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Forward Modelling of Bouguer Anomalies along a transect of the Southern Apennines and the Tyrrhenian back-arc basin.

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Abstract

In the present study, starting from original measurement stations, we created the Bouguer anomaly map of Southern Italy with a reduction density of 2670 kg m^{-3}. We perform a regional gravity modelling at crustal scale along the trace of the CROP-04 (on-shore) and MB6 (off-shore) deep seismic reflection profiles crossing the Southern Apennines and the Southern Tyrrhenian Sea. Along the 320 km-long modelled profile, we investigate crustal-scale sources for the observed gravity anomalies.

After a compelling review of the published Moho geometries in the area, that were retrieved from either active or passive seismic methods, we test them in the observed gravity field through forward modeling of the Bouguer gravity anomalies. The comparison between the different Moho interpretations shows that the steepness of the subducting slab, the position of the step between the western (Tyrrhenian) and the eastern (Adriatic) Moho and Moho depth represent the main features influencing the observed Bouguer anomalies at crustal scale.

Finally, we provide a best-fitting model across both onshore and offshore areas. In the proposed best-fitting model, the wide wavelength and strong regional Bouguer anomalies correlate with the geometry of the Moho discontinuity and deep tectonic structures. On the other hand, the small-amplitude oscillations of the gravity anomalies were attributed to the low-density values of the Pliocene-Quaternary deposits both on- (e.g. the Bradanic trough) and off-shore (e.g. recent deposits in the Tyrrhenian sea bottom). Gravity minima correspond to the crustal doubling underneath the Southern Apennines where the Tyrrhenian Moho (~27 km depth) overlies the deeper Adriatic Moho (~50 km depth). The positive trend of the observed anomaly toward NE is related to the shallowing of the Adriatic Moho to depths of ~28 km in the Adriatic. Similarly, towards SW, the observed anomaly follows a positive trend towards the maxima located in the Central Tyrrhenian Sea. We model this trend as representative of crustal thinning and shallowing to values of ~12 km depth of the Tyrrhenian Moho. We also model a crustal transition from geometries and density values typical of a continental crust in the Adriatic domain towards a more

oceanic structure and composition in the Tyrrhenian domain. This crustal model locates the westward flexure of the Adriatic Moho, mimicking the subduction of the Adriatic lithosphere beneath the Peri-Tyrrhenian block and locates step between the western (Tyrrhenian) and the eastern (Adriatic) Moho beneath the Apennines range.

The resulted gravity forward model provide contributions to the tectonic settings understanding of the area by providing a robust crustal model ranging from the Tyrrhenian Sea to the Apulian foreland.

Finally, we believe that the proposed model can serve as a starting point for future studies investigating the upper crustal geometries in the area and addressing open questions about its relations with seismicity distribution.