ANALYSIS OF GEOLOGICAL, SEISMOLOGICAL AND GRAVIMETRIC DATA FOR THE IDENTIFICATION OF ACTIVE FAULTS IN ABRUZZO AREA (CENTRAL ITALY)

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In this study we aim at identifying and better constraining the geometry of the seismogenic structures (active, outcropping and buried fault systems) in the Abruzzo area (central Italy), through an integrated analysis of geostructural, seismic, and gravimetric data. Three thematic data sets have been generated: “faults”, “earthquakes” and “gravimetric” data.

The “faults” dataset consists of a merge of the Plio-Quaternary structures extracted from the available geological and structural maps and from scientific papers. Purple: from sheets n.349, Gran Sasso, n.359, L’Aquila, n.368, Avezzano; n.369, Sulmona, 1:50.000 (CARG project, ISPRA); blue: from the Neotectonic Map of Italy 1:500.000 (Ambrosetti at al., 1987); yellow: from Galadini et al. (2003); red: from ITHACA catalogue (Italy Hazard from Capable Faults, ISPRA project).

The “earthquakes” dataset includes the seismic events extracted from historical and recent available seismic Catalogues: the CPTD4 and CPT11 (Catalogue of Parametric Italian Earthquakes, Rovida et al., 2011) that contains the historical Italian earthquakes and their seismic parameters from year -217 to 2006 A.D.; the ISIDE INGV database that contains all the revised Italian earthquakes recorded by the Italian permanent seismic network and their seismic parameters since 1990 A.D.

The “gravimetric” dataset contains MDA (Multiscale Derivative Analysis, Fedi et al., 2005; 2007) at medium scale, which yields insights about both shallow and deep structures. The lineaments are highlighted MDA maxima (black lines). For each MDA maximum, we evaluated the correlation of the MDA lineament with the local topography, faults and earthquakes.

Three thematic data sets

Faults

The studied area is one of the most active zones from a geodynamic point of view of the Italian Apennines (Calamita et al.2006). The central Apennines consists of a Mioc-Pliocene thrust-and-fold belt that developed as the result of the convergence between the Hercynian European plate and the westward subducted Paleo-Adriatic lithosphere. The present tectonic regime shows that the Abruzzi Apennines are affected by almost two sets of NW-SE to N-S trending normal faults.

The integrated analysis of different datasets to identify active faults

Good correlation between faults, earthquakes and MDA lineaments. The faults are active. In fig. Luco del Marsi Fault.

Good correlation between earthquakes and faults identified by literature, but without MDA maxima. The faults could put in contact two lithologies with a similar density. In fig. Vallalonga Fault (on the left).

Conclusion

We performed a multi-parametric data analysis (by integrating seismic, tectonic and gravity data) in the Abruzzo region, central Italy, with the aim of identifying active faults and investigating the neotectonic activity of these areas. Our study highlighted four possible scenarios as far as the correlation of faults, earthquakes and MDA lineaments is concerned: a) strong correlation between faults, earthquakes and MDA lineaments that suggest that the fault is active; b) strong correlation between faults and MDA maxima that suggests the presence of buried active faults; c) good correlation between earthquakes and faults, but without MDA maxima, that suggests the presence of faults that put in contact two lithologies with similar density; d) good correlation between MDA maxima and earthquakes that suggests the presence of buried faults.

Our results yield new insight into the existence of possible buried active faults, whose knowledge is useful to the definition of the areas’ seismic risk.

Strong correlation between MDA maxima and faults. No correlation with spatial distribution of earthquakes. The faults could be inactive or silent. In fig. Morrone Fault.

References

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