**EUREF 2007 Symposium**
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# GPS Permanent and Epoch Measurements and Geodynamic Pattern of the Bohemian Massif, Central Europe

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# Outline

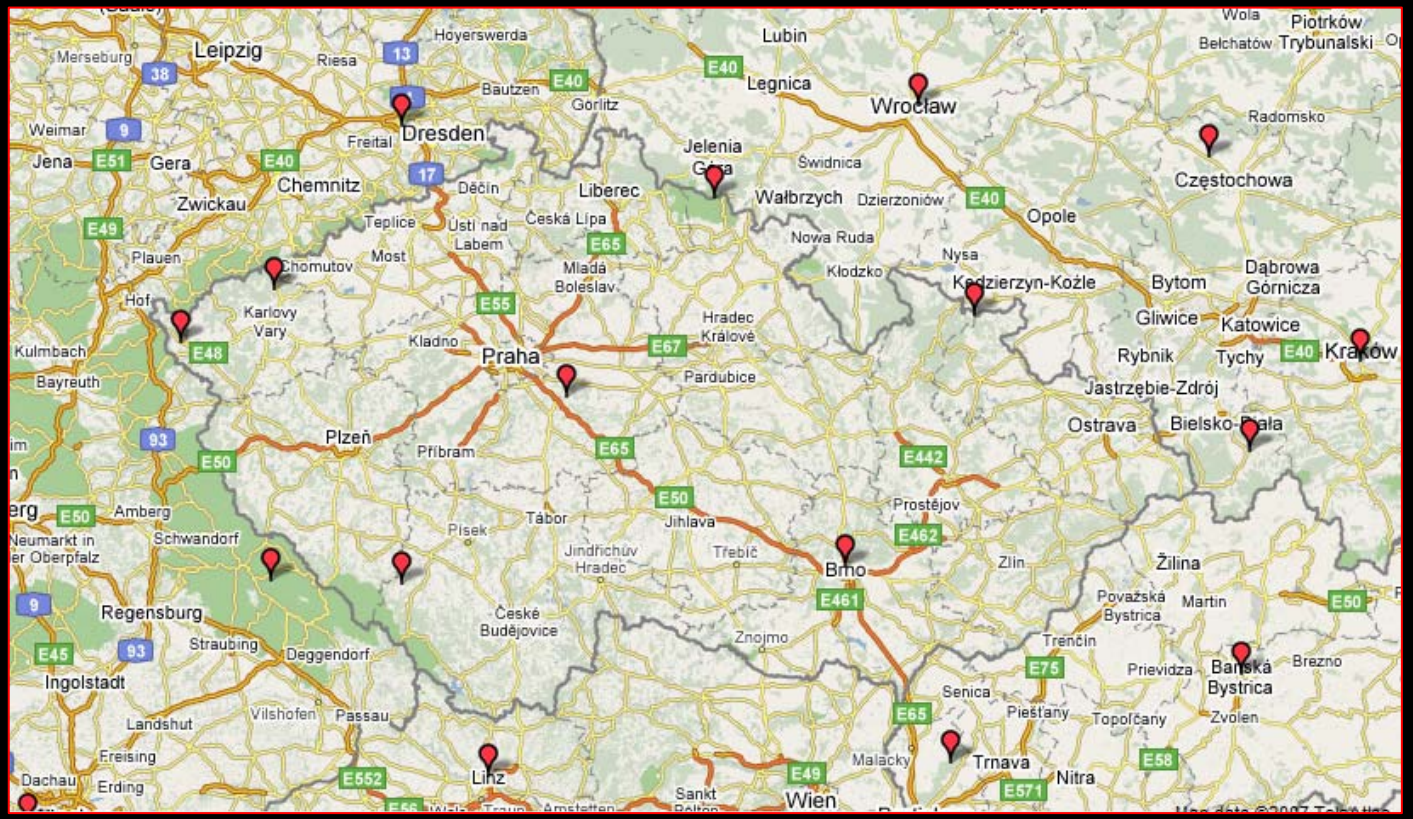
**5** EUREF observatories running under the Operational Centre IRSM and Geodynamic Network of the Academy of Sciences GEONAS

1. Site movement vectors determined from permanent GPS data and geodynamics of the Bohemian Massif
2. Movement of the SNEC observatory
3. Permanent GPS monitoring and seismic swarm activity in the West Bohemia / Vogtland region

