

Constraint of active deformation and transpression tectonics along the plate boundary in North Africa

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Abstract



New GPS data and seismotectonic results in the Maghrebian thrust-and fold range

Neotectonic and seismotectonic analysis:

- Quaternary faulting and folding with stress distribution and shortening directions
- Seismotectonic characteristics (earthquake moment tensors) rotation obtained
- Model of small tectonic blocks in the Sahara and Tell Atlas.
- Paleomagnetic results with $2^\circ - 4^\circ/\text{Myr}$ clockwise rotation of small blocks

Continuous GPS data

- Network in Morocco from 1999 to 2006
- REGAT network in Algeria since 2007
- Network in Tunisia from 2014 to 2018
- Most recent GPS data in southern Spain and southern Italy

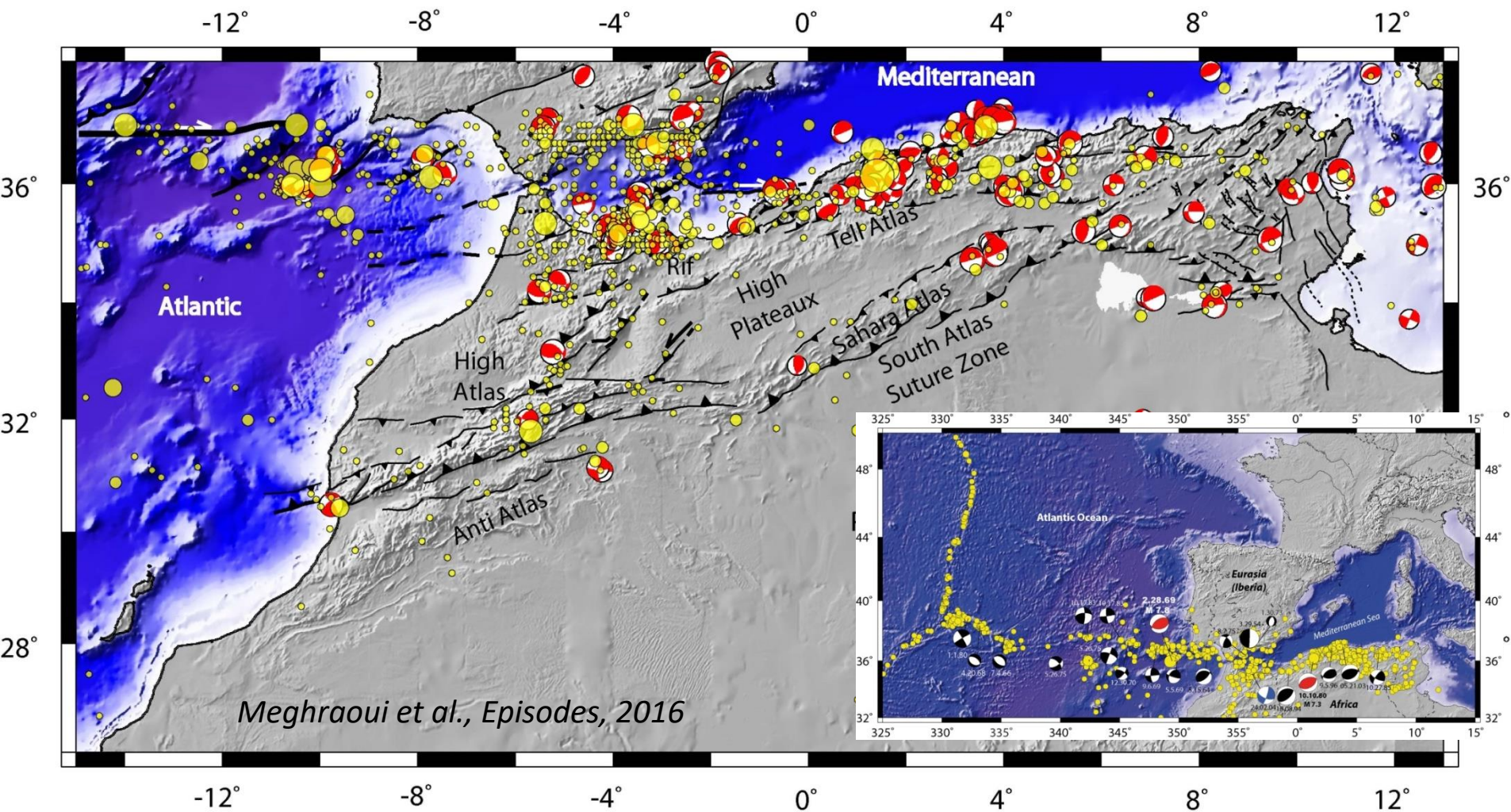
Main results

Oblique convergence and transpression along the plate boundary (western Mediterranean)

The NW-SE to NNW-SSE 5 ± 1.5 mm/yr convergence velocity
and strain distribution of the Maghrebian tectonic blocks



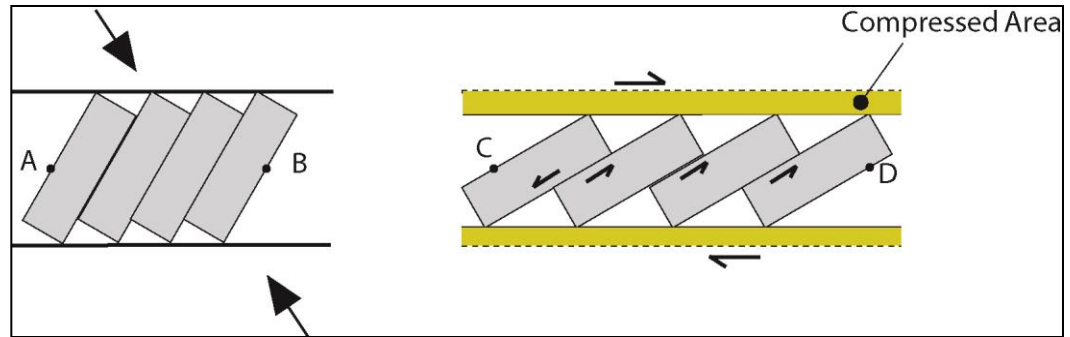
Africa-Eurasia Plate Boundary and Background Seismotectonics



Kinematic Model of Oblique Convergence and Transpression

(Meghraoui et al., 1996; Meghraoui & Pondrelli (2012))

Bookshelf Model :

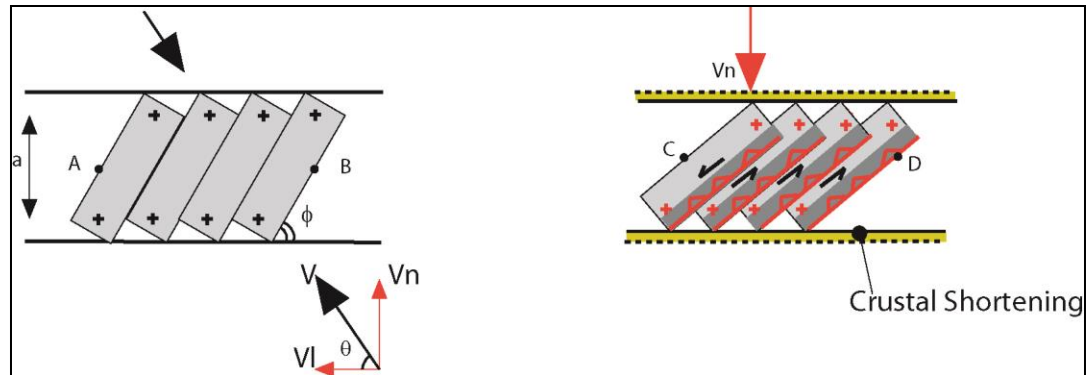


Rotation (Lamb, 1987):

