PhD work funded
50 % IRSN & 50 % OSUG

# Seismic deformation in the Western Alps : new insights from high resolution data

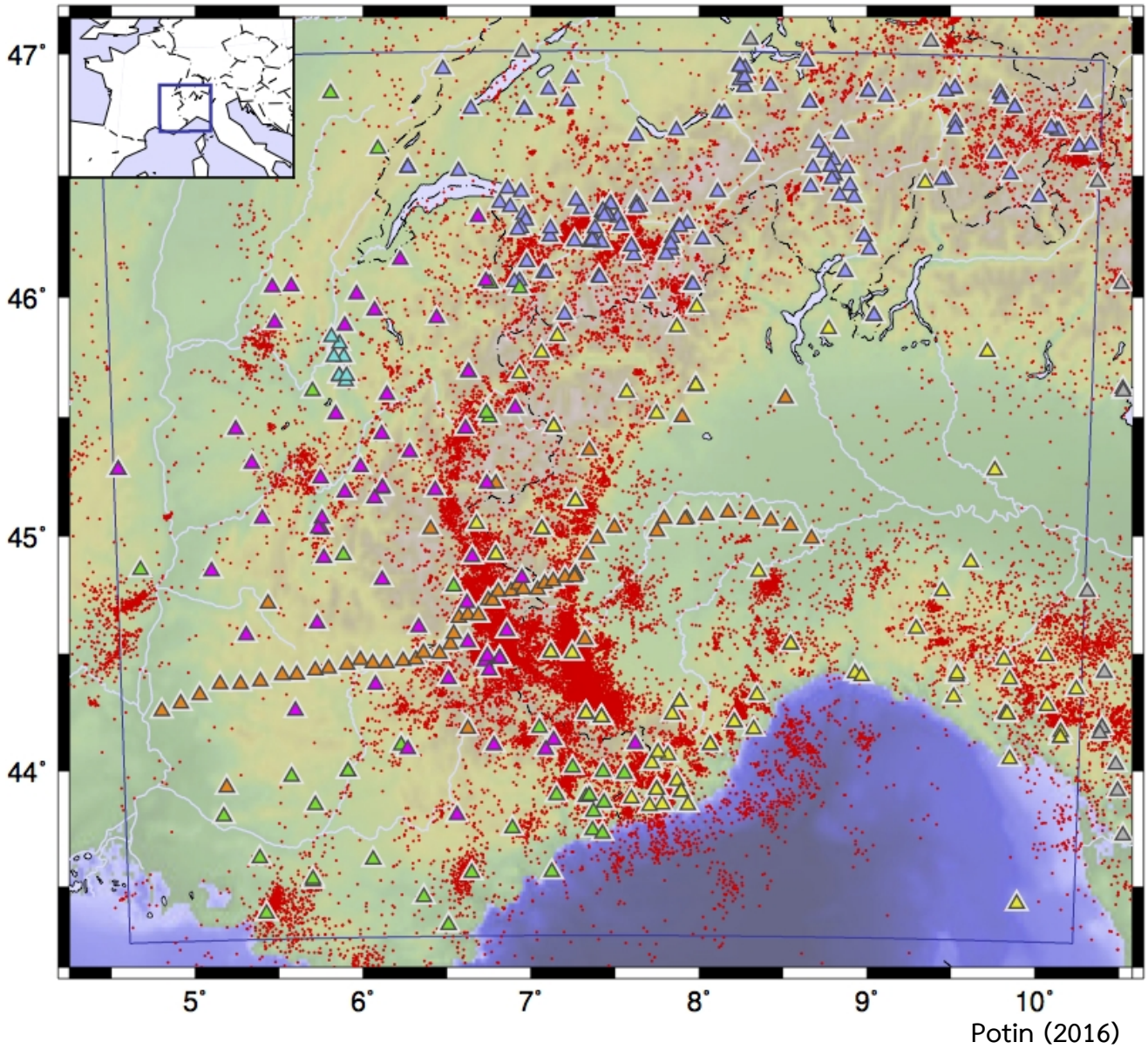
M.Mathey, C.Sue, B.Potin, C.Pagani, T.Bodin, E.Hannouz, A.Walpersdorf, S.Baize, L.Husson

EGU General Assembly 2020



CC BY

# Huge Sismalp earthquakes dataset




Potin (2016)

