

# On potential contribution of harmonic inversion method to studying volcanic unrest or reactivation

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Volcanic unrest or reactivation manifests itself among other phenomena by a gravimetric signature in terms of temporal gravity changes observable on the topographic surface. Here we take a look at the applicability and benefits of a recently developed gravimetric inversion approach in interpreting time-lapse gravity changes observed in restless volcanic areas. This inversion approach, developed by Pohánka, adopts n-harmonic (poly-harmonic) functions and their properties to facilitate an automated iterative procedure yielding solutions in terms of homogenous source bodies of complex shapes. To test the applicability and benefits of this inversion methodology we used a case study situated in the Central Volcanic Complex (CVC) of Tenerife, Canary Islands, based on the temporal gravity changes observed during the 2004–2005 unrest [1]. The inversion results obtained by the harmonic inversion approach indicate a hybrid unrest, in which a magmatic intrusion or rejuvenation by fresh magma entered a zone about 5 km to the NW of the twin stratovolcanoes of the CVC, Teide and Pico Viejo, at the depth of roughly 6 km below sea level, associated with upward and side-ways migration of hydrothermal fluids into shallower parts of the caldera. The gravimetric picture of the sources of this hybrid unrest was constrained seismically with data on the seismic unrest of this period and its interpretation [2]. It correlates well also with our previous interpretation based on a different inversion approach developed by Prutkin [3]. Issues still associated with interpreting the harmonic inversion results to be resolved in the follow-up work will be discussed along with directions for possible future developments.

## References:

- [1] Gottsmann J et al. (2006) *Geophys. Res. Lett.*, 33, L20311, doi:10.1029/2006GL027523
- [2] Cerdeña Domínguez I et al. (2011) *J. Volcanol. Geotherm. Res.* 206: 15–29
- [3] Prutkin I, Vajda P, and Gottsmann J (2014) *J. Volcanol. Geotherm. Res.* 282: 9–18

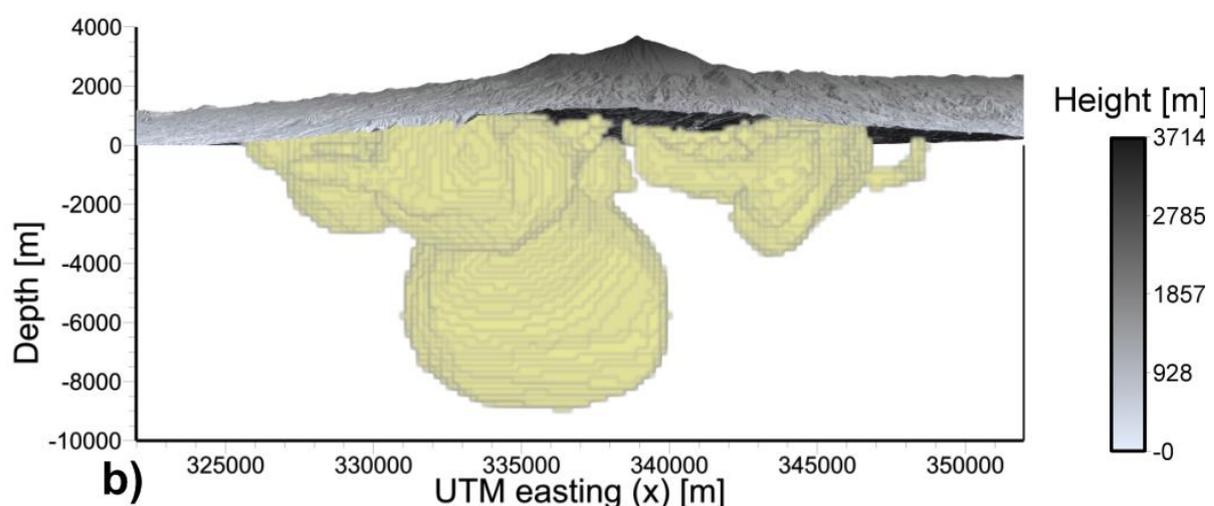


Figure 1: The harmonic inversion solution for the 2004/5 Teide unrest gravity changes.