Geophysical Research Abstracts, Vol. 9, 11117, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-11117

Relationships between tectonic and gravity: case studies in central Apennines

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Large scale tectonic and gravitational deformation can involve considerable portions of a mountainside, guiding its morphologic evolution. These different causes may generate very similar landforms and deposits, making difficult to distinguish between the causative processes and retrieve their descriptive parameters. To solve this ambiguity, field observations should be integrated with more quantitative geological/geophysical data, in an effort to produce the necessary constraints for the static/dynamic modeling of the phenomena. To this purpose, we apply a multidisciplinary approach which starts with the recognition of geomorphologic patterns of recent deformation, then uses the paleoseismological techniques to verify the ground movement in the geological/stratigraphic record, and finally investigates the present deformation rates by means of satellite multitemporal InSAR analysis. We will present applications of this methodology for the Central Apennines, where a strong tectonic deformation signal is sometimes associated with large Deep Seated Gravitational Slope Deformation (DSGSD). We used aerial photo interpretation, SPOT and DEM analysis and field observations, to identify typical tectonic and gravitational geomorphologic patterns. In particular, in correspondence of known active faults located in the Mt. Serrone, Mt. Morrone and Mt. Maiella areas, we recognised clear morphological evidences of DSGSD. We then applied the SBAS multitemporal InSAR technique, and paleoseismologic trenching to quantify the ground deformation rates and the kinematics of the structures. The SBAS technique allowed to measure maximum ground velocities larger than 10 mm/yr, with a 2 mm/yr uncertainty and a spatial resolution of 80 m per pixel. The time series of ground displacement for the last 9 years show a non-linear behaviour for some sites, confirming the presence of active gravitational processes. Considering the high seismic hazard of the study areas, the presence of remains of catastrophic

collapses of DSGSD in the Apennines, and the demonstrated accelerating effect of earthquakes on the deformation rate of DSGSD, we consider necessary to proceed to a systematic investigation and dynamic modeling of these structures.