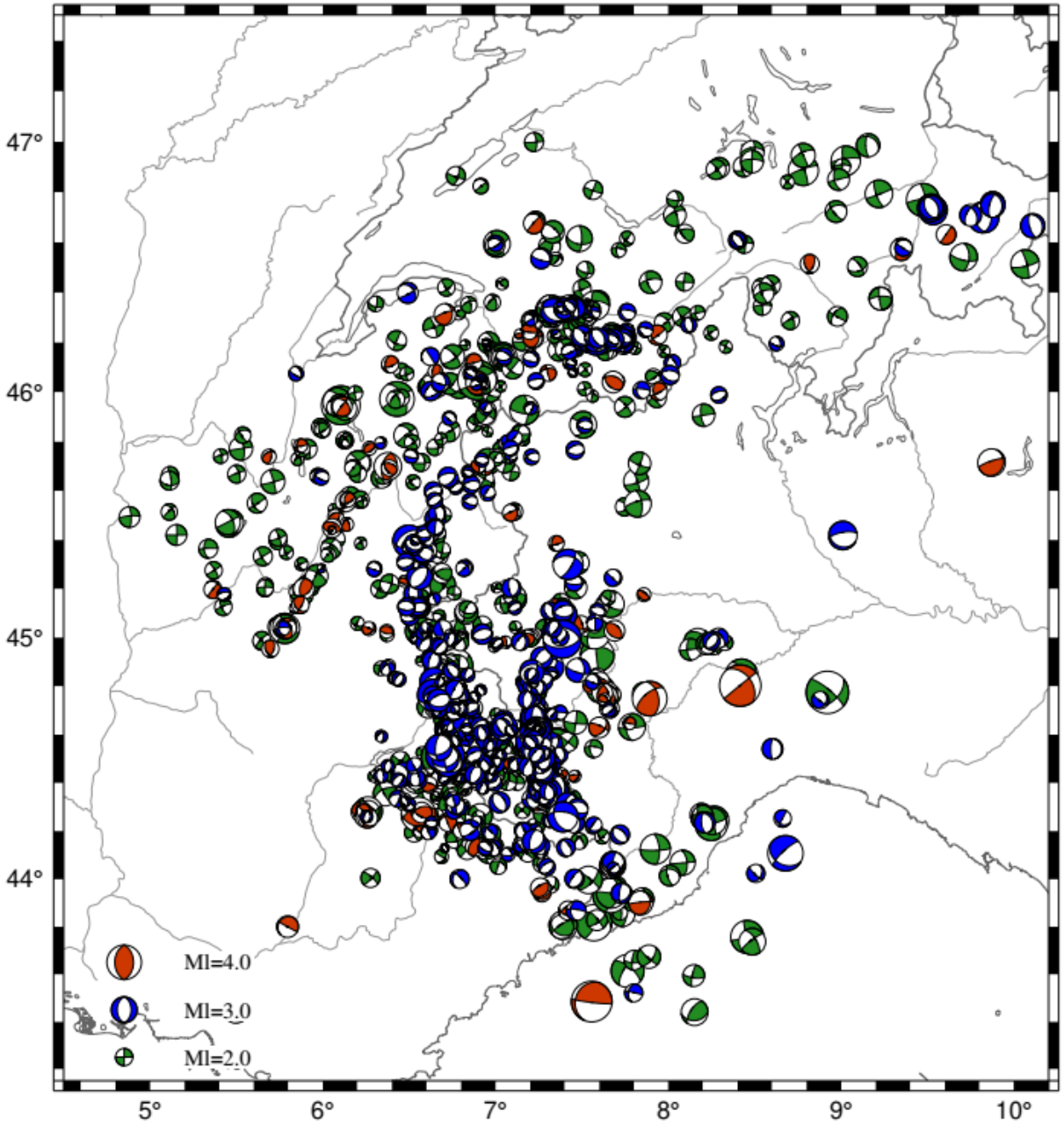
375 stations

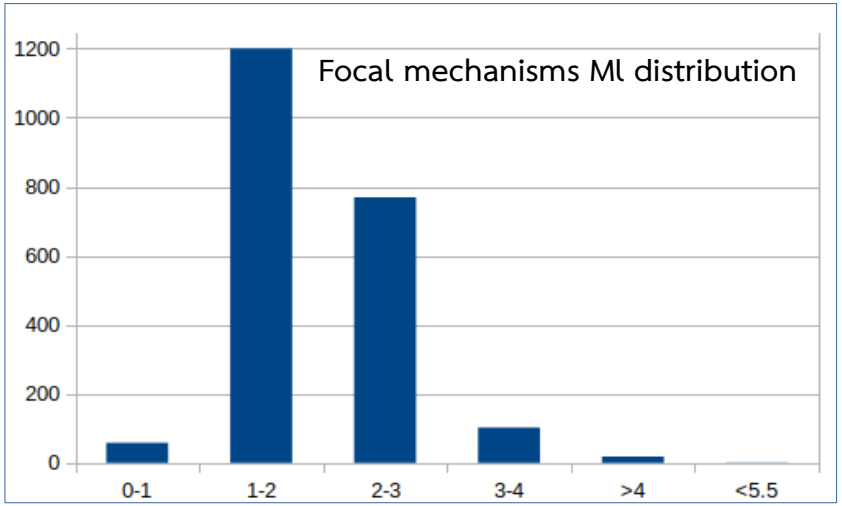
5 networks

> 36 000 events

