

Constraint of Active Deformation between the African Platform and the Maghrebian Thrust Belt: Current Plate Motion from Permanent GNSS data in Algeria



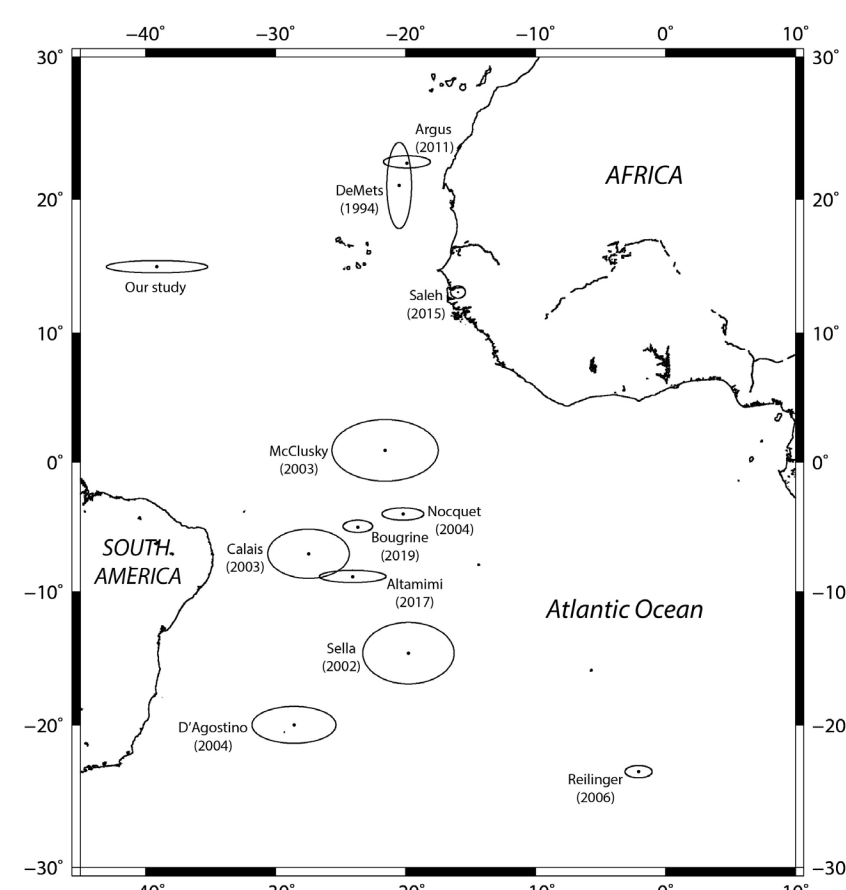
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Summary