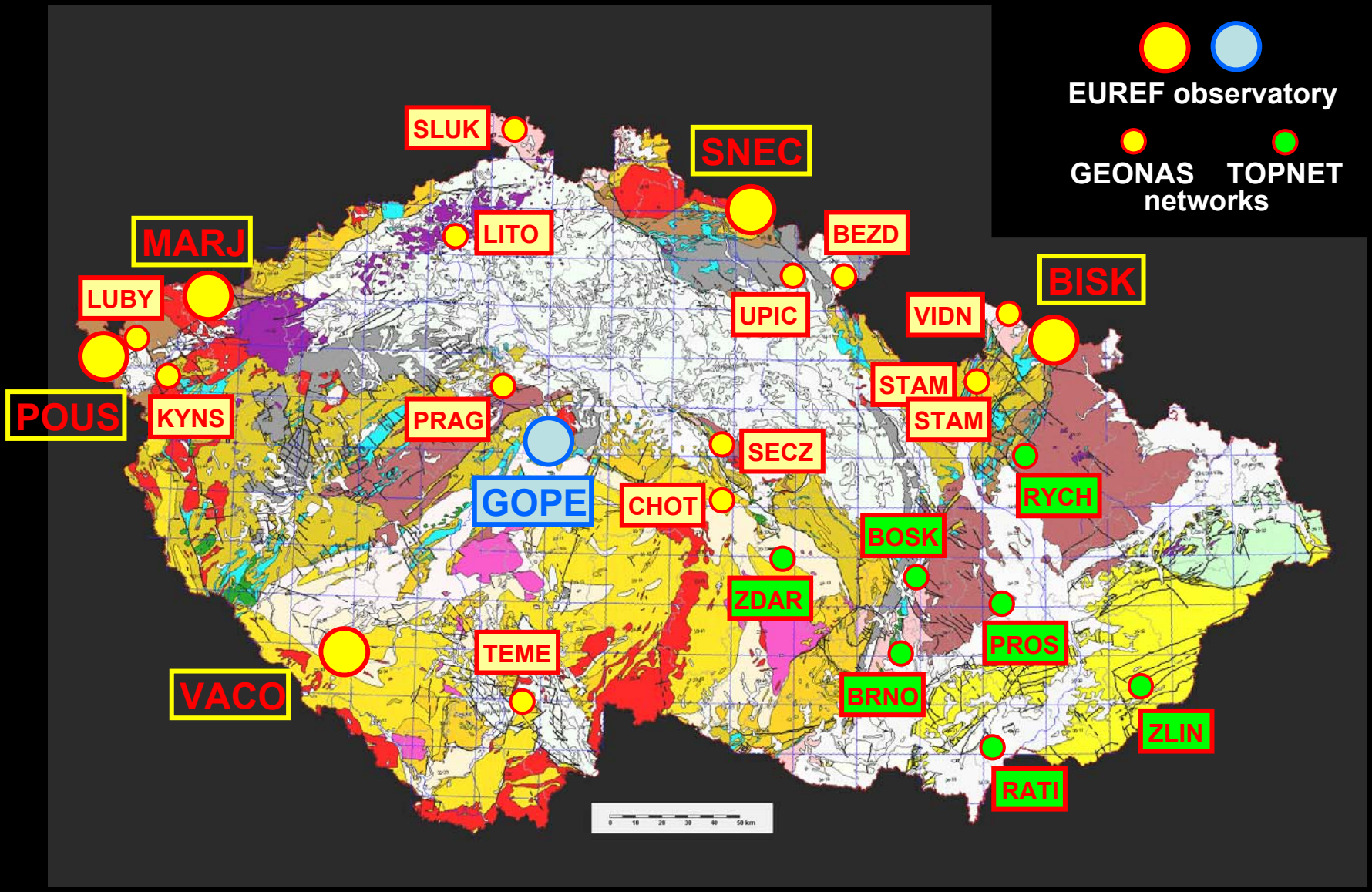
Conclusion and Outlook

# EUREF observatories running under the Operational Centre IRSM and Geodynamic Network of the Academy of Sciences (GEONAS)

# EUREF Observatories in Central Europe



# Permanent GPS observatories

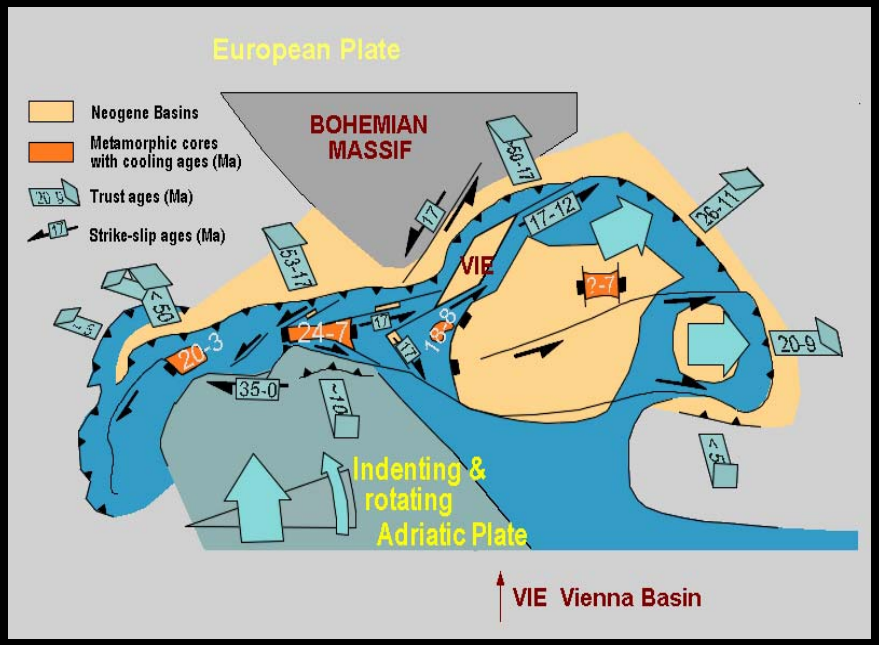


# 1

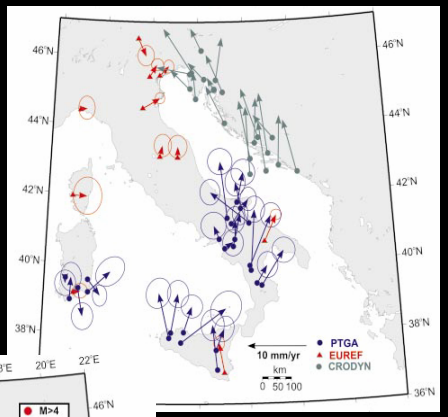
# Sources of geodynamic movements in central Europe

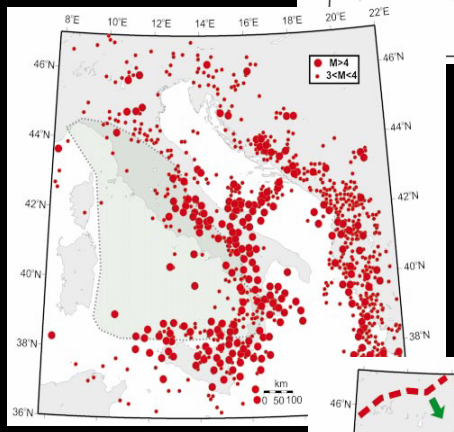
## Site movement vectors determined from the permanent GPS data and geodynamics of the Bohemian Massif