> 700 000 P and S waves

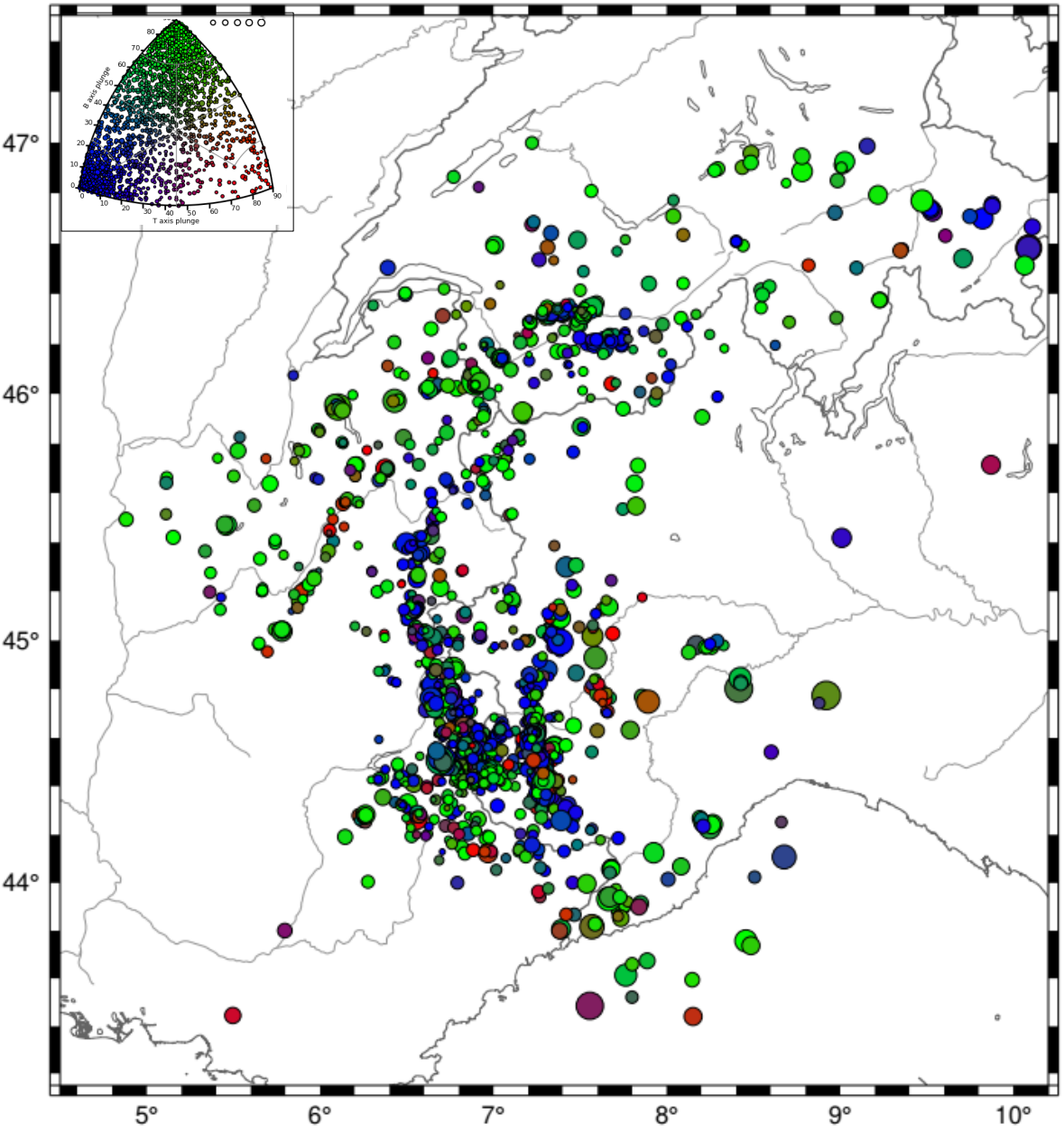
# From Sismalp dataset to focal mechanisms

