Present Day Geokinematics of Central Europe

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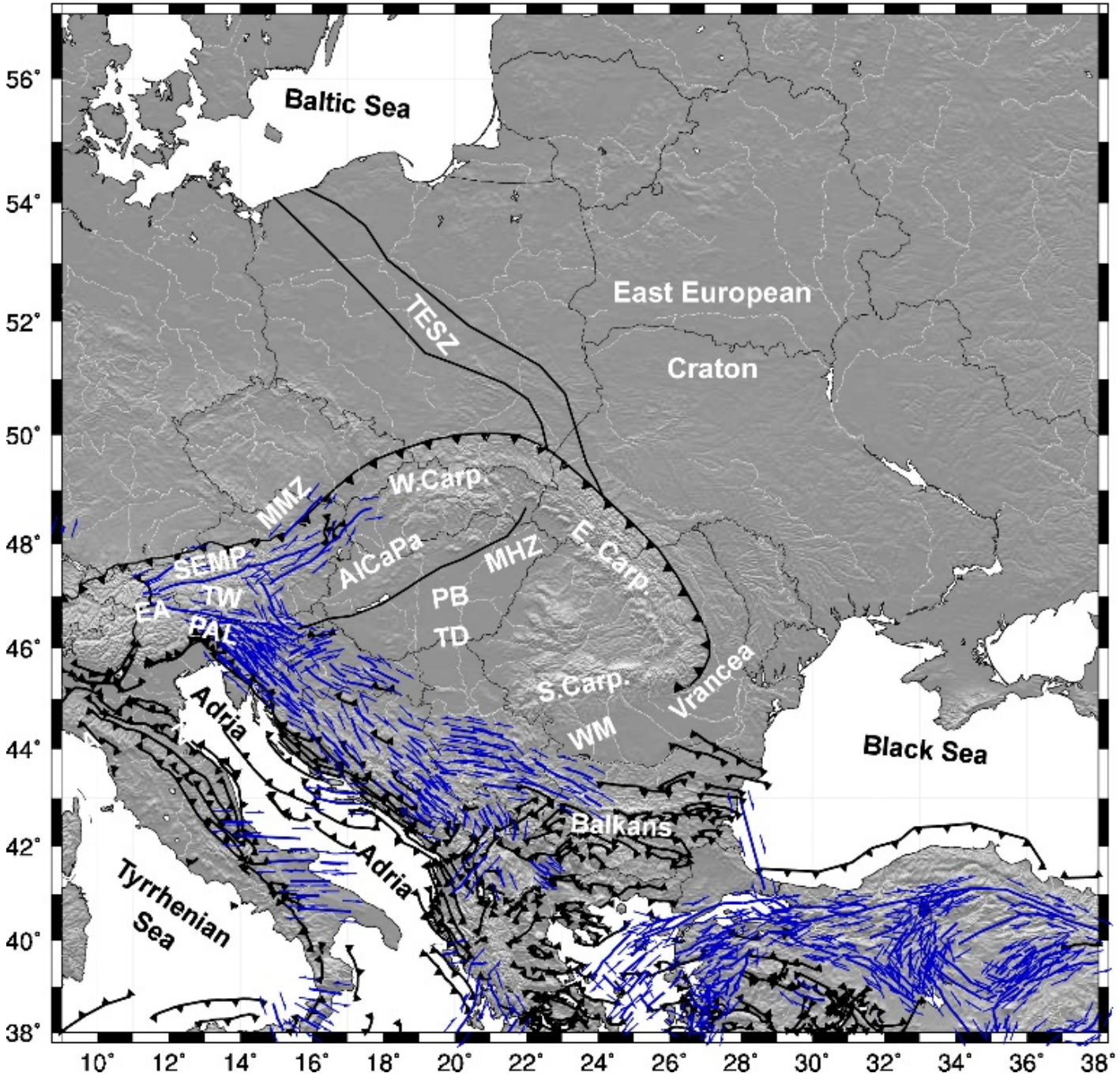
Main tectonic features:

Convergence of Adria to European Platform results in a Eastwards extrusion towards the Pannonian basin acting as an unconstrained margin

