AGU FALL MEETING
San Francisco | 14 – 18 December 2015

- G53A-03: Uplift mechanism of orogens inferred from GRACE temporal gravity changes - example of Qinghai-Tibet
- Abstract

  Friday, 18 December 2015

  14:10 - 14:25

- Moscone West - 2002

Orogenic areas are subject to uplift and horizontal deformation as observed by present-day global positioning system and repeated leveling measurements. Crustal mass is conservative and less dense than the mantle, thus the horizontal shortening must be accompanied by crustal thickening and horizontal extrusion. According to the level of isostatic compensation, the thickening is partitioned into topographic uplift and Moho deepening. We investigate the mass change induced gravity signal and discuss whether this signal could be detected using terrestrial or satellite gravity observations. An example is the Qinghai-Tibet plateau, for which we model crustal thickening and calculate the expected gravity signal. The predictions are compared with present-day gravity changes observed by GRACE and with published *in situ* absolute gravity rates. It is found that the crustal thickening signal cannot be neglected and that it contributes significantly to the observed signal. Those studies with focus on the glacier and hydrologic mass fluxes should be aware that, if neglected, the crustal signal could introduce a significant bias. The GRACE observations give a positive gravity rate over central Tibetan Plateau, unexplained by the hydrologic or cryospheric signals, and a negative rate over the Himalayas and at its foothill, which is attributable to a prolonged hydrologic drought and/or depletion of groundwater. Our model shows that the positive gravity rate could be explained by elevation uplift, and a stable or upwelling Moho. The negative gravity change signal is due primarily to the strong elevation-gradient at the foothill of the Himalayas, and to an uplift accompanied by crustal thickening and Moho lowering. Finally, we place constraints and requirements on future gravity missions, for the feasibility to more accurately observe this signal, and to separate it from the background hydrologic and cryospheric processes.

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