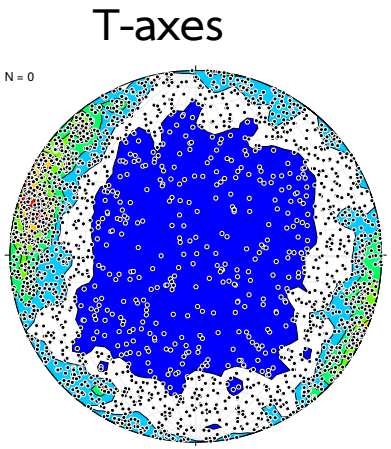


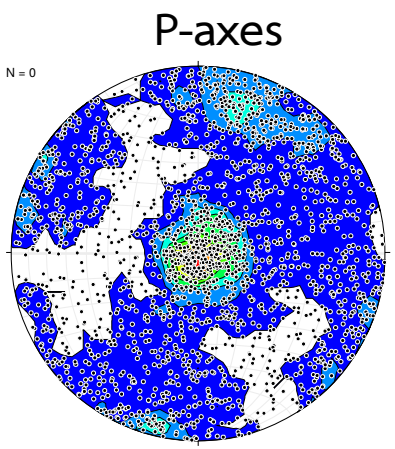



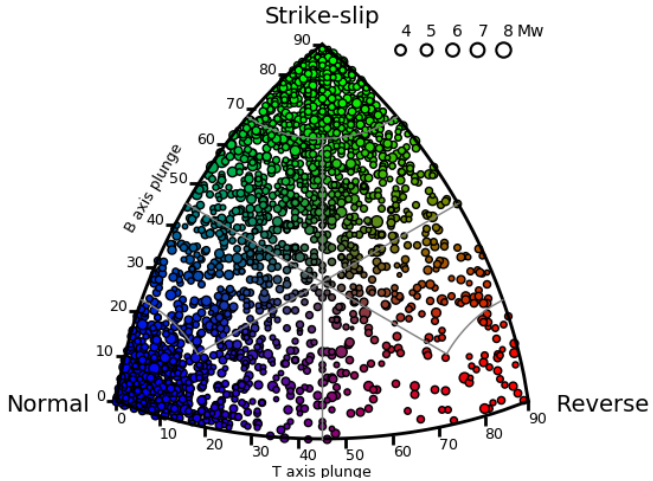

- Earthquakes (EQs) relocalized in 3D velocity model (Potin, 2016).
- HASH code (Hardebeck & Sheerer 2002) > 4000 f.m.
- 2215 f.m. constrained +++