# Cenozoic History and the Adria Plate

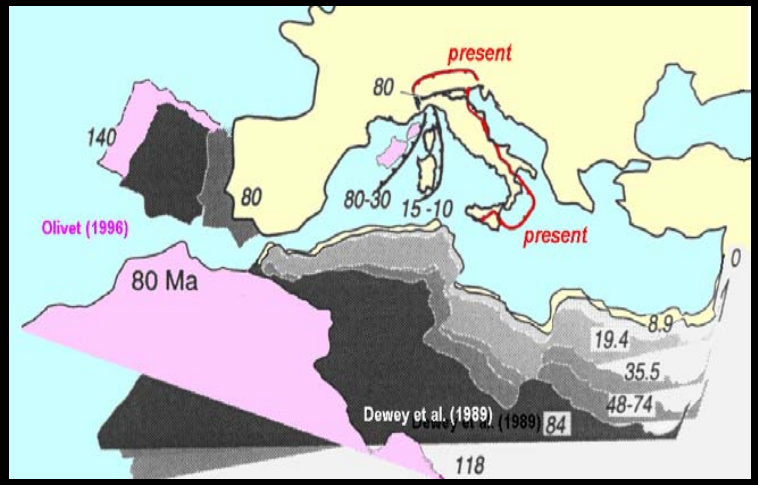



GPS motion vectors

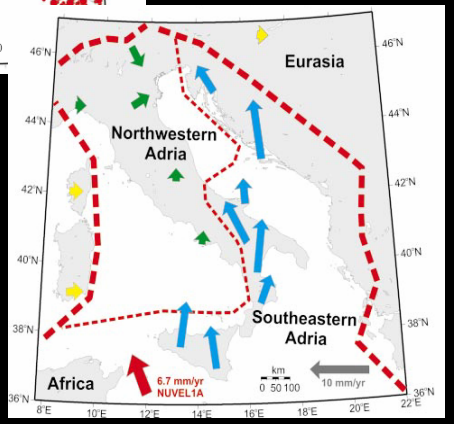



Earthquake epicenters



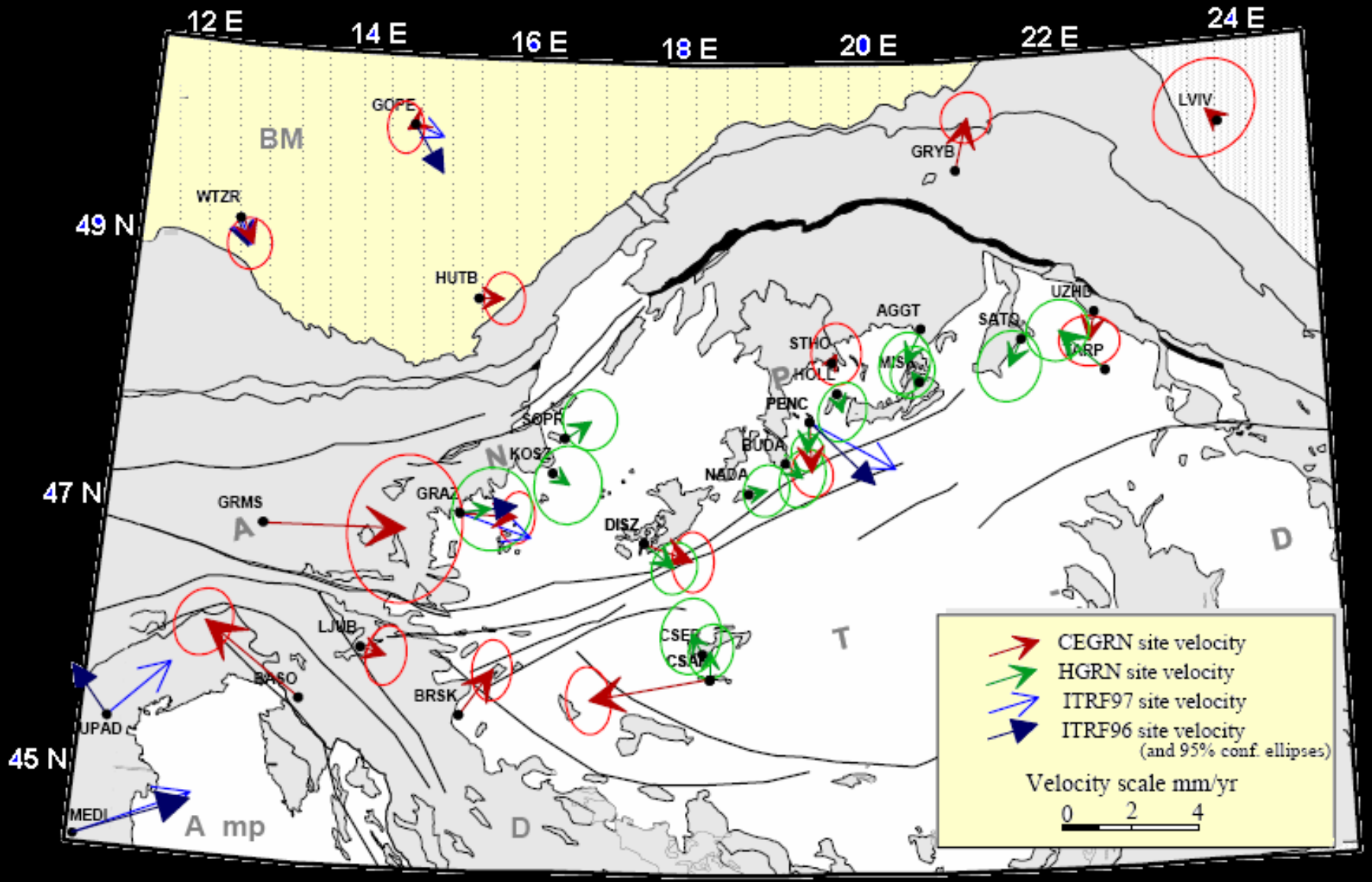

Motions of the Adria Plate



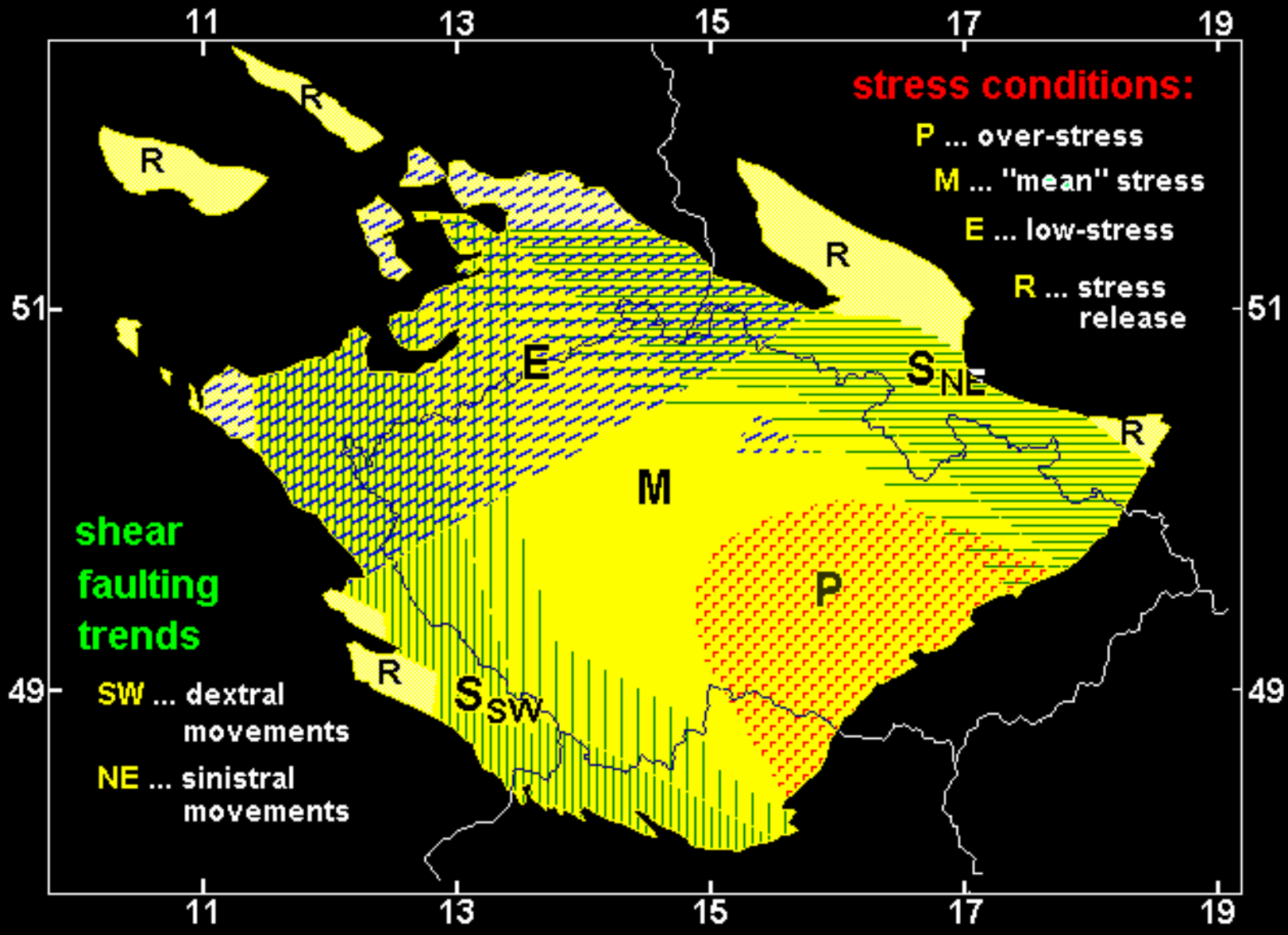

Oldow et al. (2002), *Geology* **30**, 779-782.