The Pannonian basin is bordered by the Carpathian belt and includes the AlCaPa and TD terranes, separated by the MHZ. Vrancea is seismically active at depth

TESZ: prominent lithospheric structure separating the ancient EEC from the younger European plate

Hellenic Arc – South Balkans: extensional regime related to anticlockwise rotation of Anatolia. Decouplig from NE Adria-Dinarid convergence through the Kephalonia Transform Fault



CEGRN: Central European Geodynamic Research Network

- Consortium among Central European Research Institutions to do regular GPS measurement campaigns in Central Europe
- Started operating in 1994 (one of the first in Europe)
- In 2017 1247 permanent GNSS sites were participating
- Strong interaction with EUREF: common sites for network alignment, processing standards, logsheets/metadata, Memorandum of Understanding
- Web page: http://cegrn.cisas.unipd.it/CEGRN/default.htm

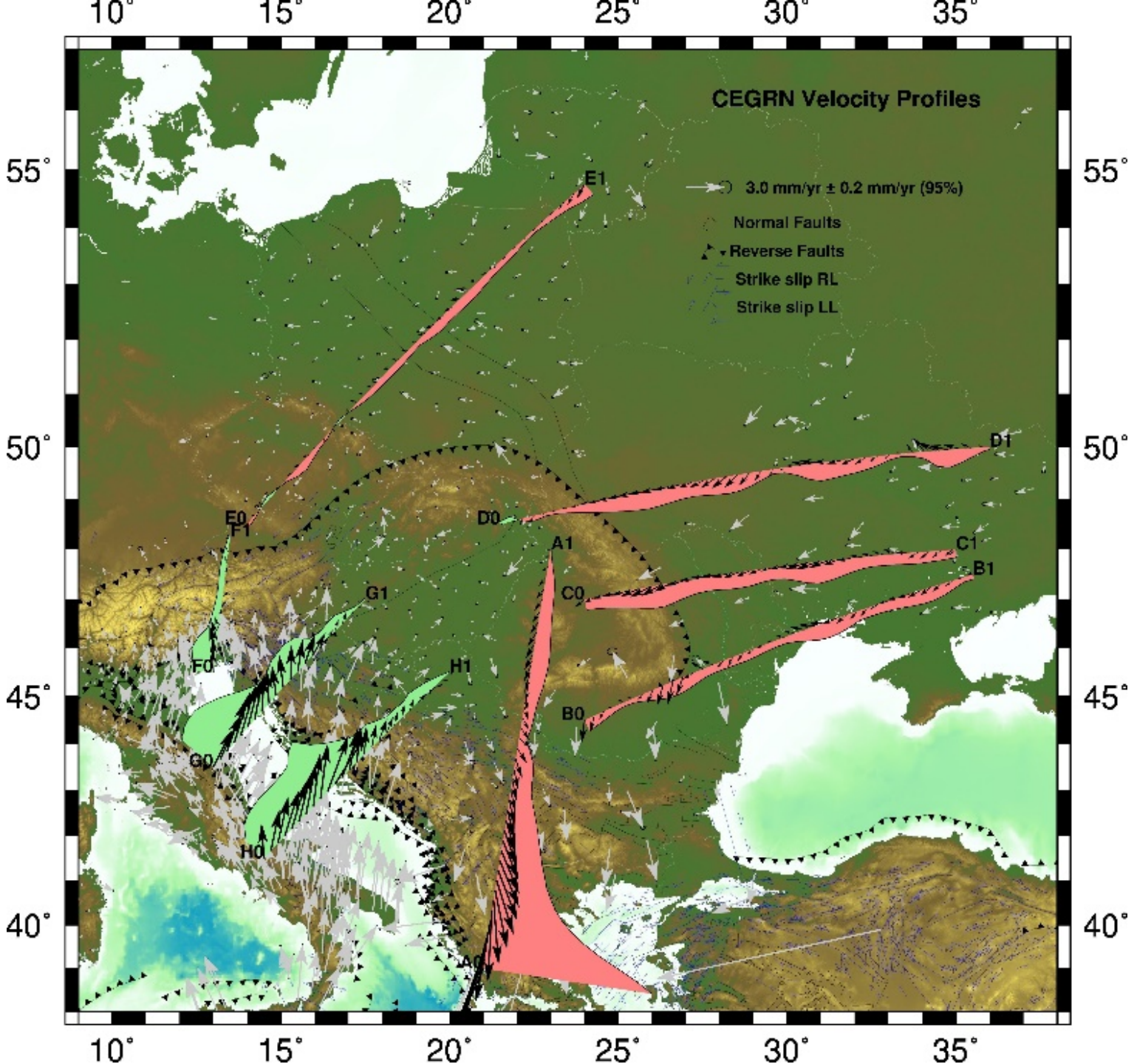
Latest CEGRN velocity field 1996-2017 is IGb08/IGS14 compliant (orbits, clocks, antenna models)

