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Interpretation of hydraulic tests performed at a carbonate rock site for CO_2 storage

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Proper design of CO_2 geological storage facilities requires knowledge of the reservoir hydraulic parameters. Specifically, permeability controls the flux of CO_2, the rate at which it dissolves, local and regional pressure buildup and the likelihood of induced seismicity. Permeability is obtained from hydraulic tests, which may yield local permeability, which controls injectivity, and large scale permeability, which controls pressure buildup at the large scale. If pressure response measurements are obtained at different elevations, hydraulic tests may also yield vertical permeability, which controls the rate at which CO_2 dissolves. The objective of this work is to discuss the interpretation of hydraulic tests at deep reservoirs and the conditions under which these permeabilities can be obtained. To achieve this objective, we have built a radially symmetric model, including a skin and radial as well as vertical heterogeneity. We use this model to simulate hydraulic tests with increasing degrees of complexity about the medium response. We start by assuming Darcy flow, then add coupled mechanical effects (fractures opening) and, finally, we add thermal effects. We discuss how these affect the conventional interpretation of the tests and how to identify their presence. We apply these findings to the interpretation of hydraulic tests at Hontomin.