# An unexpected predominant style of deformation



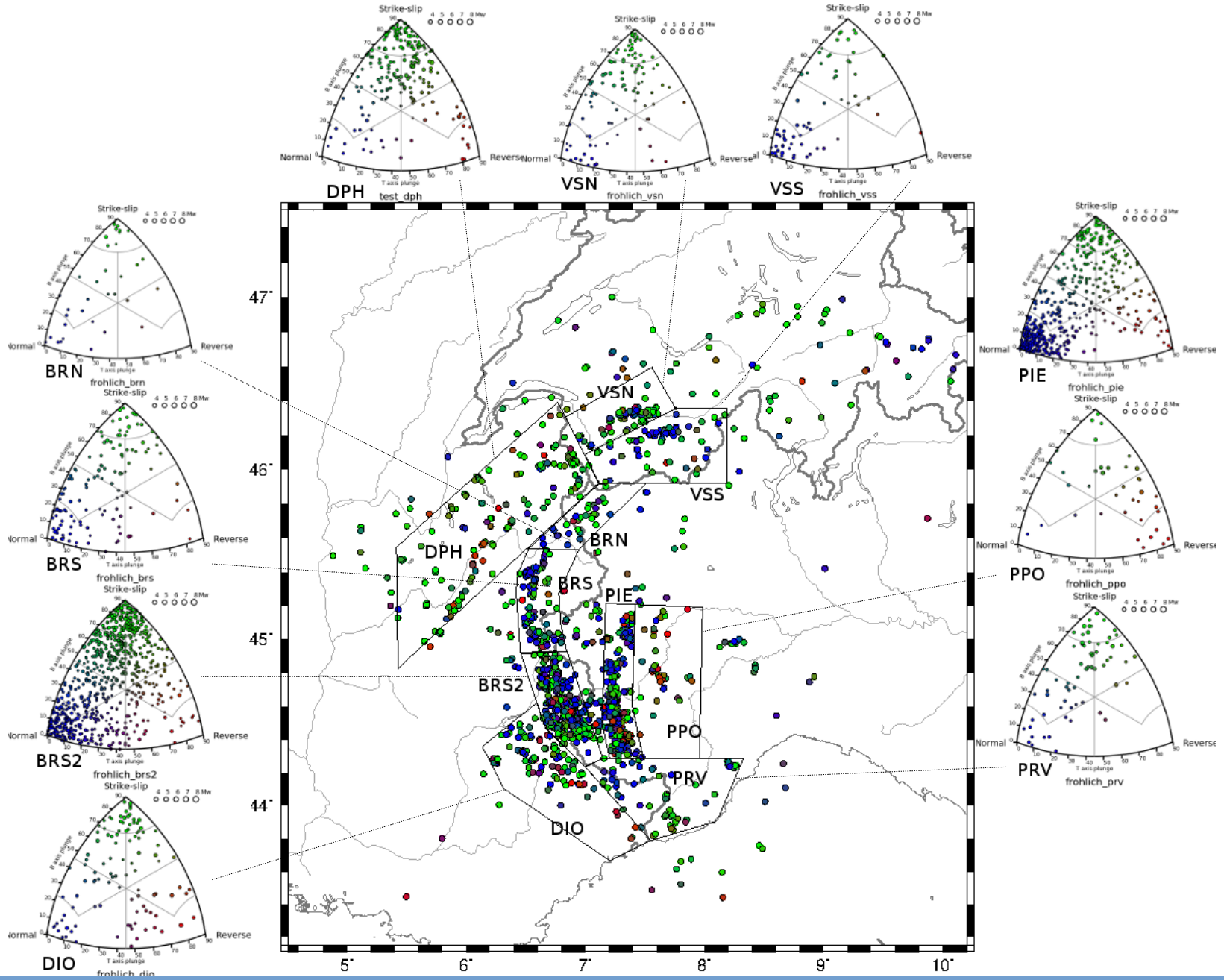




- 1200 Strike slip EQs spatially distributed
- 800 Normal EQs localized along two arcs
- only 200 reverse localized EQs

