Geophysical Research Abstracts
Vol. 17, EGU2015-10243, 2015
EGU General Assembly 2015

Crustal structure and gravity anomalies beneath the Rif, northern Morocco: implications for the current tectonics of the Alboran region

Carole Petit (1), Laetitia Le Pourhiet (2), Bruno Scalabrino (1), Michel Corsini (1), Mickael Bonnin (1), and Adrien Romagny (1)

(1) Geoazur, CNRS-UNS-IRD, Valbonne, France (petit@geoazur.unice.fr), (2) ISTEP, UPMC-CNRS, PARIS, France(laetitia.le_pourhiet@upmc.fr)

We analyze Bouguer anomaly data and previously published Moho depths picked from receiver functions in order to determine the amount of isostatic compensation or un-compensation of the Rif topography in northern Morocco. We use Moho depth variations extracted from receiver function analyses to predict synthetic Bouguer anomalies that are then compared to observed Bouguer anomaly. We find that Moho depth variations due to isostatic compensation of topographic and/or intracrustal loads do not match Moho depth estimates obtained from receiver function analyses. The isostatic misfit map evidences excess crustal root as large as 15 km in the western part of the study area, whereas a "missing" crustal root appears east of 4.3°E. Given crustal thickness provided by reciever function data, we estimated the amount of "missing" topography (in a local isostatic sense) in the Western Rif at 1000±500 m depending on the assumed crust-mantle density contrast, i.e. twice to four times lower than the actual Rif highest elevation (>2000m). Therefore, without this negative dynamic effect, the Rif topography would be higher by 25% to 75% compared to its actual elevation.

This excess root/ missing topography correlates with the presence of a dense mantle lid, the noticeable south-westward drift of the Western Rif area, and with a current surface uplift.Integrating gravity data, crustal thickness from reciever functions, seismic tomography, GPS and geologic models, we propose that local thickening of the crust corresponds to the dynamic response to the delaminated mantle lid that is progressively detaching westward or south-westward from the overlying crust.

In this model, provided the lower crust is sufficiently buoyant and weak, the inward flow of lower crust towards the mantle hinge can cause a positive isostatic topography that is larger than the negative dynamic topography created by the sinking mantle lid. According to this hypothesis, the long wavelength Rif topography can be decomposed into two components: a positive isostatic response (uplift) due to the drag of lower crust beneath the Internal Rif and a negative dynamic component due to the downwelling of the continental mantle.