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# Risk assessment and mitigation of induced seismicity for geo-energy related applications at the basin scale

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Fluid injection-induced earthquakes involve a series of complex physical processes. Evaluating these processes at the basin scale requires an amount of input data and a super computational ability to solve in near-real time risk analysis, which remains the most critical challenge in geo-energy related applications. Although the current computational tools can achieve a good simulation for the field scale problems, they are far away from the requirements of the basin scale analysis. Alternatively, we can apply verified analytical solutions of certain processes to speed the whole calculations when moving from the field to the basin scale. With this in mind, we adopt the analytical solutions for pore pressure diffusion and stress variations due to fluid injection into the reservoir. With the superposition principle, the analytical solutions can address the coupling problem of multi-injection wells at the basin scale. We then assess faults stability and the associated induced seismicity potential using the hydro-mechanical perturbations throughout the basin computed analytically.

To handle the uncertainty of geological properties, including the fault and reservoir geometries, hydraulic and mechanical properties, we perform Monte Carlo simulations to analyze their effects on induced seismicity potential. Such comprehensive parametric space analysis currently represents an insurmountable obstacle to be solved numerically, even calculating the problem in parallel. We propose a feasible methodology to mitigate the magnitude of induced seismicity, and even to avoid large earthquakes for subsurface energy-related projects, based on the results obtained both at the field and basin scales. This development will represent a great tool for risk evaluation of induced earthquakes not only in the period of site selection, but also in the whole lifetime of geo-energy projects.