Bayesian estimation of surface strain rates in the peri-Adriatic, Balkans and Aegean region

Marianne Métois*[1], Cécile Lasserre[1], Aimine Meridi[1], Maxime Henriquet[2], and Thomas Bodin[3]

[1]LGL-TPE – Univ Lyon, UCBL, ENSL, UJM, CNRS, LGL-TPE, F-69622, Villeurbanne, France – France

[2]Géoazur – Université Côte d'Azur, IRD, CNRS, Observatoire de la Côte d'Azur, Géoazur – France

[3]Institute of Marine Sciences (ICM-CSIC), Spain – Espagne

Résumé

The tectonics of the Eastern Mediterranean is governed by the convergence of the Eurasian, Nubian and Anatolian plates and characterized by the highest seismic hazard in Europe. Still, the junction between Nubia and Eurasia near the northwestern end of the Hellenic subduction remains poorly documented, and the transition zone between the NAF and the Gulf of Corinth is characterized by more distributed deformation.
Over the last decades, GNSS measurements have revealed that the Adriatic promontory moves slightly differently from Nubia, indenting the Alps and the Dinarides. Historically, the Balkan region has been considered stable, experiencing negligible strain. However, recent GNSS data show that the entire peninsula undergoes significant deformation resulting in a clockwise rotation towards the Aegean domain. Such deformation is outlined by recent earthquakes in Croatia (Petrinja and Zagreb earthquakes, 2020) and Albania (Durrës earthquake, 2019). The style, magnitude, and spatial extent of the deformation across the Dinarides and Albanides remain poorly constrained due to sparse GNSS measurements and the low strain rates expected in these regions.

In this study, we invert for the strain rate tensor over Italy, the Balkans and continental Greece using (i) the combined GNSS velocity field by Pina-Valdes et al. 2021 and (ii) the Bstrain code (Pagani et al. 2021) which employs a Bayesian transdimensional approach. Our analysis produces probabilistic continuous maps of the strain rate tensor invariants, vorticity, and interpolated horizontal velocities. We assess these results through statistical indicators derived from their probability density functions (PDFs), and make them openly accessible https://bstrainplotter.univ-lyon1.fr, ensuring transparency and accessibility according to the FAIR principles.
We delimit the various tectonic styles based on the PDFs of the principal directions of the strain rate tensor and highlight key features through representative cross-sectional profiles. This provide insights, for example, on the along-strike segmentation of the strain rates along the Apennines, the continuous arc-shaped compressive limit to the north and east of the eastern Alps, and a marked zero divergence line continuous from the Albanides region to the Hellenic subduction zone. We present first attempt to derive strain rates in this region using InSAR velocities from the Balkans FLATSIM project.

*Intervenant

Mots-Clés: deformation, intraplate, GNSS, strain rates, Mediterannean