EGU22-12634
https://doi.org/10.5194/egusphere-egu22-12634
EGU General Assembly 2022
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# Lithospheric architecture across the Zagros Orogen as sensed by the integration of isostatic analysis, gravity inversion, and seismic tomography

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Regional-scale geophysics is a central tool in improving the knowledge on geologic and tectonic units and on their structural relationships in a complex convergent setting. Harmonization, reduction, and integrated modelling of data such as gravity models and seismic tomographies allows to constrain the geometry and properties of geologic bodies at depth and to test hypotheses on their evolution. In the context of an interdisciplinary project involving multiple Italian institutions, "Intraplate deformation, magmatism and topographic evolution of a diffuse collisional belt: Insights into the geodynamics of the Arabia-Eurasia collisional zones", we present the result of an integrated analysis across the Zagros Orogen. It represents the most active collisional zone in the Iranian plateau, consequent to the NE-ward subduction of the Neo-Tethyan Ocean.

We integrate models of surface topography and gravity through isostatic analysis, i.e. by enquiring the relationship connecting the two observables – the former expressing the load on the lithosphere, the latter a proxy of the crust-mantle boundary undulations. We developed and employed two independent methods, one relying on plate flexure and providing estimates on the spatial distribution of the integrated rigidity of the lithosphere, the other a non-parametric residualization method, based on topo-gravity regression analysis (Pivetta and Braitenberg, 2020). We refine their estimates by including the additional information provided by locally available models of sedimentary infills, in order to correct the loads, and by seismological Moho depth data (e.g. Gvirtzman et al., 2016), to mitigate ambiguities in the crustal thickness inferred from gravity inversion. This analysis allowed the isolation of different rigidity domains - which reflect the assemblage of tectonic provinces and the shallow expression of deep structures - and to obtain the anomalous quantities (e.g. residual gravity disturbance, residual topography) which the initial model does not explain. These include intra-crustal loads, which correlate with areas affected by magmatism and can provide further constrain on the geometry of buried structures.

We then improve these estimates with the data derived from seismic tomographies, including the

recent shear-wave velocity model by Kaviani et al. (2020). By employing a velocity-to-density conversion strategy and gravity forward modelling, we show the impact of prior reduction of gravity data for upper-mantle signal sources. In addition to that, we use tomography-derived temperature modelling to estimate the variations of lithospheric strength profiles throughout the study area, comparing it with the independently estimated flexural rigidity.

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