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Studies of mechanism for water level changes induced by Wenchuan earthquake: intermediate field versus far field

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The M_s8.0 Wenchuan earthquake of May 12, 2008 induces large-amplitude water-level changes at intermediate and far fields in Chinese mainland. Although many hydrologic changes induced by seismic waves have been reported, the mechanisms responsible for the changes still remain unclear. We invoke Skempton's coefficient B to explain those coseismic water-level changes documented in the intermediate and far fields. In the intermediate field, we observe coseismic water-level changes of different amplitude in wells with similar epicentral distances. In order to study the mechanism of those coseismic water-level changes, we calculated the static strain change with the Okada dislocation model (Okada, 1992; Lin and Stein, 2004; Toda *et al.*, 2005). By comparing the calculated coseismic water-level change based on the poroelastic theory with the observed water-level change, we can judge whether the poroelastic theory can be applied to the aquifer of the well. From our research, we find the poroelastic theory can be used to explain those water-level changes in wells with epicentral distance $\lesssim$ 1.5 fault rupture length. Bearing this in mind, we find that when the water-level change of those wells can be explained by the poroelastic theory, the difference of the water-level change in wells with similar epicentral distances is mostly related to the difference of Skempton's coefficient B. Otherwise, the water-level change may be induced by the transition of the seismic waves because it is usually larger than the one induced by the undrained dilatation and consolidation, and changes more gradually. In the far field, some of those abrupt coseismic water-level changes, for which the variation of the coseismic water-level, Skempton's coefficient B and the effective pressure keep uniformity (all increase or all decrease) are found to favor the consolidation/dilatation induced by the shaking of teleseismic waves. While the other part of those coseismic water-level changes, especially the more gradual water-level changes in this area, can be explained with the enhanced permeability caused by fracture clearing or overcoming the capillary entrapment in porous channels of the aquifer, induced by the shaking of teleseismic waves.