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Induced seismicity at well Uha Gt2: Injection pressure is not the only culprit

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The geothermal injection well Uha Gt2 is located within the Bavarian Molasse Basin. The well targets a very productive karst aquifer (Malm) and operates at flow rates of more than 100 l/s. Nevertheless, since the start of the operation many earthquakes, of which some reach magnitudes of more than 2, have been recorded in the close vicinity of the well. The majority of the events has a horizontal distance to the well of 500 m or less. However, the vertical distance is much larger. Even though the vp/vs-ratio is not determined precisely, the events are located below the bottom of the well, depending on the parameters chosen between 300 m to 1.5 km below. Therefore, the events do not happen within the karst aquifer but within the crystalline basement. The only explanation for this surprising behavior is the fact that the well passes a fault zone, which might have a hydrological connection into the underlying basement. A 3D seismic survey which has been performed in this area can trace the fault zone through the Malm to the top of the crystalline basement. However, due to a lack of resolution and reflector horizons within the crystalline nothing is known about the existence and form of the fault zone within the basement. Thus, numerical models are necessary to examine different parameter sets (e.g. about the permeability of the fault zone) in order to gain a better understanding about the processes leading to induced seismicity in this peculiar case.
The models investigated show that depending on the permeability of the fault zone the pore pressure changes caused by the injection of cold water vary significantly. However, the models also show that these changes in pore pressure are very small (less than 1000 Pa within the crystalline) and therefore cannot be the single dominant factor for the occurrence of induced seismicity.