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Pragmatic geometric model evaluation

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Quantification of subsurface model reliability is mathematically and technically demanding as there are many different sources of uncertainty and some of the factors can be assessed merely in a subjective way. For many practical applications in industry or risk assessment (e. g. geothermal drilling) a quantitative estimation of possible geometric variations in depth unit is preferred over relative numbers because of cost calculations for different scenarios.
The talk gives an overview of several factors that affect the geometry of structural subsurface models that are based upon typical geological survey organization (GSO) data like geological maps, borehole data and conceptually driven construction of subsurface elements (e. g. fault network).
Within the context of the trans-European project “GeoMol” uncertainty analysis has to be very pragmatic also because of different data rights, data policies and modelling software between the project partners. In a case study a two-step evaluation methodology for geometric subsurface model uncertainty is being developed. In a first step several models of the same volume of interest have been calculated by omitting successively more and more input data types (seismic constraints, fault network, outcrop data). The positions of the various horizon surfaces are then compared. The procedure is equivalent to comparing data of various levels of detail and therefore structural complexity. This gives a measure of the structural significance of each data set in space and as a consequence areas of geometric complexity are identified. These areas are usually very data sensitive hence geometric variability in between individual data points in these areas is higher than in areas of low structural complexity. Instead of calculating a multitude of different models by varying some input data or parameters as it is done by Monte-Carlo-simulations, the aim of the second step of the evaluation procedure (which is part of the ongoing work) is to calculate basically two model variations that can be seen as geometric extremes of all available input data. This does not lead to a probability distribution for the spatial position of geometric elements but it defines zones of major (or minor resp.) geometric variations due to data uncertainty. Both model evaluations are then analyzed together to give ranges of possible model outcomes in metric units.