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Reservoir-induced seismicity: A review

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Within the last century the number of induced seismic events has increased significantly world wide. Different industrial operations contributed to this surge, amongst others geothermal exploitation, shale gas production and mining activities. However, unlike the above examples, seismic activity linked to the filling of artificial lakes may be relatively large in magnitude. Many works have been conducted to work out the driving mechanisms of so-called reservoir-induced seismicity in recent years. Yet, the physics are still poorly understood.

With this work we aim at presenting a review on known cases of reservoir-induced seismicity world wide to demonstrate the importance of further works on reservoir induced seismicity. We give a brief overview on the history of each reservoir, discuss the observed seismicity and present the dominant geology and other relevant parameters. As has been shown by previous studies, the tectonic stress regime significantly affects the occurrence of seismicity. Whereas the impoundment of artificial water reservoirs is understood to have a general stabilizing effect in a thrust faulting environment, seismic activity is more likely at reservoir locations in normal faulting or strike slip tectonic settings. Therefore, we will go on and focus also on the stress regime at several reservoir locations and analyze focal mechanisms from literature.

Our results demonstrate that indeed most known cases of reservoir-induced seismicity occurred under normal faulting or strike-slip conditions. However, it is the interaction of various parameters that influences the seismic activity such as preexisting faults, hydrologic and elastic rock parameters, the filling history as well as natural seismic acitivity in the corresponding region. Nevertheless, knowing the stress state and tectonic regime at a certain location prior to dam-construction is essential in order to reduce the seismic hazard.