# Crustal Deformation Pattern in the Pancardi Region

## Grenerczy et al. (2002), EGU Spec. Publ. Ser. 3, 65-77.

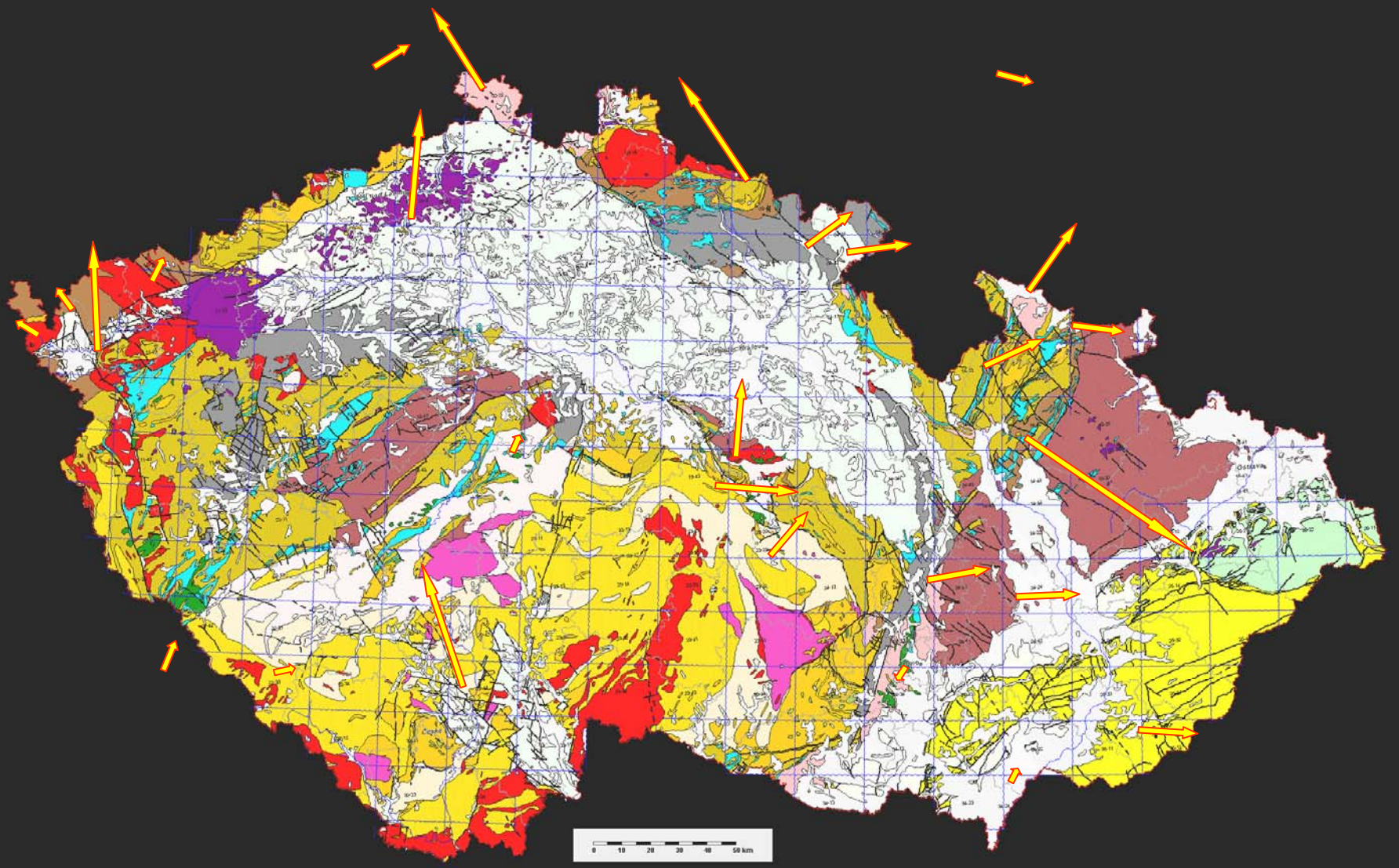


# Stress Field Expected

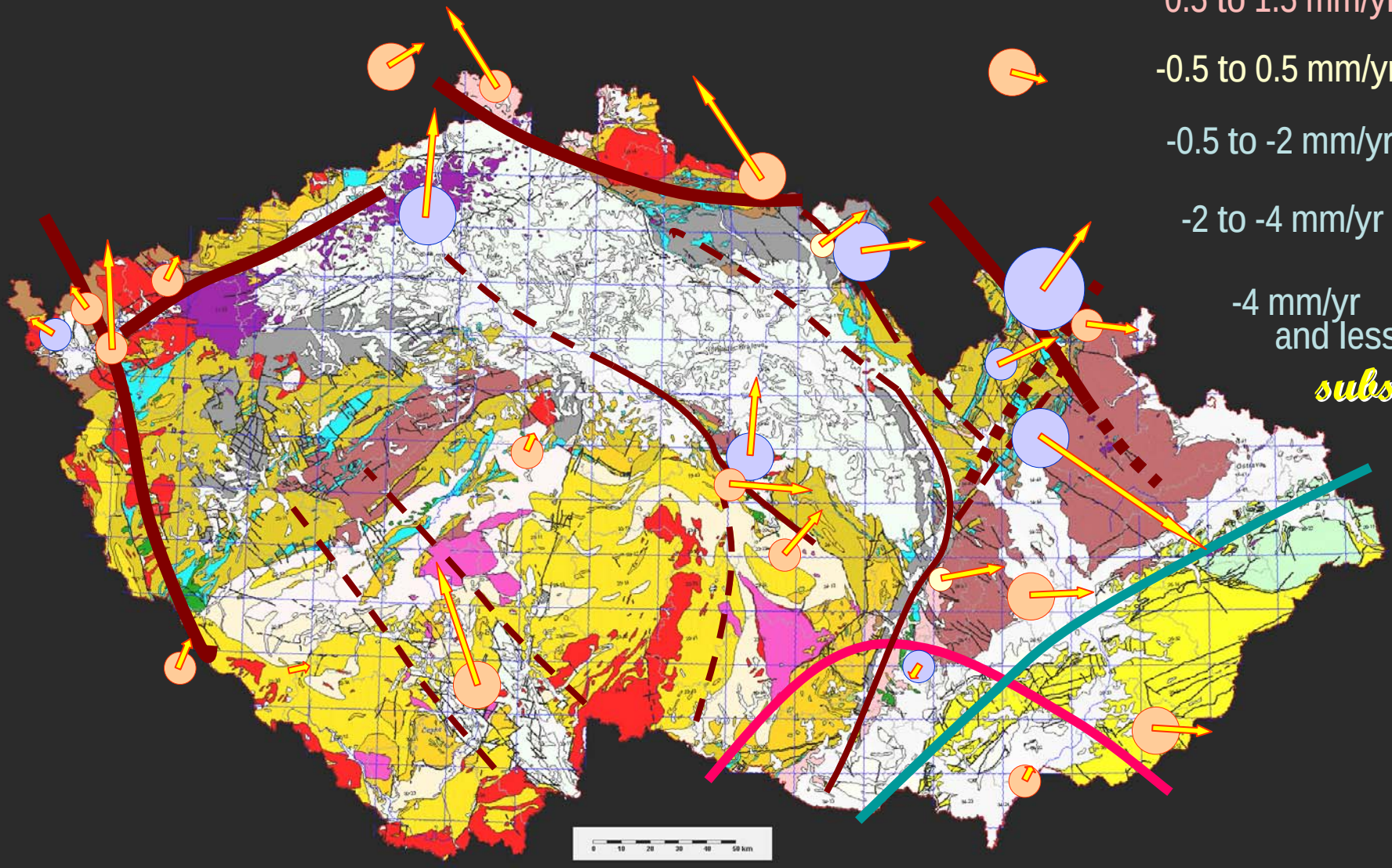



Schenk et al., 1998, *Reports on Geodesy* 3 (33), 51-60.

