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The use of Multiridge method to constrain the geodetic sources: the volcanic ground deformation case.

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Volcanic phenomena are nowadays monitored by the regular detection of physical and chemical dimensions. One of these is represented by the ground surface deformation field caused by the variations of several geometrical and physical parameters of magmatic reservoirs.
Since the development of the remote sensing techniques, a great amount of deformation field data is available and so the exploitation of these information becomes an important task. Currently, the most employed methods are essentially based on the optimization/inversion procedures of model parameters, but they are characterized by the not uniqueness solution problem.
In this context, we propose a new methodology for the estimation of the simple source geometrical parameters responsible of the ground deformation field, recorded by DInSAR technique, in a volcanic environment.
Assuming the linear elastic behavior of the media and the half space isotropicity, and considering the Love's argumentation on the potential theory of the deformation field, we use Multiridge and ScalFun techniques to achieve univocal information about depth, horizontal location and shape of active sources.
We apply the methodology on simple source model synthetic tests. The volcanic source models taken in account are: the point-spherical model (Mogi, 1958), the rectangular tensile fault model (Okada, 1985) and the dipping finite prolate spheroid model (Yang, 1988).
We show that the Multiridge analysis, applied on the ground deformation field components, returns, in the worst case, an error of 30% on the estimation of the depth, which is however reduced to a negligible level by recurring to the high-order vertical derivatives of the field; the ScalFun analysis, yields for the considered models integer values of the homogeneity degree only for the Mogi's model, while for the other sources, as expected, we obtain fractional values. Nevertheless, in most cases its variation is reduced so allowing a rather appropriate identification of the source shape.
We conclude that the proposed methodology provides important univocal solutions that can be used to reduce the number of unknown parameters in a possible classical above mentioned investigation procedures of source parameters.