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Monitoring pressure evolution during geological CO₂ storage

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Pressure build-up near the injection well is a critical factor limiting injection rates during CO₂ storage and leads to measurable deformation at the surface above the injection site. The radial solutions for pressure and saturation in two-phase compressible flow are self-similar and they illustrate that the pressure outside the two-phase region is comparable to single-phase flow. However, pressure dissipation into ambient rocks reduces lateral pressure propagation significantly. Pressure build-up also leads to surface deformation and provides a monitoring tool to invert for reservoir parameters. We formulate an inverse problem to infer the permeability distribution in a quasi-static poroelastic model. Here, we neglect two-phase flow and focus on pressure dissipation into ambient formations. The misfit between model and observations is minimized under the constraint of the poroelastic equations. A numerical study of injection into a deep layer illustrates the possibilities and limitations of retrieving lateral permeability variations from a coupled inversion.