

Evaluation of the effects of ground shaking and static volumetric strain change on earthquake-related groundwater level changes in Taiwan

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Abstract

Between 2001 and 2005, the Disaster Prevention Research Center of National Cheng-Kung University established a groundwater observation network consisting of 16 wells. Most of these were located along active faults for research on earthquake-related groundwater changes. They were selected mainly from among the 550 groundwater observation wells of the Water Resources Agency (WRA), which monitors and manages groundwater resources in Taiwan. The groundwater level was observed at a resolution of 0.2 mm at the wells. The depths of the well screens ranged between 80 and 252 m. Groundwater level data at six of the 16 wells were analyzed between 2003 and 2006 in an evaluation of such data for use in detecting earthquake-related groundwater level changes. The strain sensitivities of the groundwater level at these six wells ranged between 0.1 and 0.5 mm/10⁻⁹, indicating that an analysis of groundwater level data at these six wells can detect volumetric strain changes on the order of 10⁻⁹. Coseismic and/or postseismic groundwater level changes associated with 17 earthquakes in and around Taiwan whose magnitudes were ≥ 6 were also analyzed. Our analysis shows that ground shaking seems the main reason for earthquake-related changes but that the acceleration of ground shaking cannot always explain the observed groundwater level changes.