



Estimating Terrestrial Water Storage using GPS Vertical Motion in Taiwan

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GPS is capable of measuring crustal deformation, and is widely used in studying plate tectonics and fault slip over a seismic cycle. In Taiwan, significant annual variations can be observed in GPS time series, and the GPS seasonality greatly corresponds to hydrological cycle. On hard rock sites, the annual GPS vertical deformation is mostly due to the elastic response to variations of surface loads in the wet and dry seasons. We remove stations located in alluvial fan and estimate amplitudes of GPS seasonal vertical motion using a disk-load model with Green's functions computed from an elastic earth model, PREM. We divide Taiwan into 0.25 by 0.25 grids and use seasonal GPS vertical displacements to invert the terrestrial water storage. In average, the inverted seasonal water variation is larger in southern Taiwan compared to northern Taiwan due to heavy rainfalls during monsoons and typhoons in summer. In this study, we focus on studying water storage in in southwestern Taiwan because a good spatial coverage of GPS sites. Inferred water storage is roughly consistent with spatial variation of seasonal groundwater level in western plain. Low water storage periods correspond with droughts over the past decade. The interannual variations also infer one of the most serious droughts in the early 2015. GPS data could be used as a tool to map the spatial variation of terrestrial water storage. In the future, we would expand this study to investigate the seasonal modulation of seismicity in response to hydrological loading.