Block adjustment of the full network → velocities defined in a unique frame

Profiles are drawn across interesting structures well populated by velocity data

Red: positive velocity gradient (→extension)

Green: negative velocity gradient (→ compression)



Section from the Bohemian massif to the Vienna basin across the MMZ

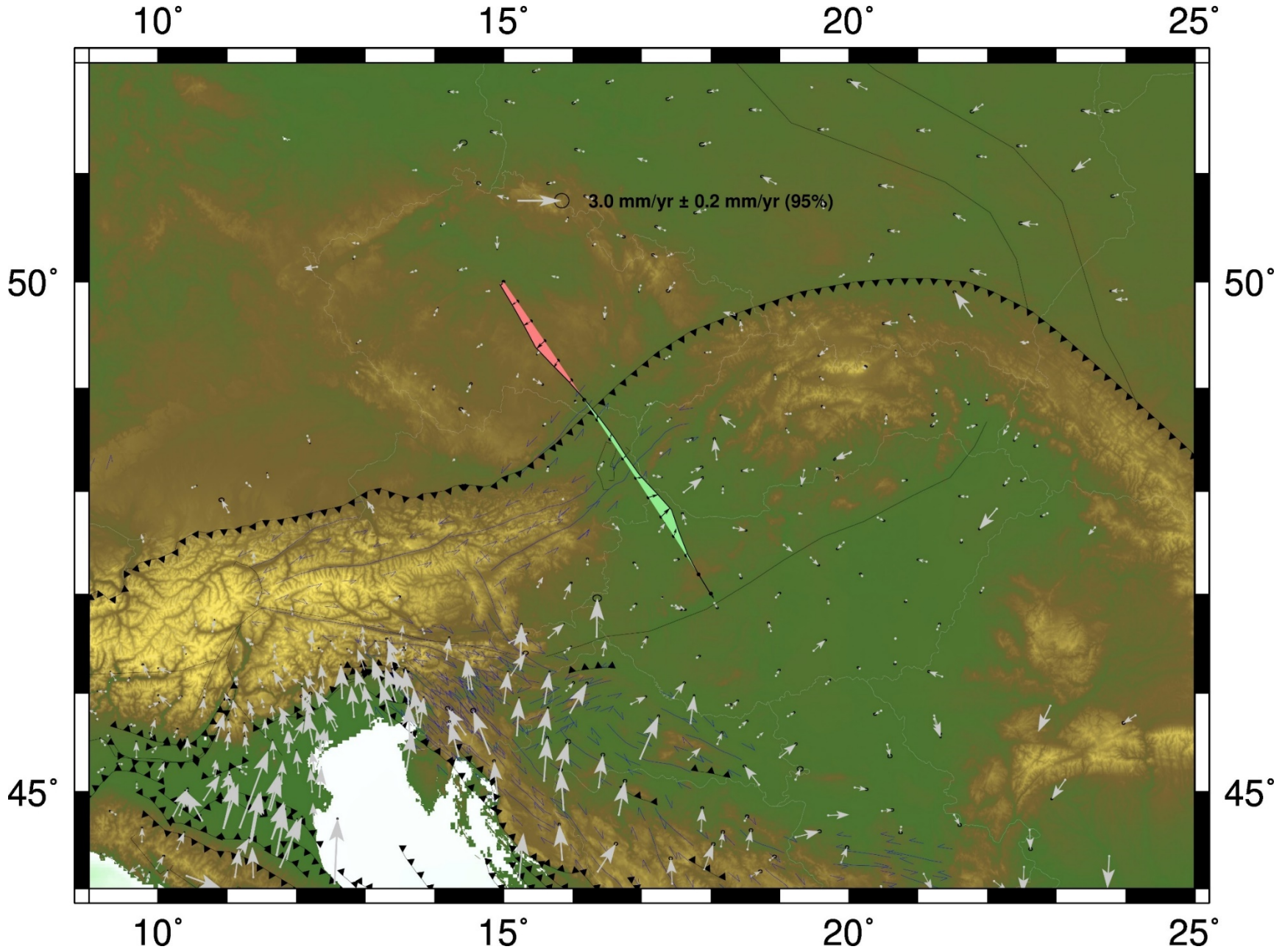
Velocity projected orthogonally to the profile changes sign:

Displacements:

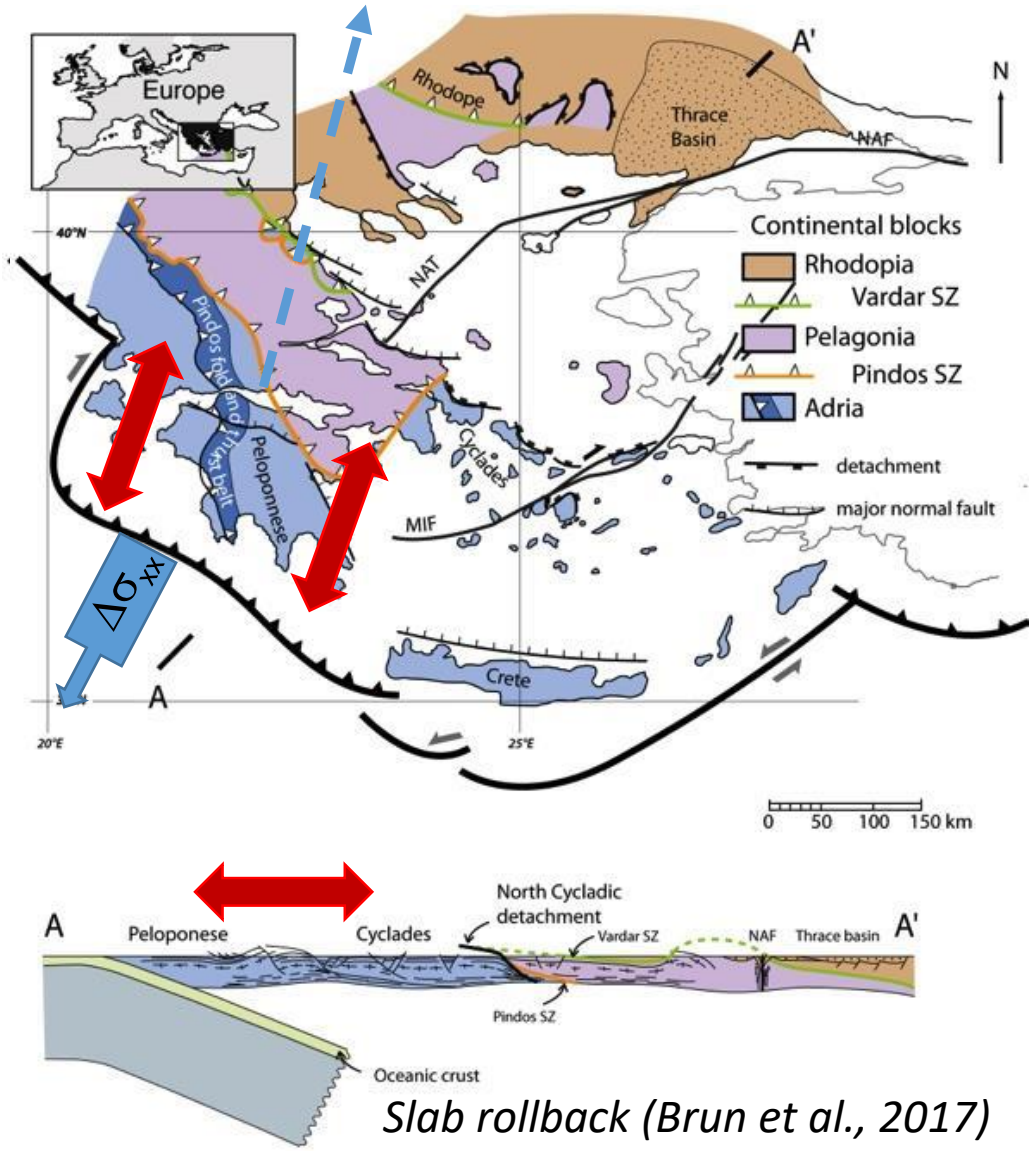
Green →NE

Red →SW

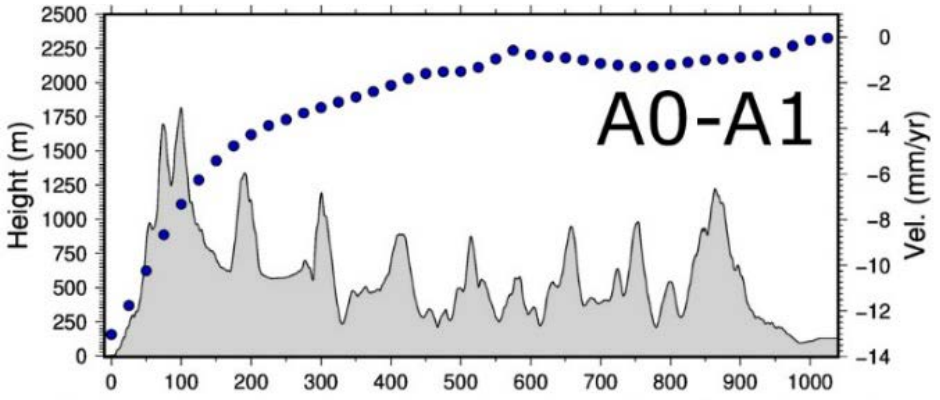
Extrusion of the Southern Alps