$$R = \frac{W}{2} [(\cos 2\phi + \tan \theta \sin 2\phi) - 1]$$

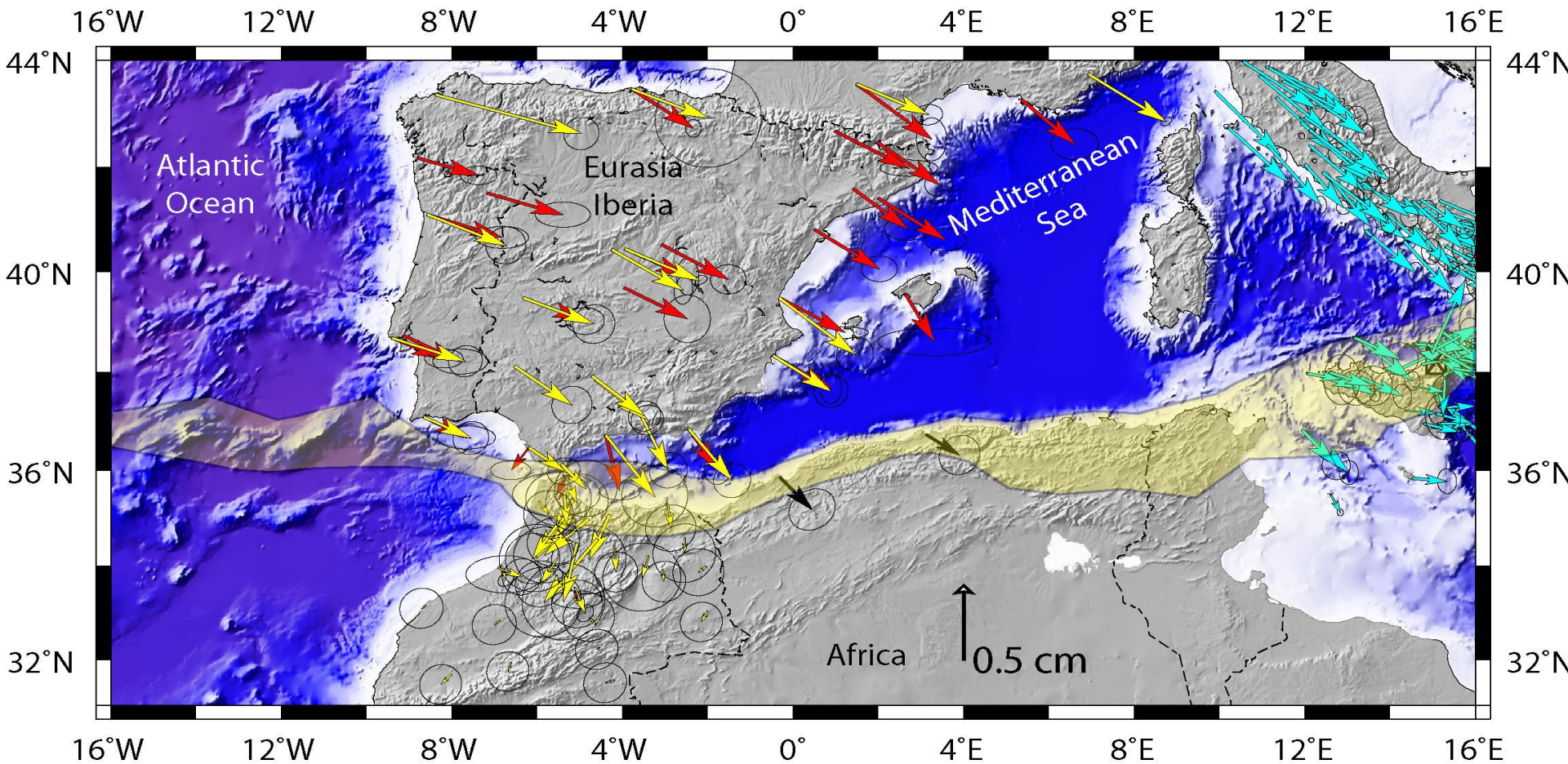
$$W = \frac{V \cos \theta}{a} \quad (\text{strain rate})$$

Pinned Model:
(Jackson & Molnar, 1990)



Geodynamics of North Africa (Pre-2019 situation)

