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A Coupled Semi-analytical Approach for the Evaluation of CO₂ Injection Induced Surface Uplift and Caprock Deflection

C. Li* (Swiss Federal Institute of Technology, EPFL), P. Barès (Swiss Federal Institute of Technology, EPFL) & L. Laloui (Swiss Federal Institute of Technology, EPFL)

SUMMARY

This study focuses on a specific problem related to the surface uplift induced by the injection of CO₂ at depth. The adopted methodology includes the development of a mathematical model that incorporates deformable behaviour of storage mediums and two immiscible fluids (CO₂ and water) flow within the aquifers while surface rock or caprock layer is modelled as a thin plate. Governing equations are solved for the axisymmetric flexure deflection due to a constant rate injection of CO₂. Numerical results show that this semi-analytical solution is capable to capture the pressure build-up during the very early stage of injection, resulting in a high rate surface uplift. It can be employed as a preliminary design tool for risk assessment such as injection rate, porosity, rock properties and geological structures. This semi-analytical solution provides a convenient way to estimate the influence of high rate injection of CO₂ on the caprock deformation. The methodology in this development can easily incorporate other pressure distributions. Thus one can benefit from the advances in hydrology researches as well.

The results of this abstract cannot be published.