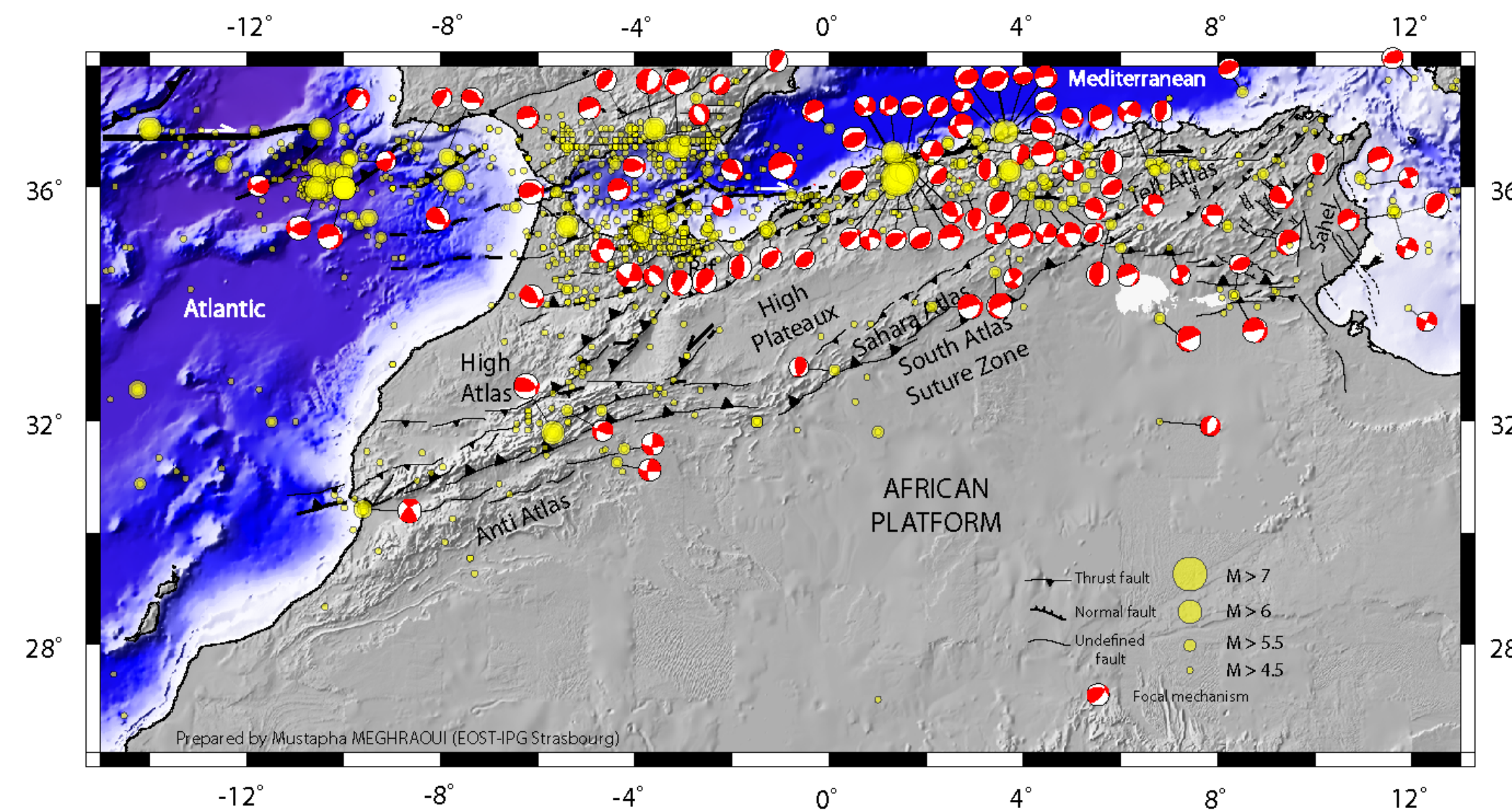
The kinematic of tectonic motions between the African (Sahara) platform and the Maghrebian thrust belt remained unexplored since the onset of space geodesy. Here, we use data of 6 permanent GNSS stations located north and south of the Atlas thrust belt in Algeria to constrain shortening and transpression at the tectonic boundary [1]. The GNSS data are processed using Gamit-GlobK and results show tectonic motions with a predominant 5 to 6 mm/yr velocities trending NNW-SSE to NW-SE (westward) in the Sahara Platform. The GPS velocities show uniform trend in the African platform from which we obtain 0.5 to 1.0 mm/yr convergence across the south Atlas suture zone. The intraplate convergence is attested by the moderate but permanent seismic activity at the tectonic boundary. The south Atlas suture zone constitutes the limit between African (Sahara) shield domain considered as a stable continental interior and the Sahara Atlas that belong to the Alpine orogeny. The tectonic boundary is marked by a E-W to ENE-WSW, en echelon fold belt system with deformed Plio-Quaternary formations to the North and flat laying Mesozoic and Tertiary sedimentary units south of the suture zone