# Relative Horizontal Site Movements



# Relative Site Movements



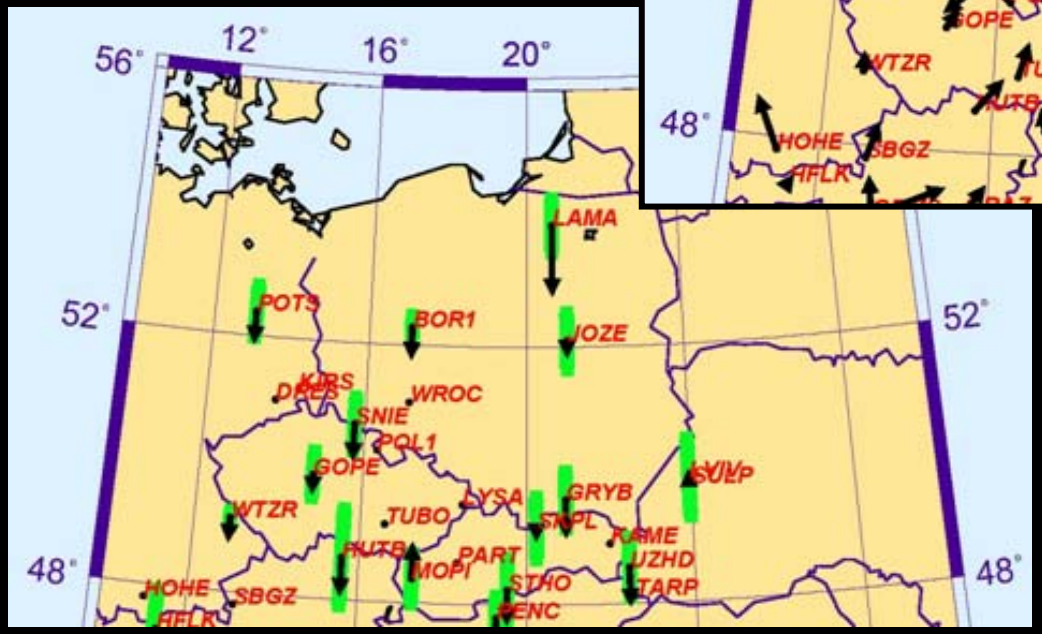
# 2

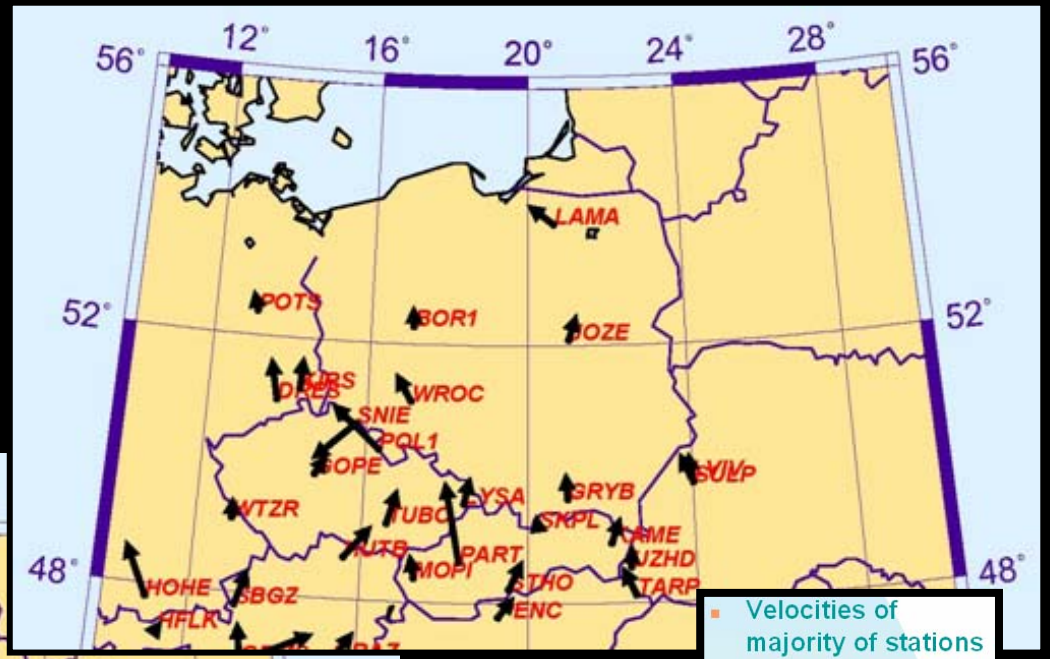
# Movement of the SNEC observatory

# Site Velocities in Central Europe Obtained from Epoch Observations 1994-2003 within the CERGOP and CERGOP-II / Environment

**Hefty (2005)**

**EUREF Symposium**
**Vienna, June 1-3, 2005**




- Velocities of majority of stations are oriented to north with 2-5 mm/year amplitude
- Exceptions:
  (1) Part of Balkan stations
  (2) Some „continental“ stations – SNIE, GRMS, DISZ

