On gravimetric monitoring and analysis of volcanic edifice unrest and possible magma recharge

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Keywords: natural hazards, volcano reactivation, volcanic unrest, geophysical monitoring and interpretation.

Abstract

Volcanoes can reactivate after even very long repose periods of several centuries. Consequently the current population inhabiting a given volcanic area has long lost the feeling of possible volcanic hazard, its extent, magnitude, and possible damages or fatalities. Awakened volcanoes may pose threat to human lives, health, property and infrastructure, as well as tourism. The better the hazard can be assessed and forecasted the better for society and its economy. It is of prime interest to protect the lives and property in such areas. It is the role of earth sciences to monitor and analyze possible hazards, and to be able to assess potential risks and issue early warnings to the respective authorities. Geophysics plays an important role. Gravimetry is among those science disciplines that can detect the early signs of volcanic edifice reactivation and analyze the subsurface magma recharge. Emerging magmatic processes within the edifice have their signatures on the topographic surface, such as observable gravity changes and surface deformations. When these are monitored, analyzed and interpreted, insights into the nature of the underground process are gained that are valuable for assessing the threat and making forecasts. Here we present a gravimetric case study for the Teide (Tenerife, Canary islands) volcanic unrest of May 2004 to July 2005. Our objective is to detect a possible magma recharge from the observed gravity changes. Our own inversion methodology is applied to analyze and interpret the observed data. We detected a magma injection at the depth of about 6 km b.s.l. We came to the conclusion that the 2004/5 Teide unrest was a failed eruption after a repose period of about a century.

Acknowledgements
Jo Gottsmann acknowledges support by the Royal Society University Research Fellowship and EC FP7 project “VUELCO” (grant #: 282759). Peter Vajda was supported by the Slovak Research and Development Agency (contract No. APVV-0724-11) and by Vega grant agency (projects No. 2/0067/12 and 1/0095/12).