Andersonian fault model of extensional strain



Slab rollback (Brun et al., 2017)



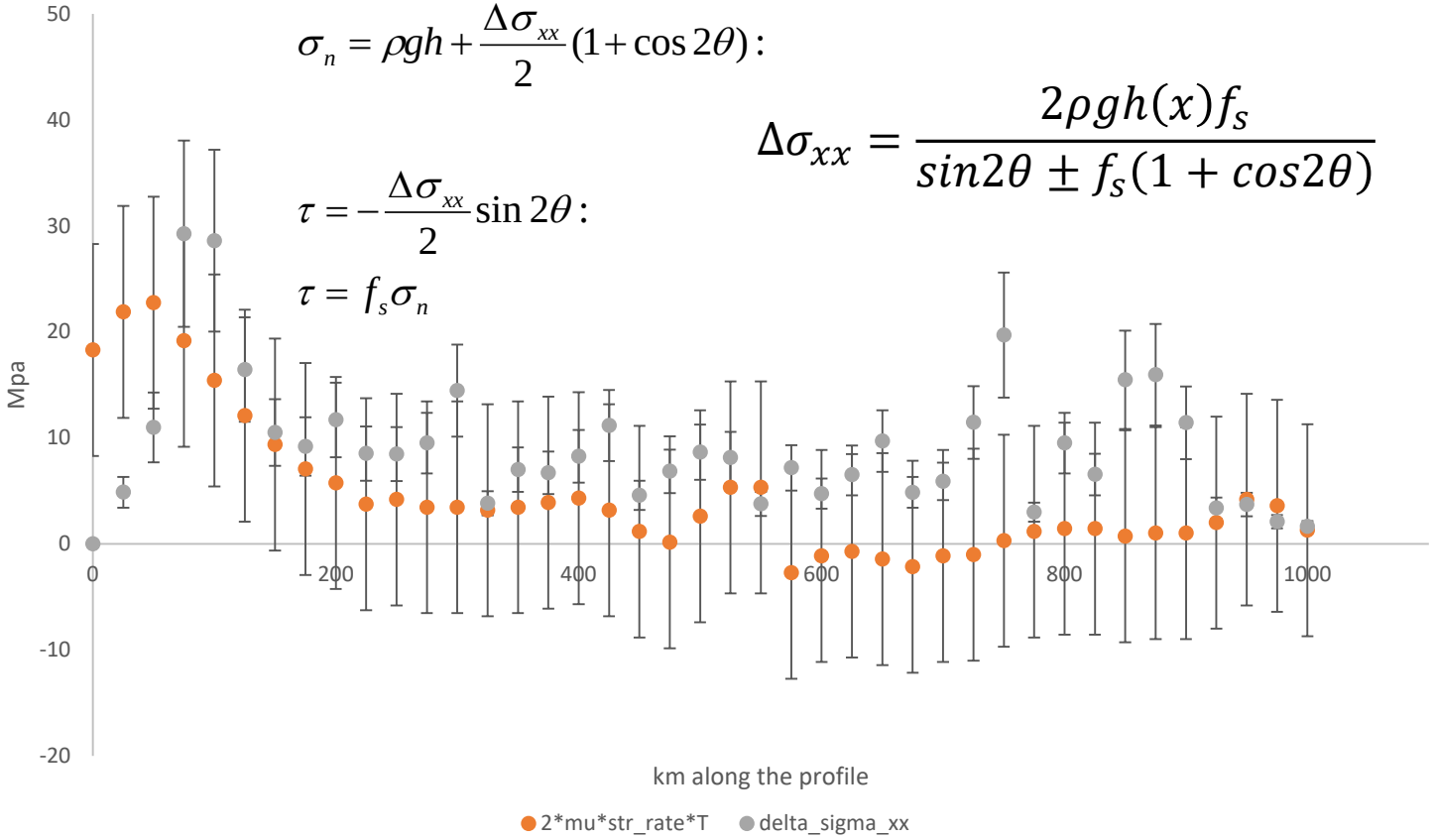
$$\sigma_{xx} = \rho g h + \Delta\sigma_{xx}$$