Pole of rotations

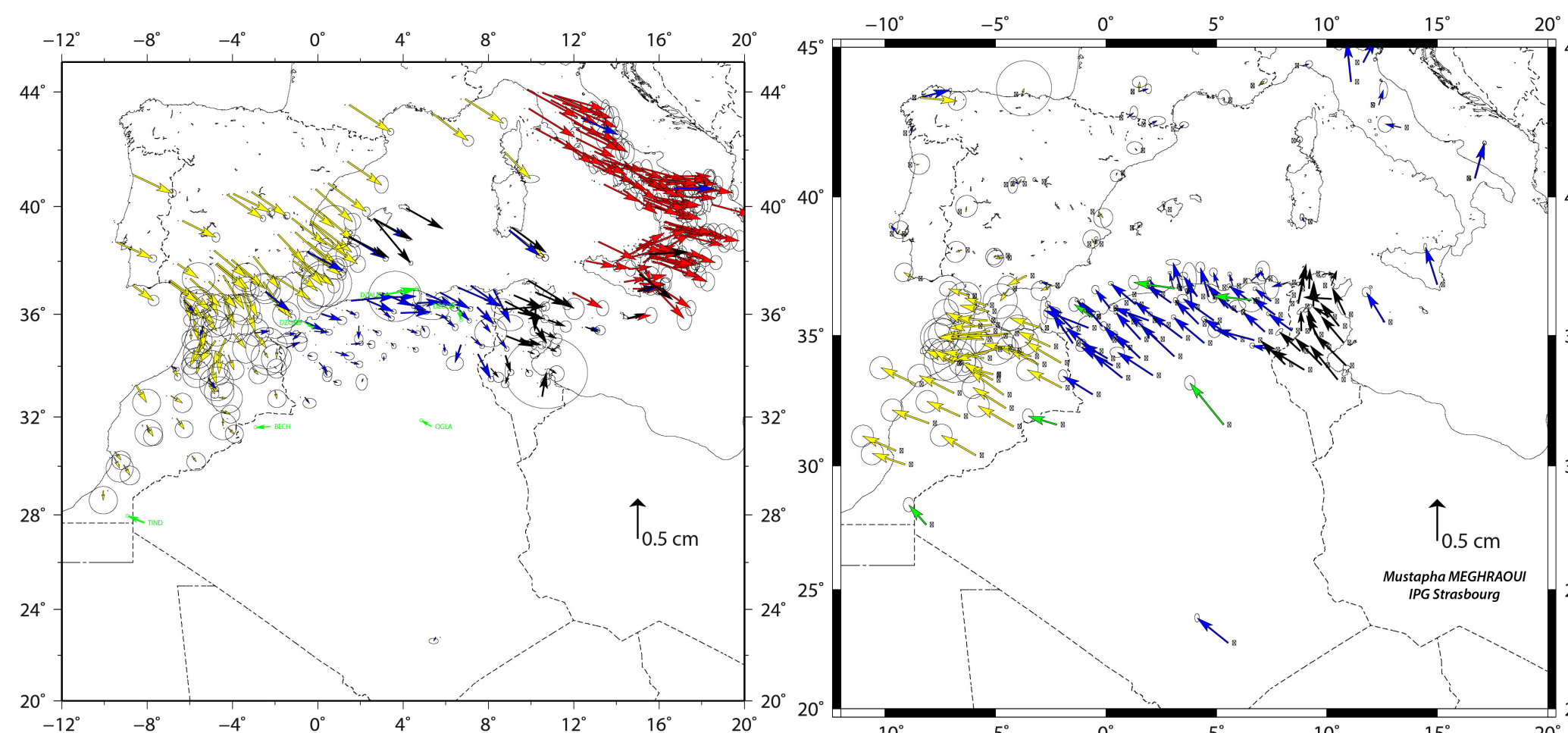


Euler poles computed for the GPS results of the Maghreb region, Uncertainty ellipses show 95% confidence limits (references in [3]).

Seismotectonics



Seismotectonic framework of the Maghrebian Atlas Thrust Belt and neighboring regions as an excerpt of the Seismotectonic Map of Africa [2]. Seismicity is from ISC and focal mechanisms are CMT-Harvard. Background topography is Gebco (Smith and Sandwell, 1997).



GPS velocities with Nubia fixed (left) and Eurasia fixed (right) of the Maghreb region and west Mediterranean regions. Uncertainty ellipses show 95% confidence limits. Black GPS Tunisia [3], Blue GPS Algeria1 [4], Yellow GPS Morocco [5], Red GPS Italia [6], Green Algeria2 [this work]. The permanent green GPS data and results are obtained from the network in Algeria; the accessed date are from 2013 to 2019.

Conclusion

The differential shortening velocity between the southern and northern GPS results that reaches 4 to 5 mm/yr in Tunisia, 3 to 4 mm/yr across Algeria, and 2 to 3 mm/yr across Morocco. The anti-clockwise rotation of GPS velocities is consistent with the current Eu-Nu plate motion obtained from high-resolution magnetic reversal and plate circuit model [7]. The estimated shortening between the African Platform and the Sahara Atlas is < 1 mm/yr. The interplate – intraplate active deformation appears to be linked to geological domains characterized by tectonic blocks that include the High Atlas and Sahara Atlas with moderate seismicity, the aseismic High Plateaux, the Middle Atlas in Morocco and Central Atlas – Sahel domains in Tunisia, and the Rif – Tell Atlas. Large scale N-S to NW-SE shortening combined with E-W trending right-lateral slip observed across the Atlas Mountains imply 10 to 20 nanostrain/yr. of transpression deformation.

References

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Acknowledgements

This research is funded by the TELLUS project “Geodynamics and neotectonic in North Africa”, by the EOST-Institut de Physique du Globe Strasbourg (CNRS - UMR-7516) - France, and by the UNESCO-IGCP-659 Project “Seismic Hazard and Risk in Africa”. We are thankful to Patrice Ulrich for his assistance in processing GPS data.