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Induced seismicity along a fault due to fluid circulation: conception and application

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It is believed that the some seismicity is driven by the fluid circulation within fault zone and different rheology models have been proposed principally based on the Darcy's law, fluid flow in porous medium. Although it is very difficult to quantify such feature in natural seismicity (some aftershocks of large earthquakes, or seismicity in subduction), the direct application is the induced seismicity at the geothermal sites where micro-fracturing (seismicity) is necessary to allow fluid circulation between two wells and thus the assessment of such seismicity becomes also important. In this study, we construct a conceptual model for the simulators, taking into account of elastic and plastic porosity change (e.g. Segall and Rice, 1995) and fault width evolution (e.g. Yamashita, 1999), supposing first that the seismicity (fluid flow) expands dominantly along a plane. In fact, for an injection of about a few 10 l/s, pore pressure increases immediately (about 1 min) up to more than 10 MPa. This is much faster than the fluid circulation in general. This requires that the fracturing co-seismic process should play a dominant role for bringing the fluid circulation.

Keywords: induced seismicity, fluid, porosity, Darcy's law, fault rheology