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Joint inversion of ground deformation and gravity changes using free geometry bodies.

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Persistent inflation and long-period gravity fluctuations occurred at Mt Etna (Italy) during the time interval bounded by the 1991-93 and 2001 main flank eruptions. Several studies suggest that, since 1993 and before the 2001 eruption, a large amount of magma was stored at depth. Up to date, an integrated inversion of the available ground deformation and gravity data has not been attempted, in spite of the possibility of bringing new insight into the processes that led to the 2001 eruption.
We use nearly annual microgravity , GPS and interferometric SAR data acquired on Mt. Etna during the 1995-2000 period .
We apply a recent published methodology able to carry out a simultaneous inversion of the whole data to obtain a 3D modelling of the causative extended sources of pressure and density changes. The method is characterized by setting up the anomalous body as aggregations of small cells in a step-by-step growth process. The ambiguity problem is solved by adding a simple regularization condition. The non-linearity problem is solved by explorative schemes.
In the present communication, the inverse method has been modified to take into account the existence of possible regional deformations and local noise. Actually the inverse approach permits an exhaustive inversion and modeling, allowing a good separation of the regional, local and noise components.
Preliminary results indicate constancy in time of the position of pressure and mass sources, in spite of the different phases of activity displayed by the volcano during the period of interest. A fundamental result of this study is that pressure and mass sources are widely separated in space.