams. Geomechanical models enable stress predictions even in areas without stress data and can therefore greatly contribute to the long-term safety and productivity of underground activities.

As computational power is limited the geology of geomechanical models often needs to be simplified, especially for larger scale models. This is true not only for the resolution of the implemented stratigraphy but also for the implementation of faults as they severely increase the amount of required elements and influence the model stability. Furthermore, the implementation of faults often leads to artifacts and can therefore reduce the accuracy of the model results. Due to these limitations it is frequently necessary to distinguish between faults that are crucial for the model as they influence the stresses in magnitude and orientation on a large scale and faults that will only influence the model on a local scale and may therefore be neglected on a regional perspective. The impact of faults on a geomechanical model depends on various different factors such as geometry and mechanical properties of the fault itself, the tectonic regime or the scale of the model. As the relevance of a fault for a geomechanical model is not necessarily identical to its relevance in other geoscientific fields it can be challenging to identify relevant faults.

The SpannEnD project focuses on the generation of a 3-D geomechanical model of Germany and adjacent areas in the context of the disposal of nuclear waste in order to predict the tectonic stresses in areas without stress data. There is a multitude of faults known in the modelling area but due to their sheer amount not all faults can be incorporated. Criteria have to be found that drastically reduce the number of faults while keeping the change in the geomechanical stress pattern to a minimum. We will present different criteria that can be used for the fault selection which have been worked out in the framework of the SpannEnD project.
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