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Gravimetric evidences of active faults and underground structure of Chelif seismogenic basin (Algeria)

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The Chelif basin is known as one of the most seismic active zone in Algeria and the West Mediterranean region. We can cite the El Asnam earthquake which occurred in 10th October 1980 with magnitude of 7.3. It was generated by a NE-SW thrust fault with sinistral component. Until now, there is little information about the active fault which generates this strong activity. Furthermore, no deep geological data are available in this basin. The gravity field is an important resource of information on crustal structure. The aim of this work is to establish the geometry of the major faults in the context of the kinematic of this region.
The gravity data were acquired in different surveys carried out in this area. All these data were in first step, homogenized by reducing data to the "Bouzareah" absolute gravity base. The stations are irregularly distributed and their density of the distribution range among the 1-2 per Km2. This distribution however, is sufficient for our purposes.

The data were uniformly reduced to Bouguer anomaly, at mean sea level, and topographic reduction was computed with uniform density of 2.400 Kg/m3 and width of 20 km. The Bouguer gravity map shows ENE-WSW anomalies trending with values increasing from SSE to NNW. The E-W positive anomalies near the coast reach 70 mGals and are mainly due to the effect of the oceanic nature of the Mediterranean crust. In the South, we note the positive effect of the "Ouarsenis" Mountain. The central part of the map corresponding to the Chelif basin is characterized by closed low anomalies. The results obtained from various filtered maps (horizontal derivatives, upward continuation) of the gravity data, were used to generate a structural map of the studied area. The continuous wavelet transform method gives a 3-D model of the region. The resulting structural map confirms the existence of several faults, previously identified from geological studies, and give some additional information about others. Whereas, the obtained results from the 3D model point out a great number of deep or near-surface faults that had remained unknown until the present time.

This study reveals also two principal geological structural directions, the first one is NNE-SSW whereas the second one is of conjugate direction. The good agreement between the gravity anomaly and the spatial distribution of earthquakes suggests that some of these potential field lineaments are probably active faults.