Response of Groundwater to Oklahoma Induced Earthquakes

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for research papers:

It is very interested to analyze the responses of waters to Oklahoma earthquakes because the earthquakes were also induced by waste-water disposal injected to underground. This research mainly showed there were obvious co-seismic changes of groundwater after three Mw ≥ 5.0 earthquakes in Oklahoma, USA. They have calibrated the findings with precipitation and barometric pressure data and considered that the coseismic changes were more likely due to earthquake occurrences. Three possible mechanisms of earthquake-groundwater interaction were examined well i.e. static strain from permanent displacement, coseismic liquefaction mechanism and earthquake-enhanced permeability by transient stress. The static strain calculation result (using some global parameter assumption) as well as dynamic shear strain is inconsistent with observation data. Most of response of wells falls beyond the liquefaction limit built by many previous researches from many observations. The later proposed mechanism is considered to explain the water response due to earthquakes in this region better. A one-dimensional model of aquifer with wells and coseismic recharge within it showed better correlation between earthquake and groundwater response. The simulation can show the model fit the observation data very well, considered the earthquake enhanced the permeability by dynamic stress transfer. The simulation result is also consistent with geologic observations. This research still leave some important problems about why other two earthquakes did not influence closer wells or some wells in the vicinity of certain wells did not have response to the closer earthquakes. Some explanations are needed in future research, maybe it was caused by the differences in frequency of the seismic waves, or rupture directivity effects, or the most interested issues is about the existence of many injection wells. We can also consider other important factor such as the foreshocks and aftershocks pattern or energy. The one-dimensional aquifer model that was considered to simply the mechanism maybe not draws the real aquifer in that region. This research need to explore about the aquifer model in Oklahoma region better with some observations. Many possible issues must be addressed in the future research.

Keywords: Earthquake-triggered groundwater; Static and dynamic stresses; Oklahoma earthquake