kgz

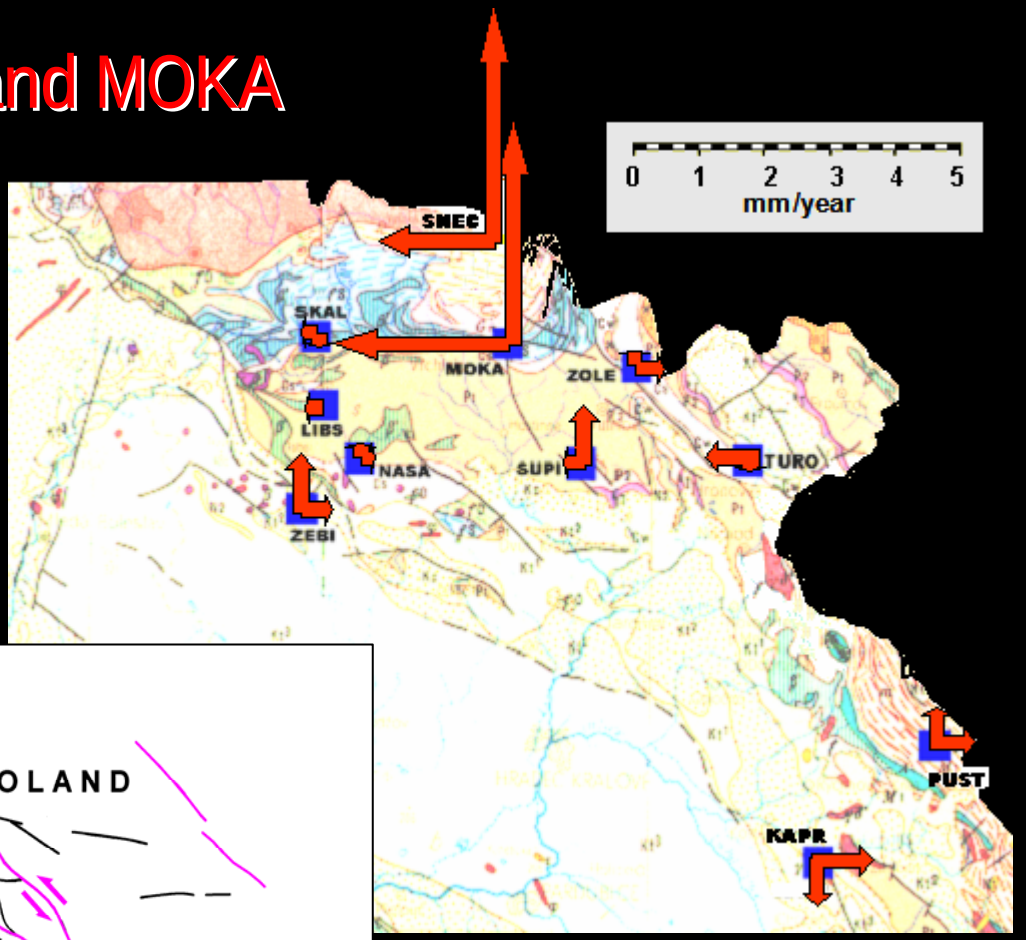
# Relative Horizontal Site Movements

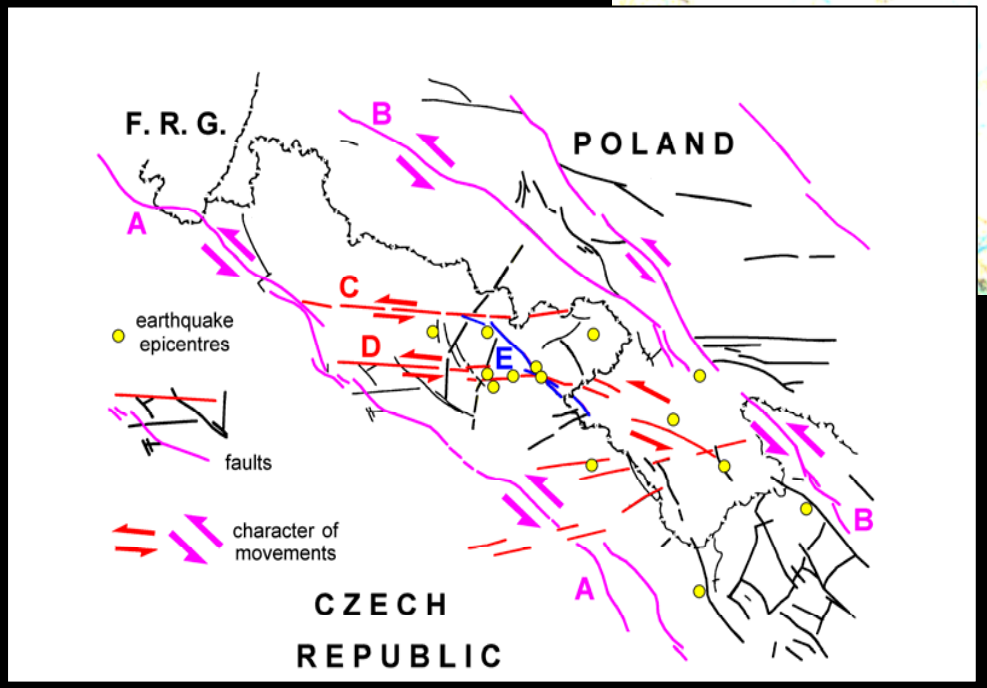
# SNEC and MOKA

**Annual epoch measurements**

West Sudeten Network

2001 - 2006




Schenk V. et al. (2006),
*Acta geodynamica et geomaterialia*,
vol. 3, 45-51.

Schenk V. et al. (1989),
*Geophysical Transactions* 35,
101-116.

