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Comparison of fault-related folding algorithms to restore a fold-and-thrust-belt

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Fault-related folding means the contemporaneous evolution of folds as a consequence of fault movement. It is a common deformation process in the upper crust that occurs worldwide in accretionary wedges, fold-and-thrust belts, and intra-plate settings, in either strike-slip, compressional, or extensional regimes. Over the last 30 years different algorithms have been developed to simulate the kinematic evolution of fault-related folds. All these models of fault-related folding include similar simplifications and limitations and use the same kinematic behaviour throughout the model (Brandes & Tanner, 2014).

We used a natural example of fault-related folding from the Limón fold-and-thrust belt in eastern Costa Rica to test two different algorithms and to compare the resulting geometries. A thrust fault and its hanging-wall anticline were restored using both the trishear method (Allmendinger, 1998; Zehnder & Allmendinger, 2000) and the fault-parallel flow approach (Ziesch et al. 2014); both methods are widely used in academia and industry. The resulting hanging-wall folds above the thrust fault are restored in substantially different fashions. This is largely a function of the propagation-to-slip ratio of the thrust, which controls the geometry of the related anticline. Understanding the controlling factors for anticline evolution is important for the evaluation of potential hydrocarbon reservoirs and the characterization of fault processes.

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