Studies of spatial sensitivity of the hydrological response to earthquakes

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Abstract

Numerous observed earthquake induced hydrological changes inferred some sensitive wells could detect the tiny signals of the crustal deformation. But the reasons and mechanisms included for the sensitive wells are not well-known. Some previously study (Matsumoto et al., 2003; Roeloffs et al., 2003) show individual mechanism could be the reasons made the wells with high sensitivity to earthquake. Also the earthquake induced hydrological changes shows the high variances in spatial distribution (Lai et al., 2005). To make a criteria for choosing sensitive sites or wells are still quite a big challenge.

In this study, we using the observations of the groundwater and earthquake monitoring network in Taiwan act as the dense observation dataset to the earthquake induced hydrological responses. The comparison of the all events (detectable and non detectable) in groundwater level and the inferred volumetric strain step in response to the earthquake events were discuss. These observations had been geostatistically analysis for estimate the sensitivity of the observation well to different spatial regions.

From the spatial analysis of the detect ability, they shows the highly anisotropy and heterogeneity in four wells. They could partly explain the different responses of earthquake induced groundwater changes. Tectonic and structural geology setting could be the main reason control the spatial difference of earthquake induced groundwater changes (Fault-Barrier Effect). The strain model usually could explain the type of the coseismic change, but the amplitudes usually not fit to the homogeneous assumption. The Structural anisotropy and mechanical heterogeneity should be considered to improve the volumetric strain estimation. The results issued the limitation and ability of the detection of the observation well spatially. Base on the spatial distribution of the detection, we should choose fitted sites or wells for the purpose.