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Statistic bounds for magnitudes of induced and triggered seismicity

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Identifying parameters that control magnitudes and their statistics is a key point for evaluating the hazard of induced seismicity. Similarly to the tectonic seismicity, statistics of the fluid-induced seismicity can be rather well described by the Gutenberg-Richter frequency-magnitude distribution. However, large-magnitude events deviate from it.

I analyze the influence of fluid injections on the frequency-magnitude statistics of induced events. I start with a model of point-like independent seismic events. This model describes well the statistics of numerous small-magnitude earthquakes. The model allows to formulate a simple description of the seismicity rate and to introduce parameters quantifying the seismo-tectonic state of a fluidinjection site.

One of such useful parameters is the seismogenic index. It helps to predict the probability of givenmagnitude events. However, the model of point-like events tends to overestimate the probability of significant magnitudes. Then I consider statistics of large-magnitude events. I take the finiteness of rupture surfaces of such earthquakes into account and consider the influence of the finiteness of stimulated-rock volumes on this statistics. I address also the issues of the maximum-magnitude induced earthquake and of the relation between triggered and induced earthquakes.