$$\sigma_n = \rho g h + \frac{\Delta\sigma_{xx}}{2}(1+\cos 2\theta):$$

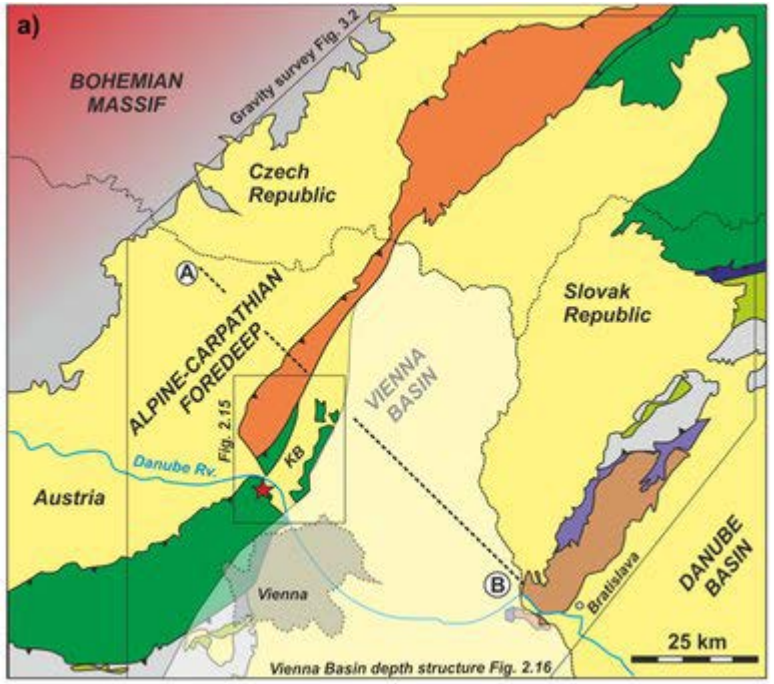
$$\Delta\sigma_{xx} = \frac{2\rho g h(x) f_s}{sin2\theta \pm f_s(1+cos2\theta)}$$

