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Crustal deformation evidences for viscous coupling and fragmented lithosphere at the Nubia-Iberia plate boundary (Western Mediterranean)

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A spatially dense crustal velocity field, based on up to 15 years of GNSS observations at more than 380 sites and extensively covering the Iberian Peninsula and Northern Africa, allow us to provide new insights into two main tectonic processes currently occurring in this area. We detected a slow large-scale clockwise rotation of the Iberian Peninsula with respect to a local pole located closely to the northwestern sector of the Pyrenean mountain range (Palano et al., 2015). Although this crustal deformation pattern could suggest a rigid rotating lithosphere block, this model would predict significant shortening along the Western (off-shore Lisbon) and North Iberian margin which cannot totally ruled out but currently is not clearly observed. Conversely, we favour the interpretation that this pattern reflects the quasi-continuous straining of the ductile lithosphere in some sectors of South and Western Iberia in response to viscous coupling of the NW Nubia and Iberian plate boundary in the Gulf of Cádiz. Furthermore, the western Mediterranean basin appears fragmented into independent crustal tectonic blocks, which delimited by inherited lithospheric shear structures and trapped within the Nubia-Eurasia collision, are currently accommodating most of the plate convergence rate. Among these blocks, an (oceanic-like western) Algerian one is currently transferring a significant fraction of the Nubia-Eurasia convergence rate into the Eastern Betics (SE Iberia) and likely causing the eastward motion of the Baleares Promontory. Most of the observed crustal ground deformation can be attributed to processes driven by spatially variable lithospheric plate forces imposed along the Nubia-Eurasia convergence boundary. Nevertheless, the observed deformation field infers a very low convergence rates as observed also at the eastern side of the western Mediterranean, along the Calabro Peloritan Arc, by space geodesy (e.g. Palano, 2015).

References

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