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Solving Laplace equation to investigate the volcanic ground deformation pattern

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Volcanic eruptions are generally preceded by unrest phenomena, which are characterized by variations in the geophysical and geochemical state of the system. The most evident unrest parameters are the spatial and temporal topographic changes, which typically result in uplift or subsidence of the volcano edifice, usually caused by magma accumulation or hot fluid concentration in shallow reservoirs (Denasoquo et al., 2009). If the observed ground deformation phenomenon is very quick and the time evolution of the process shows a linear tendency, we can approximate the problem by using an elastic rheology model of the crust beneath the volcano. In this scenario, by considering the elastic field theory under the Boussinesq (1885) and Love (1892) approximations, we can evaluate the displacement field induced by a generic source in a homogeneous, elastic, half-space at an arbitrary point. To this purpose, we use the depth to extreme points (DEXP) method. By using this approach, we are able to estimate the depth and the geometry of the active source, responsible of the observed ground deformation.