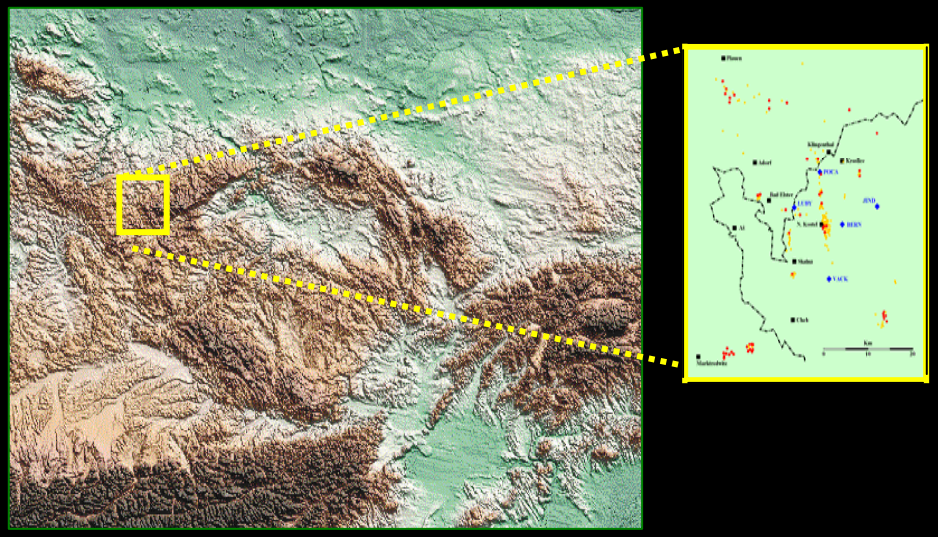
# 3

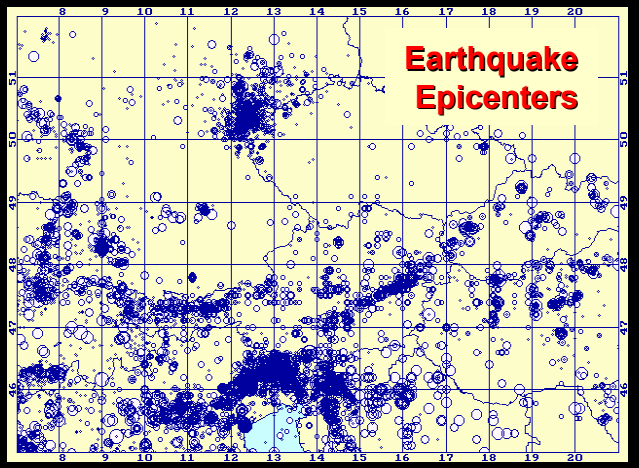
# Permanent GPS monitoring

# and

# seismic swarm activity
# in the West Bohemia / Vogtland region

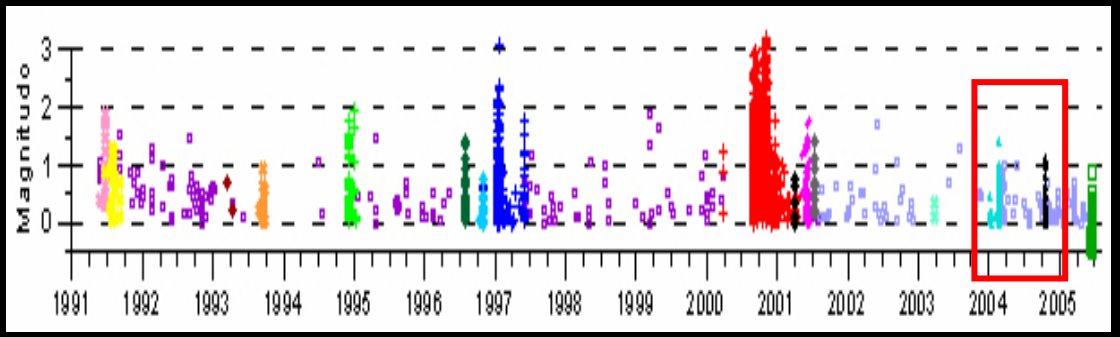
# Earthquake Swarm Activity in the Western Part of the Bohemian Massif



