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New insights into the dynamics of the upper east flank of Etna through a joint analysis of seismic and gravity data (1994 - 2006)

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This study focuses on the relationship between changes of the gravity field and the release of the seismic energy at Mt. Etna over a 12-year period (1994-2006), covering different eruptive patterns. We show that, through the joint analysis of the seismic and gravity data, new inferences can be drawn about the dynamics of the upper southeastern flank of Etna. The most striking features evidenced are: i) the time coincidence between the periods of higher gradient of the strain release curve and the long-term gravity decreases before the start of the 2001 eruption and ii) during the periods of gravity decrease/high rate of the seismic strain release, the clustering of most epicenters in the area where the gravity anomalies are centered. Various evidences suggest that, since 1994, the eastern flank of Etna remained peripheral to the lines of rise of the magma. Accordingly, we hypothesize that, rather than being directly associated to the migration of the magma, the joint anomalies we found image phases of higher tensile stress on the upper southeastern sector, associated to rarefaction of the weak crust along a preexisting fracture/weakness zone. That implies new, non-clichéd possibilities of microgravity studies at active volcanoes: if utilized in particular geodynamic contexts, such as Etna's, and in conjunction with the information derived from seismic studies, they can allow to discover the ongoing formation of zones of rarefacting medium, and thus of "paths" able to convey the ascent of magma, months to years before the occurrence of a lateral intrusion.