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Structural and mechanical analysis of the Mont Terri Anticline (Jura, Switzerland)

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The main motivation of this study is to illustrate how geometrical constructions of geological structures can be constrained by mechanical equilibrium and the Coulomb criterion using the theory of limit analysis. In the NW deformation front of the Jura thrust belt in Switzerland, the Mont-Terri anticline is located at an interruption of the Muschelkalk décollement, due to former normal faults. It is characterised by a reversed frontal limb, a steep back limb, and a ramp cross-cutting some of the former normal faults. A borehole and a highway tunnel constrain the inner structure. Three 2D kinematics and present-day cross-sections are proposed as various combinations of fault-bend folds, fault propagation folds and detachment folds (one of them being the only previously published interpretation of Mont Terri). Each interpretation is tentatively tested with the external approach of limit analysis, leading to different compatible ranges of values of the frictional parameters and of their variation with progressive shortening. It is not possible to reject any interpretation with confidence. Furthermore, the exact evolution of the topography during shortening is largely unknown. It is shown by the mechanical analysis to play a very important role in selecting the locations and dips of the active faults because it imposes spatial variations of their loading. The merit of the present approach is therefore to provide a quantitative link between the assumed evolution of the internal structure, the topography, and the frictional parameters.