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Space and terrestrial geodetic observations in the study of hydrogeologic processes.

A close link exists between the hydrologeologic mass movements and the observation of crustal deformation and gravity changes. The observations of crustal movement measure the sum of deformation caused by tectonic agents and ambient factors, the most evident of the latter being thermoelastic deformation and loading due to hydrogeologic fluids. Monitoring subsurface fluids with geodetic observations is achieved at large scale with satellite gravity observations from the GRACE satellites; recently also from GOCE a gravity change rate product was released. We investigate to which amount the tectonic vertical movement contributes to the gravity change rate and find it is non-negligible over the Tibet-Himalaya and the Alpine range. At local scale it is shown that the water flows in Karstic areas are recovered by geodetic deformation observations of crustal movement and tilting with subsurface tilt measurements. The results demonstrate that geodetic gravity and deformation observations could be developed as monitoring devices of subsurface hydrogeologic systems.