Interference of tectonic signals in subsurface hydrologic monitoring through Gravity and GNSS due to mountain building

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Abstract:

Time series of GNSS observations over 10 or more years have sufficient precision to reliably observe vertical crustal movement rates. The geodynamic modeling of converging plate margins requires constraints on the origin of orogenic uplift, of which the two end members are pure crustal uplift and crustal thickening, respectively. Gravity change rate joint with uplift monitoring allows to distinguish the two uplift mechanisms. We use the vertical uplift rates over Italy extending to the entire Alpine range, to predict the gravity change for different geodynamic hypotheses of pure uplift and mantle inflow, or crustal thickening and isostatic Moho lowering. The sensitivity of gravity as a tool to distinguish the two mechanisms is investigated. The estimate of this tectonic signal is important, when gravity change rates as those obtained from GRACE are interpreted exclusively in terms of hydrologic changes tied to climatic variation. It has been already shown that in some areas, as the Tibetan plateau and the Himalayas, the tectonic signal is not neglectable. Here we estimate the entity of the tectonic signal for the uplift of smaller mountain ranges, as is the Alpine arc.

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