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Mechanism of the Co-seismic Change of Volumetric Strain in the Far Field of Earthquakes

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Coseismic strain is important for understanding the crustal response to earthquakes. Several studies showed a large discrepancy between the measured coseismic change of volumetric strain in the far field and that which was predicted from the theoretical static strain, yet the underlying mechanism for this discrepancy is unknown. Here, we compare the tidal response of the volumetric strain with that of the groundwater level documented in a well located in northeastern China before and after three distant great earthquakes. The phase of water-level fluctuations increased after each earthquake and became the same as that of the volumetric strain. Furthermore, both the sign and the time history of the volumetric strain match that expected from the poroelastic response of aquifers to a localized coseismic increase in pore pressure. These observations imply that the coseismic change of volumetric strain in the far field of great earthquakes may primarily reflect the poroelastic response to coseismic pore-pressure change that, in turn, is caused by earthquake-enhanced permeability.