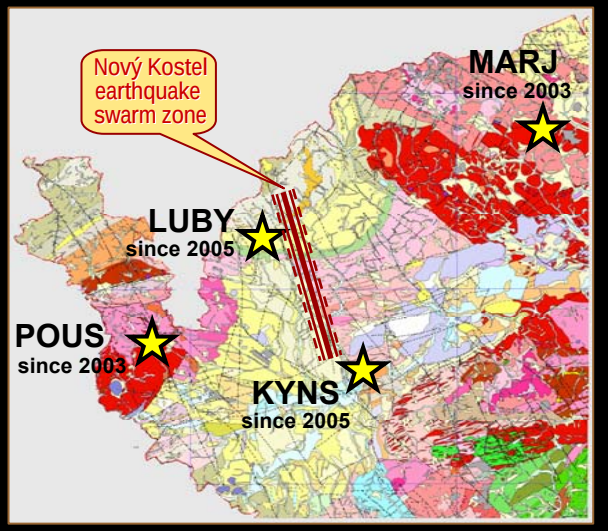



Schenková Z. and Schenk V., 1997

1991 - 2005

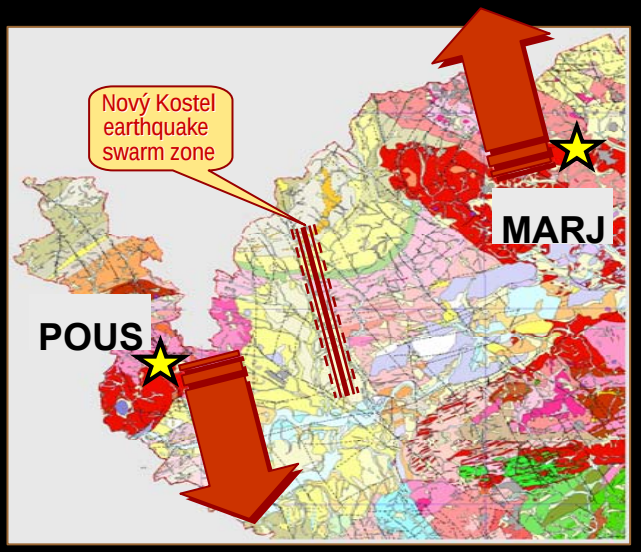


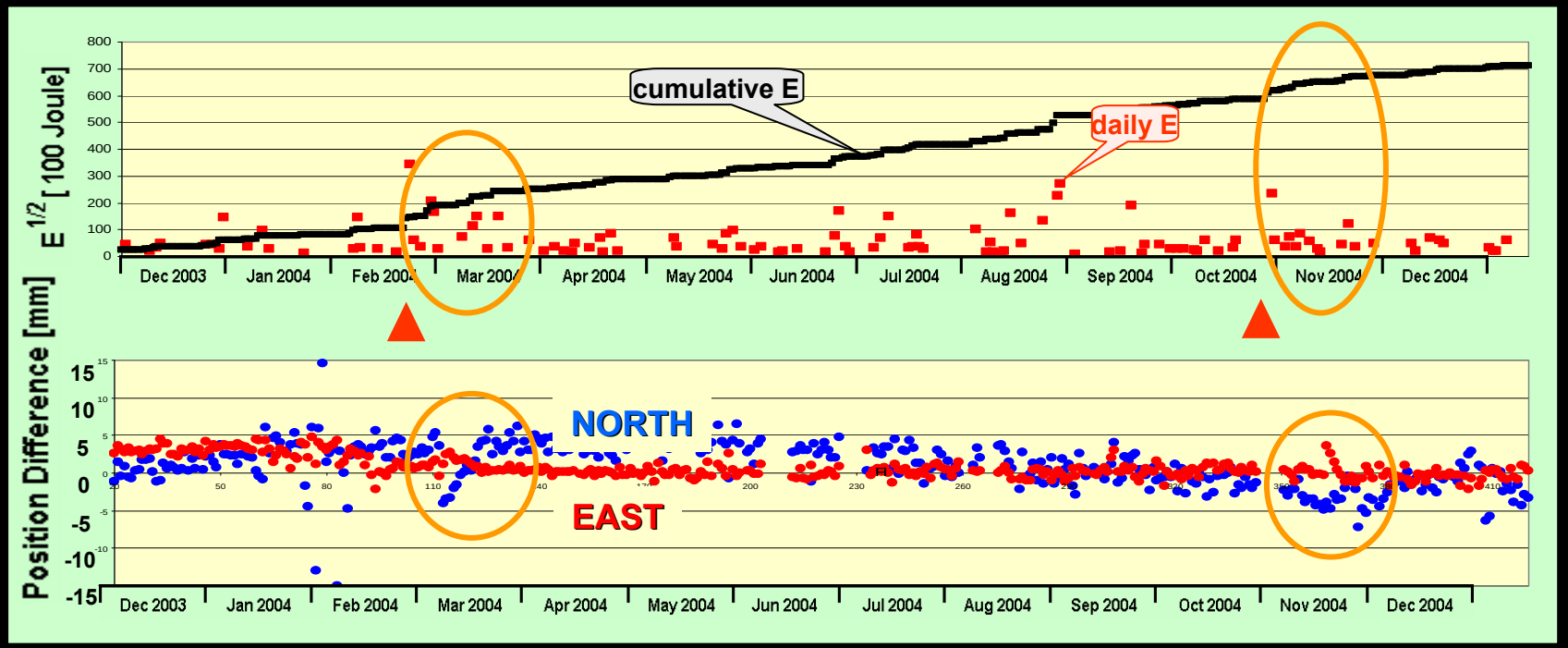

www.ig.cas.cz



# Post-seismic slip movements

detected by the GPS observations reflect the energy release phase



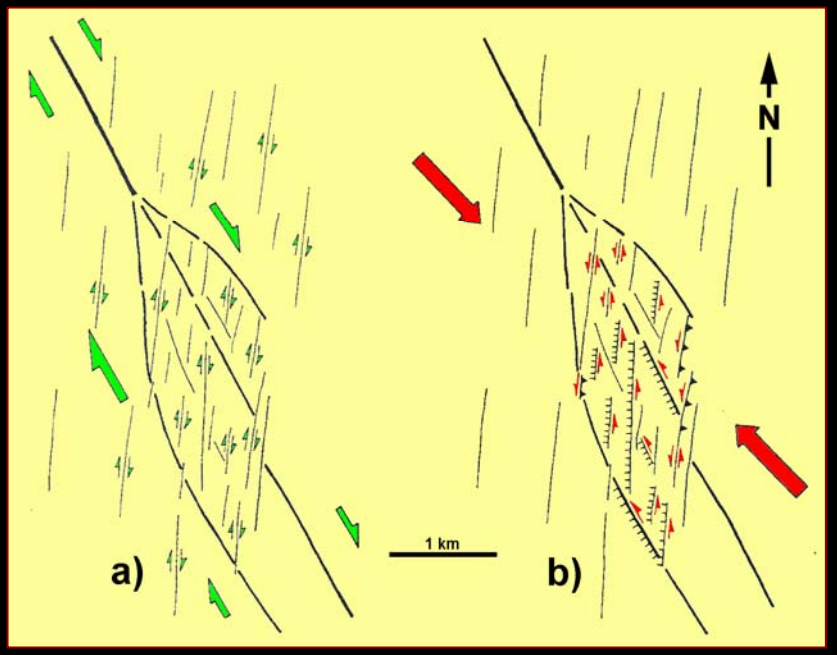



# Seismotectonic Model

Grünthal G., Schenk V., Zeman A. and Schenková Z. (1990), *Tectonophysics* 174,369-383

**The seismotectonic model elaborated after the earthquake swarm occurred in 1985/86 suggested an existence of two following phases in the strain process:**

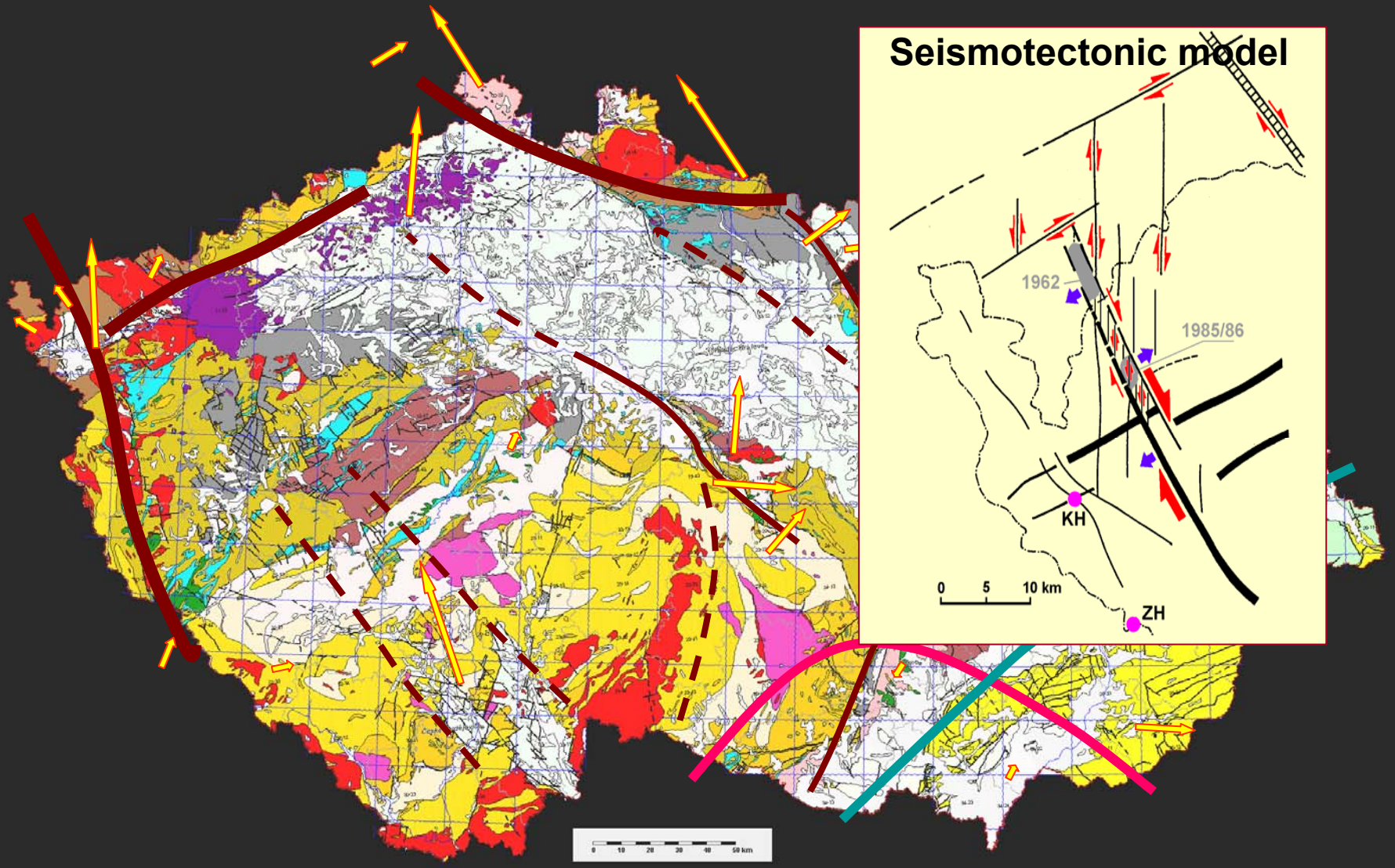
**(a) Long-term strain accumulation phase: The 135ºE striking Mariánské Lázně fault zone (MLF) is intersected by a bundle of lamellar N-S to NNE-SSW fault elements that create splay-structure. In the focal area both tectonic systems display tendency to a dextral creep and during the long-lasting period with a relative seismic quiescence the strain is cumulated.**




**(b) Short-term strain release phase: When tectonic systems are already not able to keep the cumulated strain, in the focal zone a rupture process as a sinistral elastic rebound started, just on the lamellar N-S to NNE-SSW fault splits. By this way the weakness zone of the splay-structure along the MLF becomes to be the most suitable setting for earthquake swarms.**

**As evident, the post-seismic slip movements detected by the long-term GPS measurements after the both investigated 2004 earthquake swarms fully coincide to that seismotectonic model.**

# Relative Horizontal Site Movements



# Conclusions and Outlooks

If GPS data are applied to a geodynamic analysis, the relatively dense observatory network must be used

Individual structural blocks can move in various directions because of their different geological development (the SNEC observatory study)

Even in areas with relative low or moderate seismic activity the permanent GPS observations can contribute to earthquake focal processes studies

The GPS satellite signal monitoring together with seismological and other geophysical observations and complementary structural geological data can relevantly contribute to detect recent crustal deformation processes

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# The End

## Thank you for your attention

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