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Coseismic Hydro-Environmental Changes

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Editorial

Observation of water level and discharge changes in response to earthquakes provides insights into aquifer property changes like pore pressure and permeability. Numerous reports documenting these changes in historical books and up to date scientific papers demonstrate that the observations are universal and global phenomena typically seen in active seismotectonic regions. Such hydrogeological alteration can modify the water-rock interaction and material transportation systems that lead changes in hydro chemical and biological signatures. However, the consequences of seismotectonics on hydro environments, a crucial aspect of science and human life, remain incompletely understood and a multidisciplinary approach is required to deal with these issues. Causes and processes of hydro-environmental changes related to seismotectonic activity are often evaluated on a regional scale employing a spatiotemporal dataset of physicochemical and biological parameters. However, such long term monitoring is usually difficult due to the high cost that ought to be invested in regions where large earthquakes might hit, although several monitoring networks have recently been developed in some countries. Thus, a big improvement in understanding the sector of earthquake hydrology has been obtained using data limited to a selected place and time.

The rarity and intermittency of the chance to document phenomena haven't allowed us to comprehensively understand these systems. This Special Issue aims to strengthen and deepen our understanding by efficiently examining by a multidisciplinary approach various topics associated with recent earthquakes previous studies are briefly discussed here to point out what has already been proposed and what remains to be answered. First, the main mechanisms invoked to elucidate the observed water level and discharge changes are often classified into five categories: pore-pressure response to crustal elastic strain, permeability changes caused by seismic waves and cracks in shallow systems, soil pore-water release by seismic vibration, fluid migration along dilatant cracks or deep crustal ruptures and pore-pressure changes in response to liquefaction or consolidation. Because the crustal strain change and seismic wave can propagate within the order of ~ 103 km, the associated hydrological response is detectable in wells relatively far away from the epicentre apart from near field phenomena like water transportation along seismogenic rupturing.

Previous works have revealed these mechanisms and qualitatively explained observed hydrological changes. However, an appropriate quantitative chemical analysis of those changes at the watershed scale, which needs the appliance of hydrogeological modelling, has not been made. Additionally, the available studies are limited and more investigations are required for a far better system understanding. Second, hydrogeological changes can induce changes in water chemistry and isotopic signatures. The main processes proposed to elucidate these changes include deep and hydrothermal fluid injection, mixing of waters from different aquifers, infiltration of soil waters and contaminants through new pathways and rock weathering enhancement in new rupturing. Site-specific long term hydro chemical and H and O isotopic monitoring successfully revealed a hydro chemical changing system on an in depth duration. However, changes within the scale of active groundwater flow systems, including contaminant transportation, were poorly understood because it had been lacking a spatial dataset to explain chemical anomalies that cover entire watersheds on a regional scale.

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