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Inferences on magma uprising at Mt. Etna (Italy) by seismic and GPS ground deformation data

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In this work, we analyze both the space-time evolution of seismic activity and ground deformation affecting Mt. Etna during the last thirteen years, with a particular attempt to the years following the December 1991-March 1993 lava flow eruption. After a short period of deflation following the 1991-1993 eruption, ground deformation measurements indicates that, during 1994-1999, the entire edifice underwent a marked inflation which preceded the recent July-August 2001 and October 2002 - January 2003 eruptions. Careful analysis of the spatial pattern of the seismic energy release, since the second half of 1996 evidences some strict relationship with the GPS ground deformation behavior, and both strongly supported a link between magma-related mass changes at depth and associated stress and strain variations. This observed stress-strain pattern is clearly influenced by the regional tectonic and the NNW-SSE trending fault zone which plays a relevant role in the recent volcano dynamic, until the July - August 2001 lateral eruption. Our observations suggest that there has no major magma reservoir inside the upper crust (depth <= 10 km) or within the volcanic pile, but that high-level storage occurred in dykes, not concentrated in a specific area, with their position variable in the time. Moreover the comparison between seismic and ground deformation data suggests that during the period of observation a transfer of different magma pulses from the volume located at depth in the western flank occurred towards the central area of the volcano.