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# Importance of structural and rheological complexity on ground deformation inversion: a numerical study

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Understanding the source of ground deformation at active volcanoes is of primary importance for a better assessment of the volcanic hazards. The inversion of recorded data is a powerful tool to infer features of the source responsible for such deformation. It is a computationally complicated and costly procedure due to the complexity of the rock domain and the number of unknown variables such as the source position, shape and extent. As a consequence, inversion methods are normally based on models that simplify the source geometry and/or rock properties. We have examined the degree to which the complexities of the rock matrix may be neglected when interpreting data associated with awakening episodes. The ground deformation associated with a volume change at depth has been simulated using a numerical code based on a discrete elastic lattice method (O'Brien and Bean, 2004) which accounts for the presence of complex topography, rock heterogeneities and fractures/faults. The deformation due to the same source but different rock models, from homogeneous to heterogeneous with fault discontinuities and topography have been computed. These synthetic data have been then inverted through the commonly used model by Davis (1986) that accounts for a point pressurized cavity of ellipsoidal shape, arbitrarily oriented in an homogeneous half-space. The results show that the inversion of ground deformation data is very sensitive and that the assumption of simplified models (i.e. ignoring rock heterogeneity) can lead to a wrong interpretation of the ground deformation itself, in particular in term of the source mechanism and magnitude. The present study highlights that the incorporation of realistic rock models is crucial for determining the correct source of volcanic ground deformation. A possible solution could be the use of Green's function calculated for the specific site under-investigation but it involves a large computational cost.