(Meghraoui & Pondrelli, 2012)



GPS solutions for Africa fixed:

black: Anzidei et al., (2001); red: Fernandes et al., 2007;

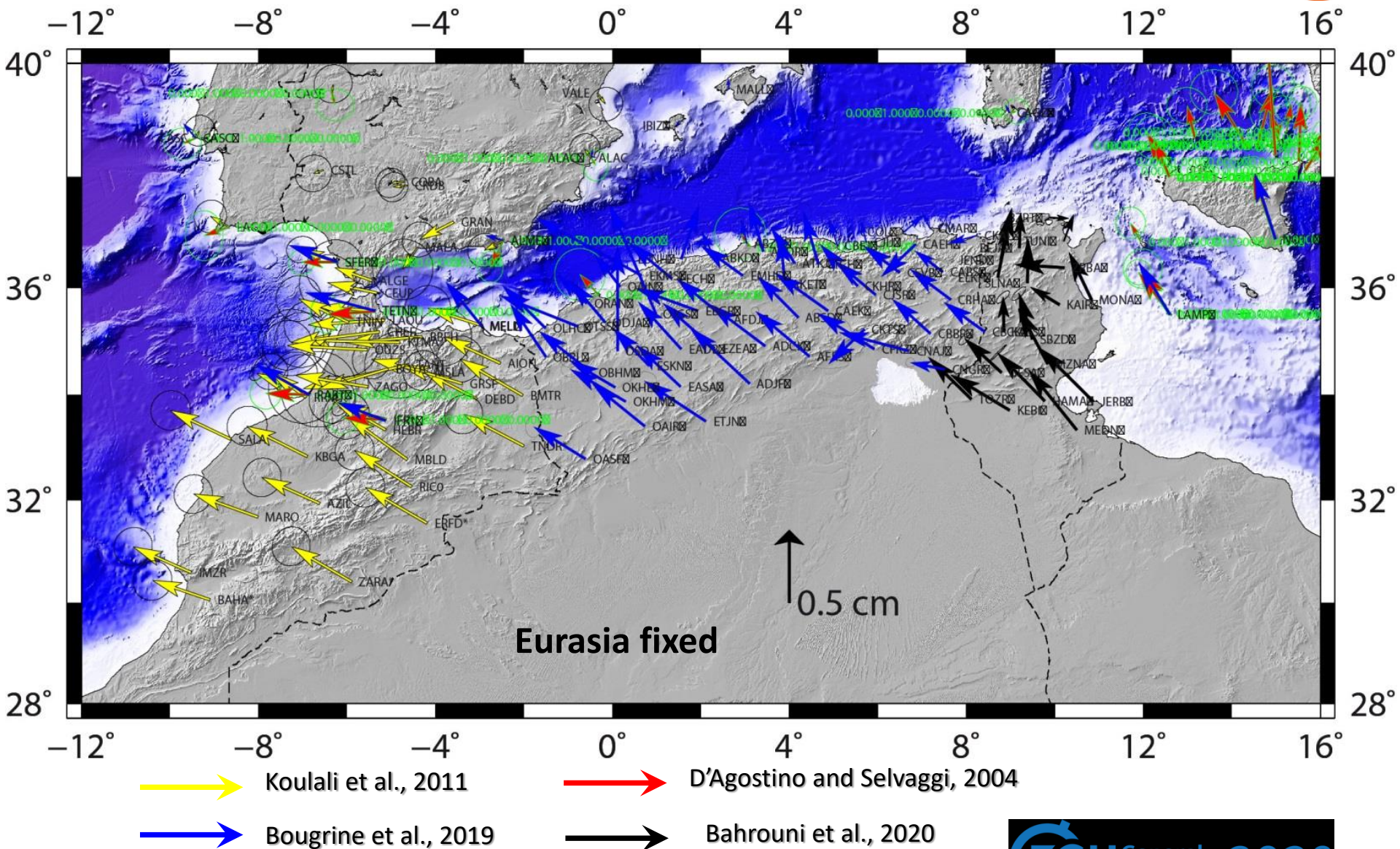
yellow: Vernant et al., 2010; cyan: Serpelloni et al., 2010.

