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Dani W. Schmid[1] (1) GeoModelling Solutions GmbH, Zurich, Switzerland

Dynamic Restoration of Diapirism with Realistic Rheologies and Boundary Conditions

The rise of diapirs is strongly influenced by the behavior of the overlying material in general and the top/surface boundary condition in particular. For example erosional processes are known to greatly enhance the speed and maximum level of diapiric ascent. It has been established in recent publications that fully dynamic inversion of Newtonian diapirism with numerical models is possible, promising great enhancements to conventional back-stripping techniques. In order to account for typical natural material properties non-linear rheologies are essential. Combining non-linear material rheologies with various boundary conditions we systematically study the resulting diapirs, including diapirs rising through a plastic overburden under an erosional surface. We demonstrate that it is generally possible to perform fully dynamic inversion with numerical models for such realistic scenarios and outline the limitations of the procedure. Applying the resulting method to natural examples of halokinesis and comparing it to conventional back-stripping techniques we prove the usefulness of the developed method.