# Precise zonation

→ clear regional styles of deformation

→ most of them strike slip or extension

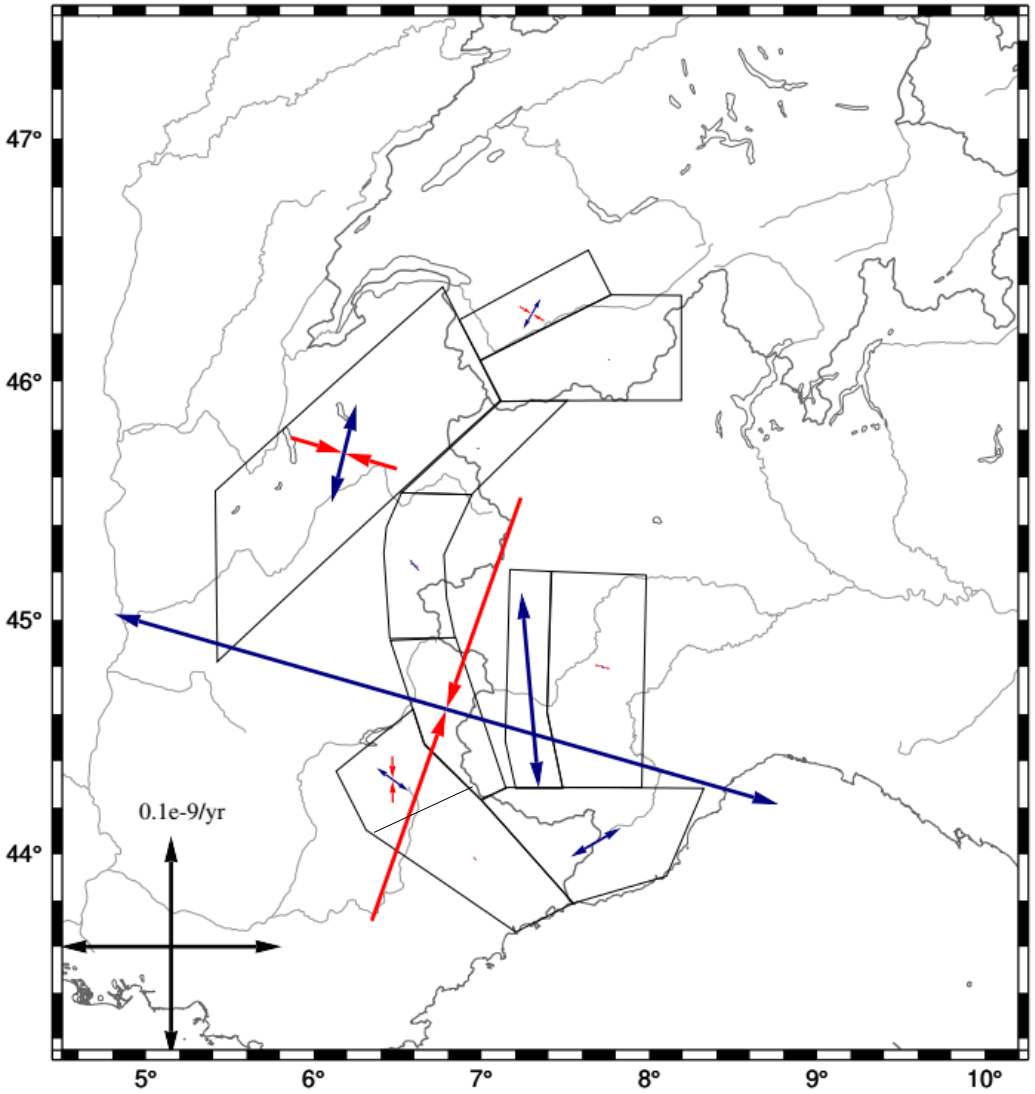


# Strain rates quantification

→ Kostrov method :

1) summation of moment tensors in each area

2) summed tensor divided by area volume and duration of the catalog



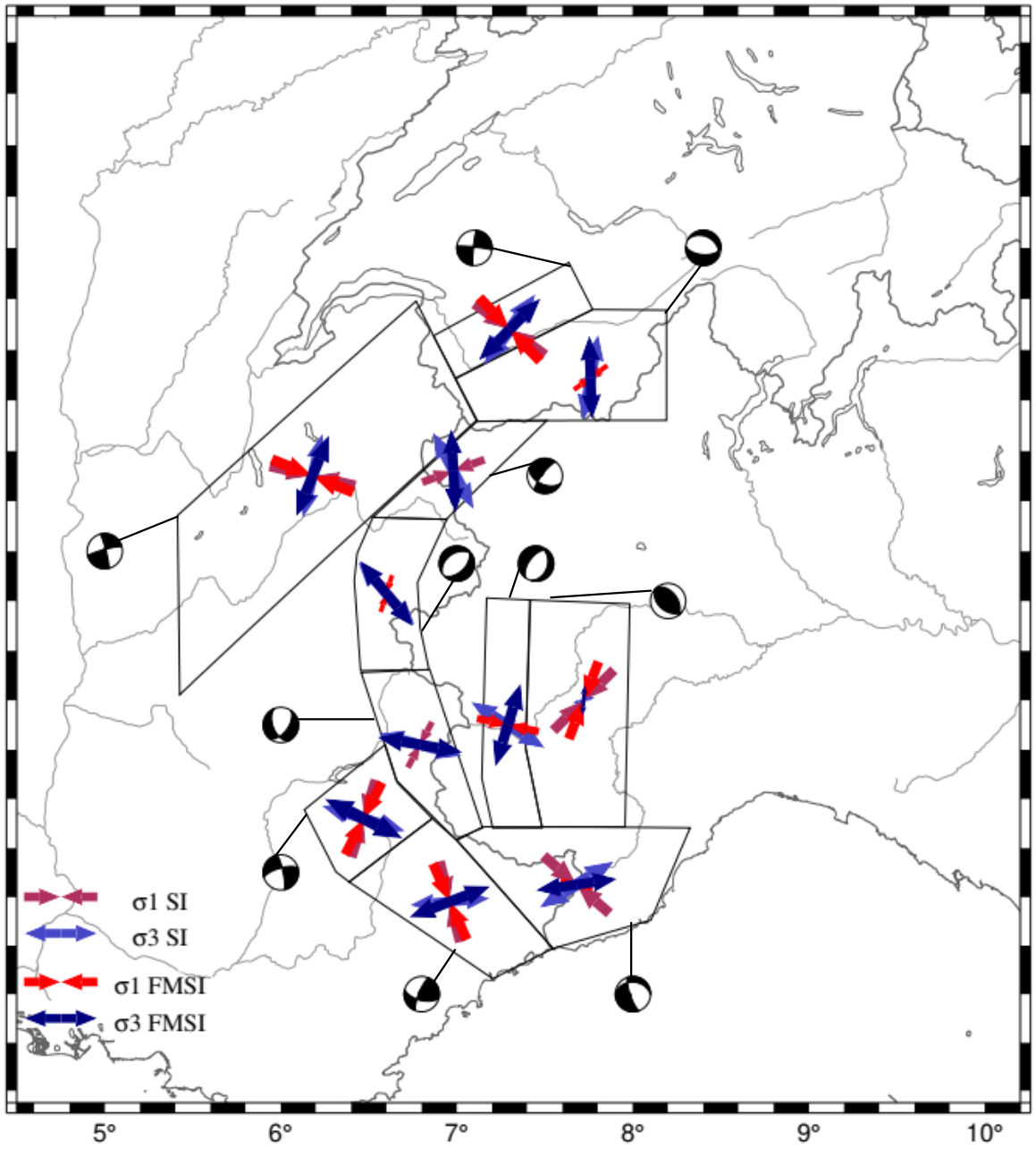

⇒ Most of the def° seems to occur in the southern inner part of the belt

Keep in mind :