Compiled in Meghraoui & Pondrelli, 2012



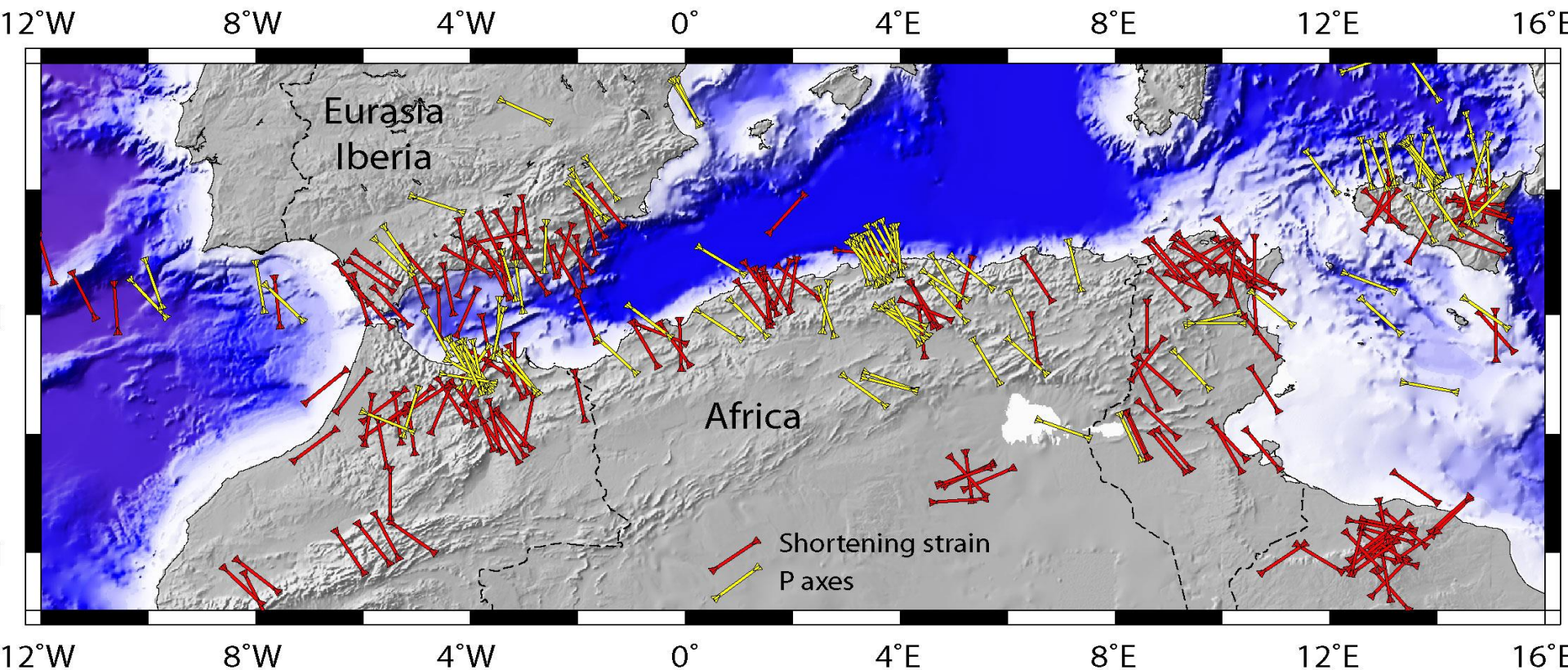
Geodynamics of North Africa revisited

(Meghraoui et al., in preparation)

