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Title: Gravity changes due to mountain-building processes and their detectability with satellite gravity missions

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Abstract: The Himalaya and Alps mountain ranges, and Tibetan plateau are presently subject to uplift, as documented by GNSS vertical movement rates. Uplift occurs in response to climatic mass loss (deglaciation or hydrologic mass loss) or due to the dynamic forces (crustal compression or mantle inflow below uplifting crust). The uplift generates a mass change, which produces a time variation of the gravity field. The deglaciation and changes in the subsurface hydrologic budget, also generate a mass change, which sums to the tectonic change. The shrinking outlines of glaciers are revealed by remote sensing, but the total volume budget estimate requires also the thickness variation. Remote sensing catches the surface height changes, but these must be corrected for the crustal uplift. The geodetic measurements of the crustal dynamics of the Alpine range in terms of height and gravity changes, is therefore in close relation to the estimate of the climatic changes inducing glacier and hydrologic budget changes. We show that for the Alps and Himalayas the hydrologic gravity signal is superposed to the tectonic signal, and discuss to which amount the signal can be resolved by gravity measurements (Braitenberg and Shum, 2015; Chen et al., 2018). We consider the satellite observations of GRACE and GOCE and propose what kind of error curve would be necessary for possible future gravity satellites to significantly increase the resolution.

Braitenberg C., Shum C. K. (2015) Geodynamic implications of temporal gravity changes over Tibetan Plateau. Italian Journal of Geosciences, Vol. 136, No.1, 39-49, doi: 10.3301/IJG.2015.38.

Chen W., Braitenberg, C., Serpelloni, E. (2018) Interference of tectonic signals in subsurface hydrologic monitoring through gravity and GPS due to mountain building, Global and Planetary Change (in press),https://doi.org/10.1016/j.gloplacha.2018.05.003