- rates depending partly on area volume

- style of deformation in each area given by biggest EQ

# Principal stress inversion




Two methods compared :

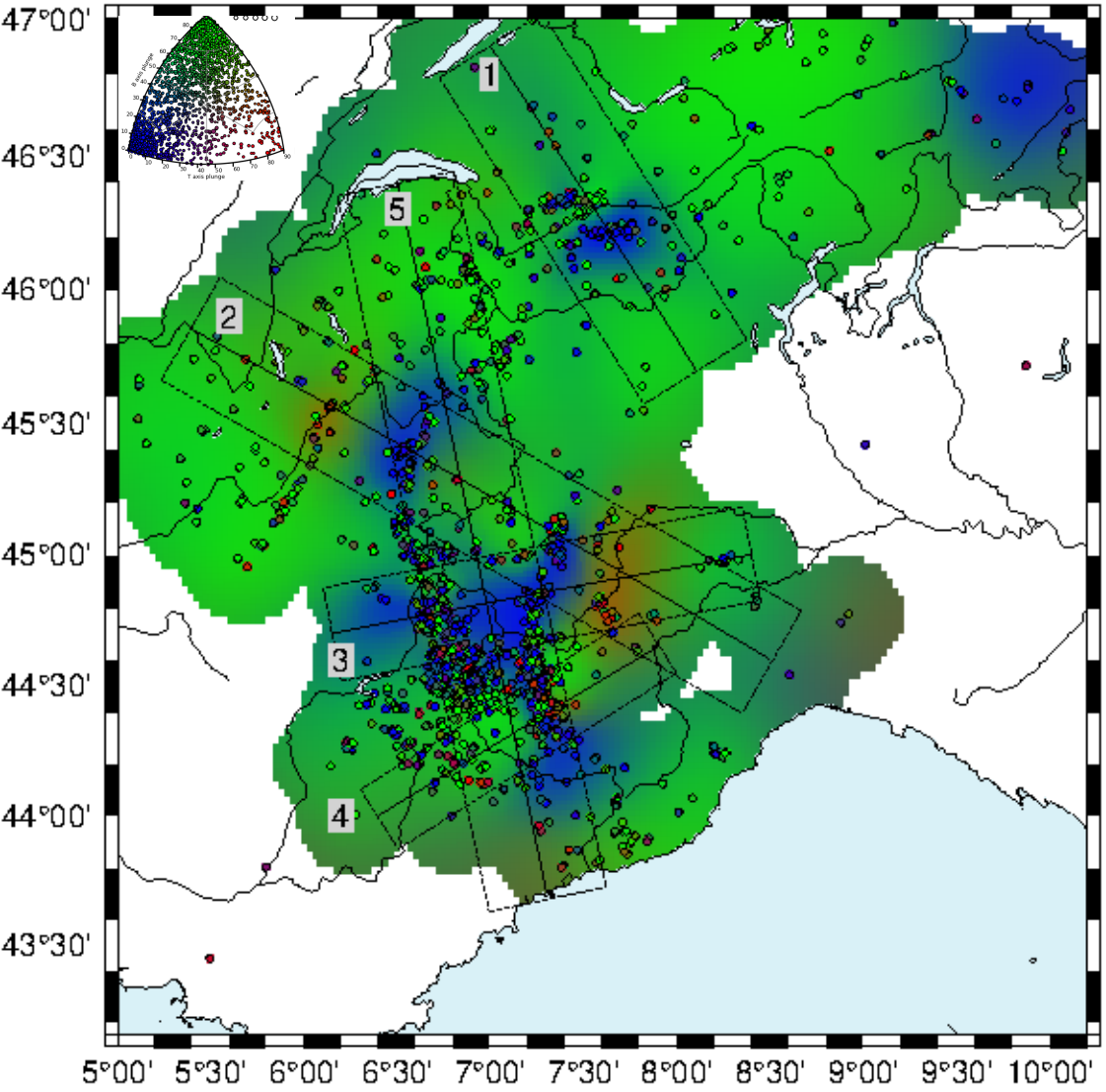
- linearized least squares :
*StressInverse* (SI) code (Vavrycuk 2014)