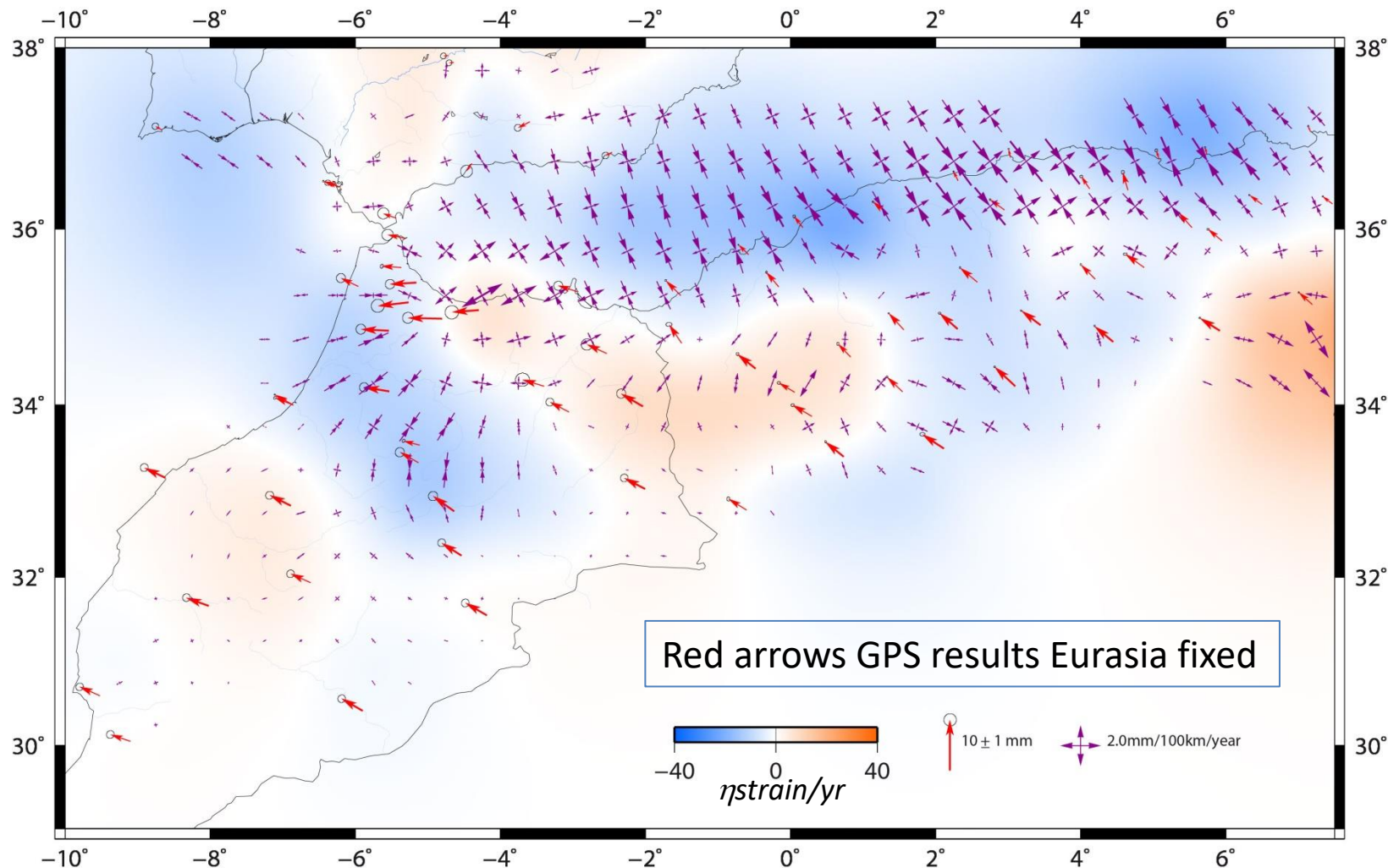


Strain distribution (neotectonic) at the Plate Boundary

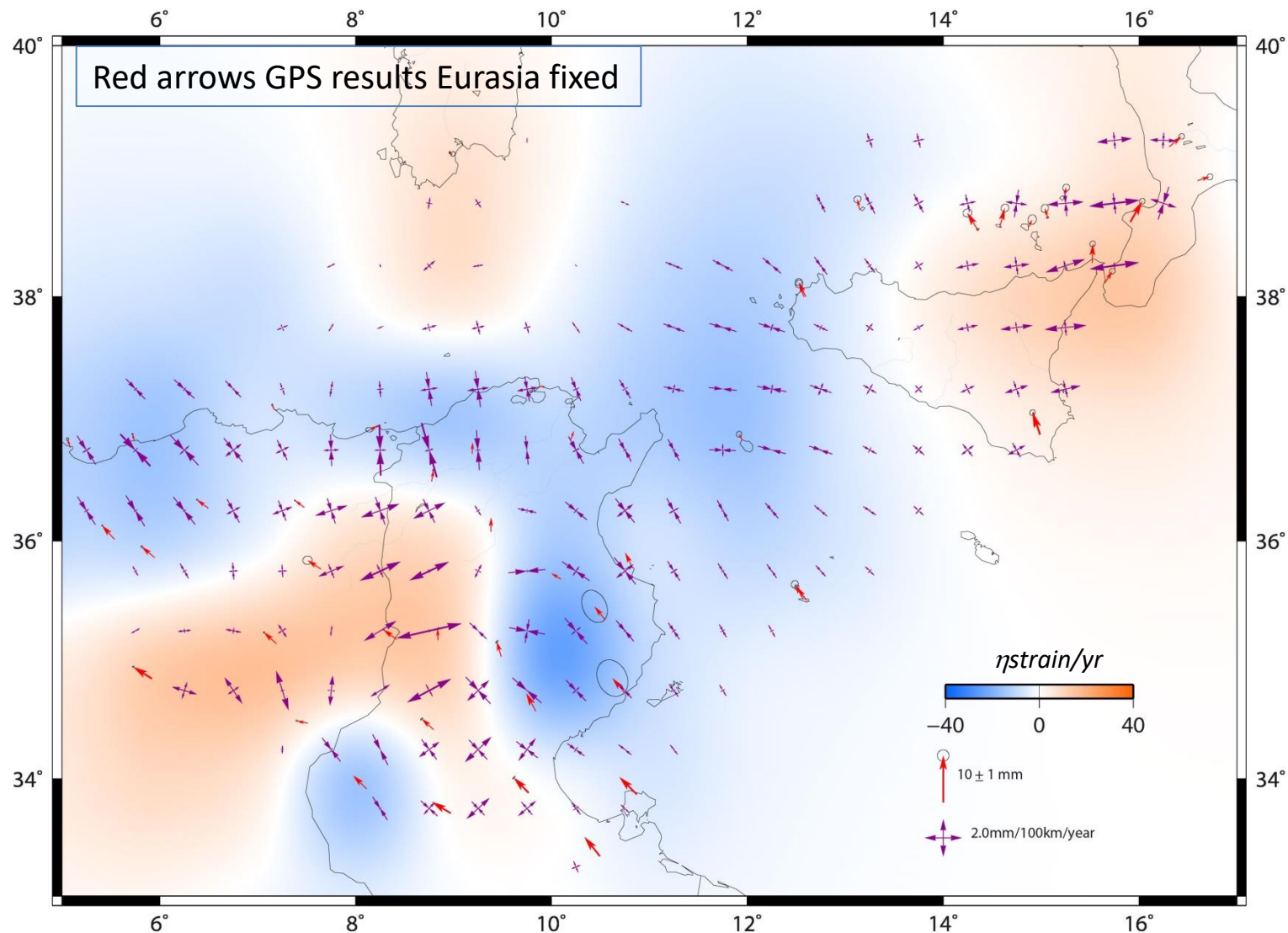
Meghraoui & Pondrelli, 2012



Strain distribution at the Plate Boundary (red arrows GPS data Eurasia fixed)



Strain distribution at the Plate Boundary (red arrows GPS data Eurasia fixed)



CONCLUSION AND PERSPECTIVES

- New geodynamics of the Maghrebian Thrust range
- Comprehensive seismotectonics
- Active tectonics and fault kinematics
- GPS velocities across the Atlas Thrust belts
- Strain distribution from neotectonic data
- Strain distribution from geodetic (GPS) data

Future tasks

- Regional active tectonics and geodynamic models
- Implications for the Seismic Hazard Assessment