$$\tau = -\frac{\Delta\sigma_{xx}}{2}\sin 2\theta:$$

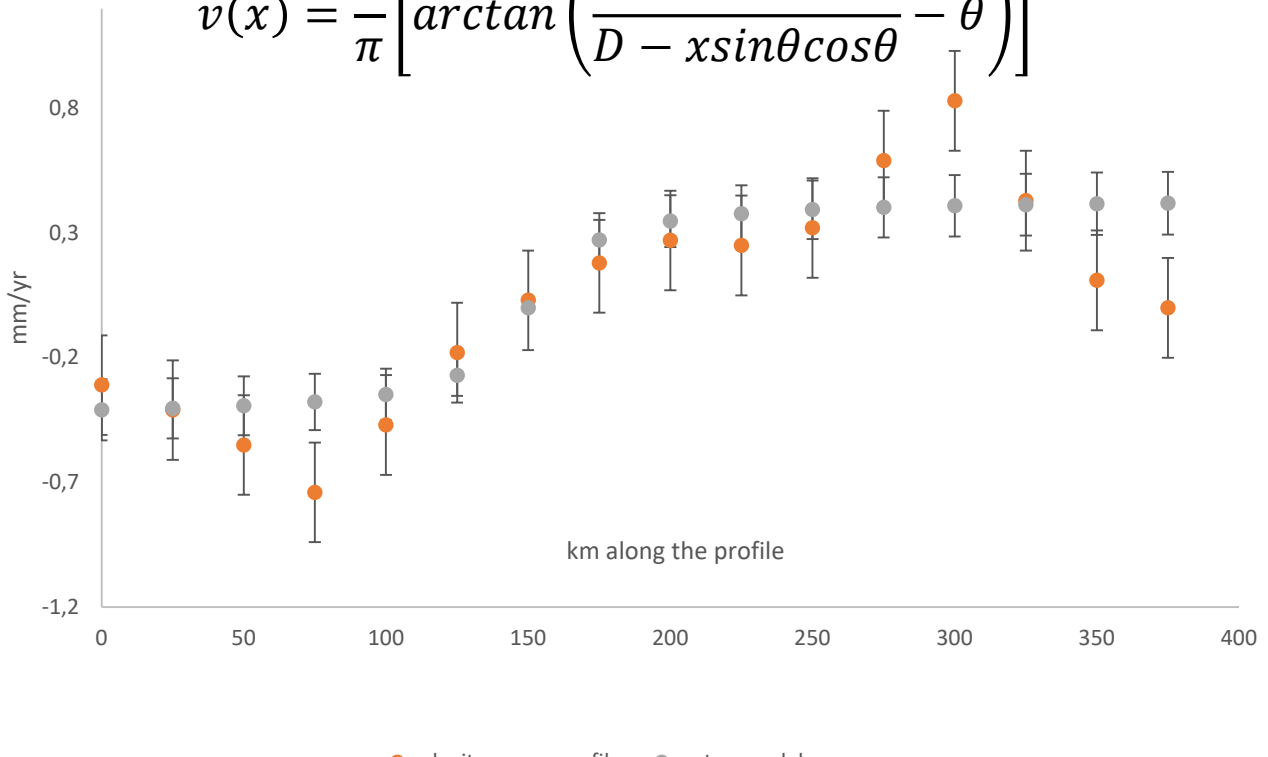
$$\tau = f_s\sigma_n$$

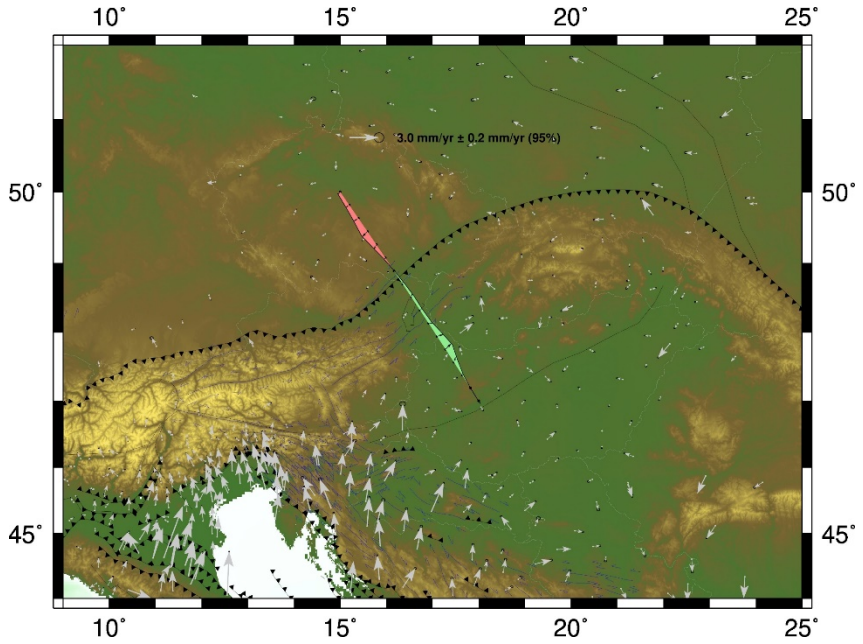


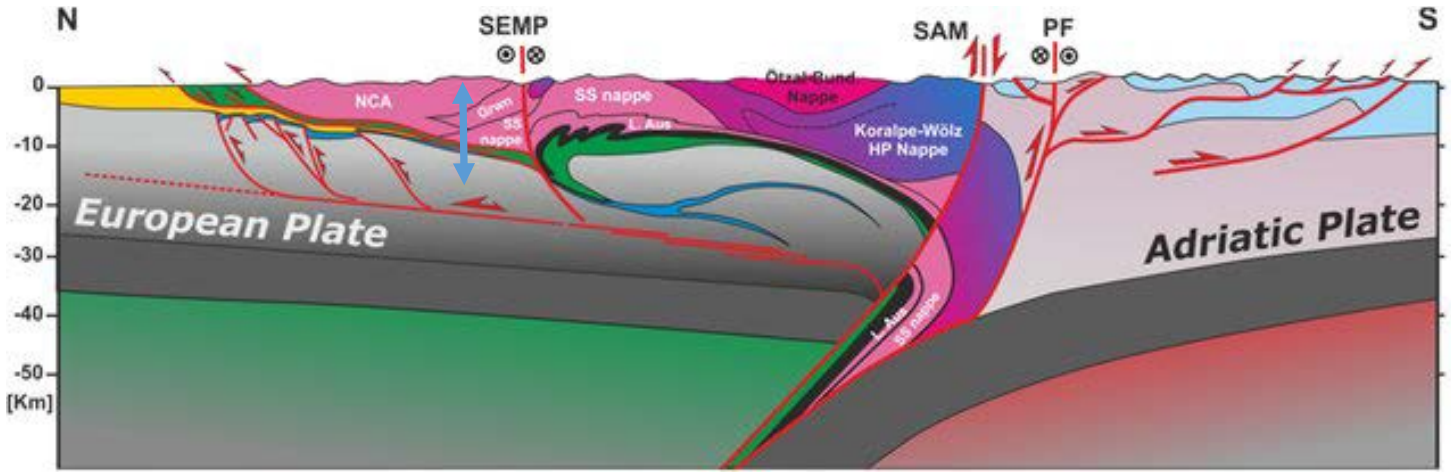
f_s=0.4; T=6000+/-1000 yrs



$$v(x) = \frac{V}{\pi}\left[arctan\left(\frac{x cos^2\theta}{D - x sin\theta cos\theta} - \theta\right)\right]$$







Conclusions

- CEGRN: multinational, long lasting partnership results in a dense velocity field in Central Europe
- Data reduction made using the latest IGS/EUREF standards ensures absence of local biases in orientation and scale of the Central European velocity field
- Analysis of the velocity profiles reveals that:
  - the extensional strain rate across the Hellenides matches the topography and fits an Andersonian deviatoric stress, provided the geodetic stress rate is scaled by ca 6000 yrs (+/- 1000 yrs)→ this could be a scale time for seismic balance in the absence of a '*slab pull'* force (not modeled here);
  - Southern Alps are eastward extruded at ca 1.8 mm/yr (+/- 0.4 mm/yr) relative to stable Europe; profile consistent with a vertical fault and a 18 km locking depth → slip takes place in the basement of the European plate.