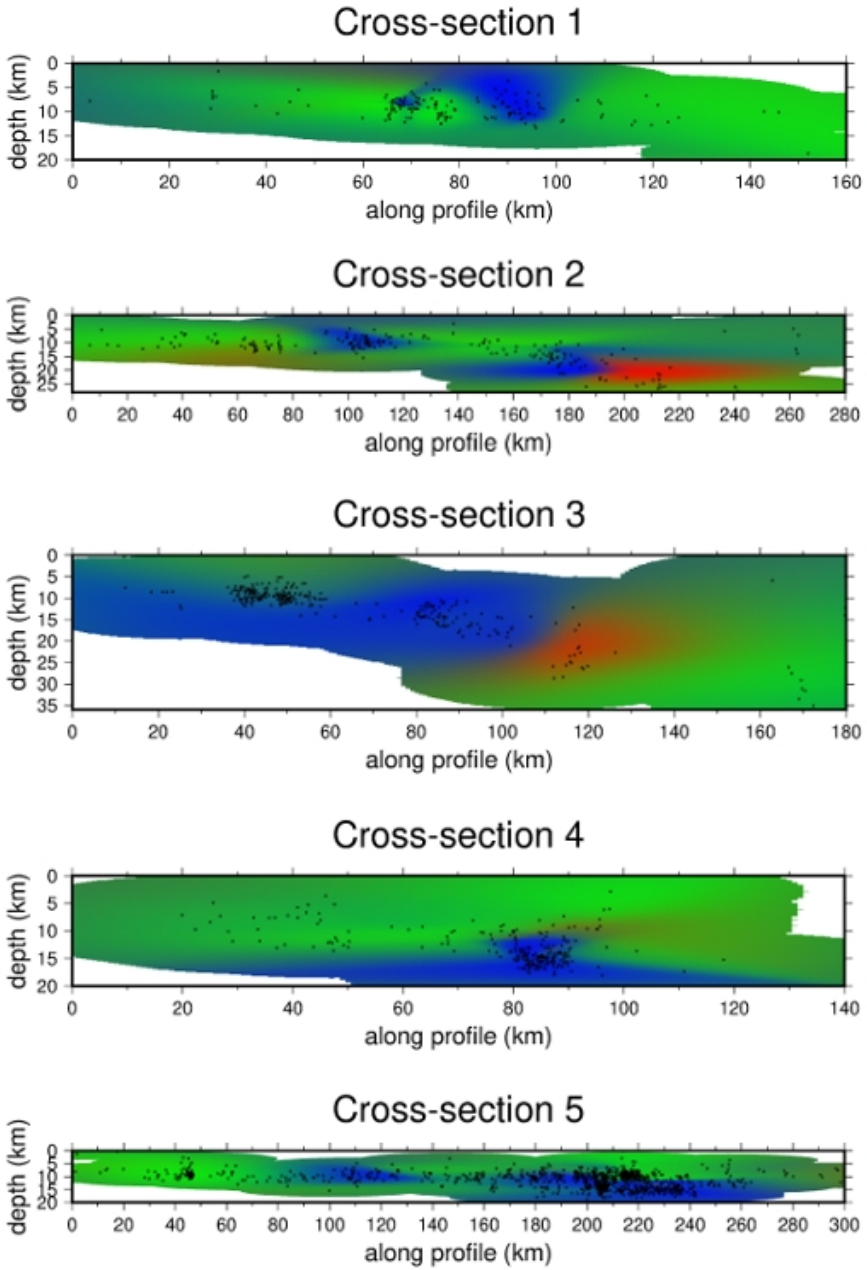
- grid search :
*FMSI* code (Gephart & Forsyth 1984)

=> similar results : robustness of the estimation

- 6 extensive areas
- 4 strike-slip areas
- 1 compressive area

# Probabilistic interpolation of f.m.




→ 4D Bayesian inversion (Pagani et al., in prep): P and T axes plunges at the surface or at depth = dependent parameters

→ average of posterior distribution

→ spatial variation of data density (Voronoï meshing)

# Main outlooks :

Methodolgy :

- 2215 unreleased well constrained f.m. computed
- stress state derived on a grid for the 1st time

Tectonics :

majority of strike-slip
Compression in the Pô plain only
Extension oblique to the arc

## Next steps :

→ Strong variations in EQs density for the 25 years period !

→ Is there any temporal variations in strain rates ?
⇒ seismic flux including historical seismicity

… any discussion welcome !