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Mapping the Moho in the Bohemian Massif with P-receiver functions

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Studied area

Bohemian Massif (BM), one of the largest outcrops of Precambrian structures in Central and Western Europe, is under investigation for a very long time and there are already crustal models for this area. Nevertheless, thanks to complex international AlpArray project we have a more dense network of stations and we have an opportunity to update existing knowledge about the structure of the BM. Area was selected from 48ºN to 52ºN and from 10ºE to 19ºE to cover Bohemian Massif and its surroundings.

Method

- Receiver functions (RFs) are a widely used method to retrieve structure of the crust, whose knowledge is needed in various studies of the upper mantle.
- The recorded waveforms are composites of direct P and P-to-S converted waves that reverberate in the structure beneath the receiver (Amonn, 1991).
- The RFs are sensitive to seismic velocity contrast and thus suited to identify velocity discontinuities in the crust including Mohorovičić discontinuity (Moho).
- Relative travel-time delays of the converted phases are transformed into estimates of discontinuity depths.

Data

- Data were gathered during the last decades from 325 permanent or temporal broadband stations (operational time of stations was from several months to many years).
- Temporal stations were included in these experiments:
  - AlpArray (2015 – 2019): 78 stations
  - AlpArray – EASI (2014 – 2015): 30 stations
  - BOHEMA I – IV (2001 – 2014): 77 stations
  - PASSEQ (2006 – 2008): 56 stations
  - Eger Rift (2007 – 2013): 10 stations

Preprocessing

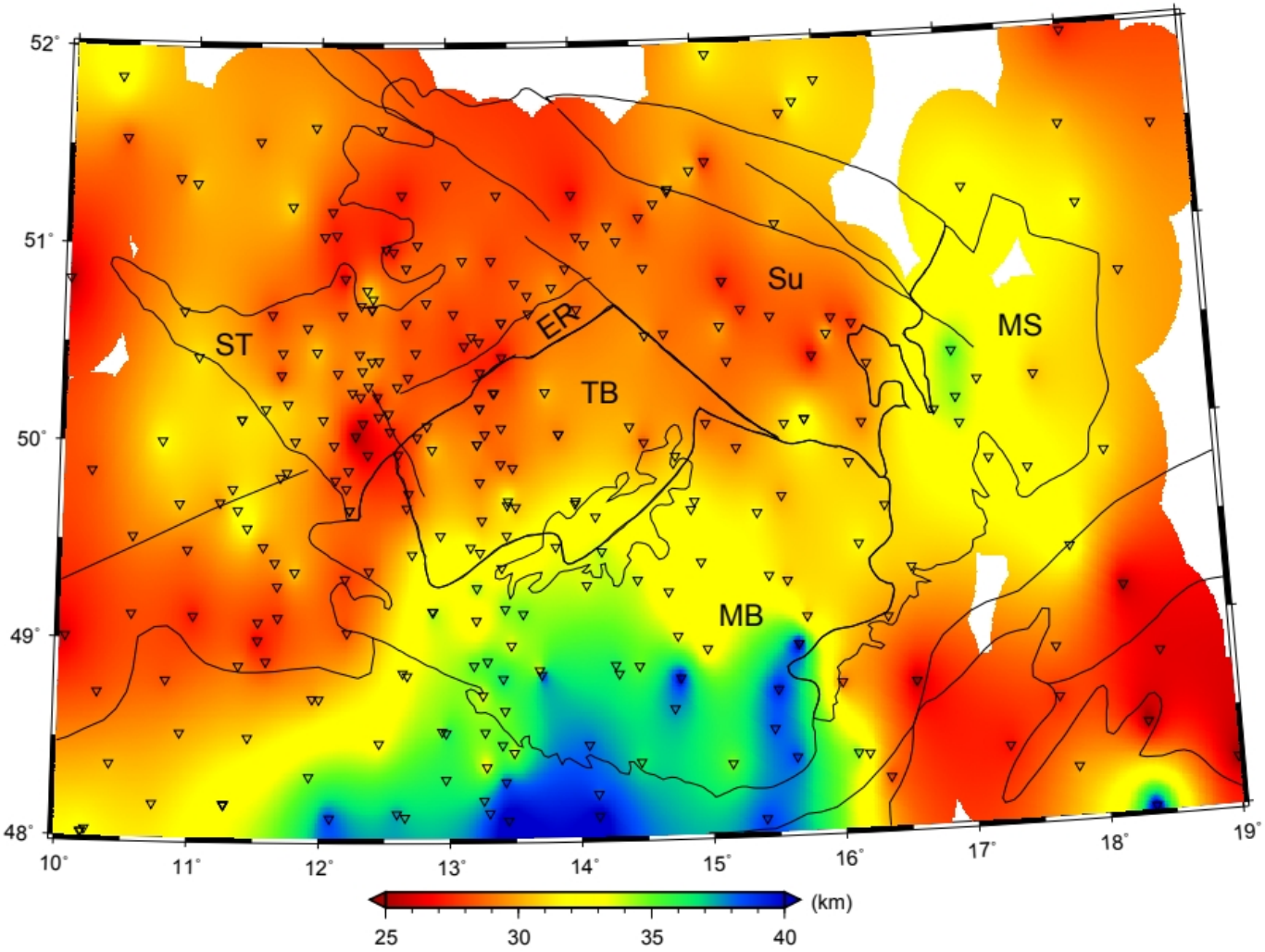
- Teleseismic data from earthquakes at 30 – 95º
- Cut-off magnitude (Liu and Gao, 2010)

$$M_c = 5.2 + \frac{\Delta - 30}{180 - 30} - \frac{D}{700}$$

- Bandpass filtering 1 – 8s
- Rotation to L-Q-T

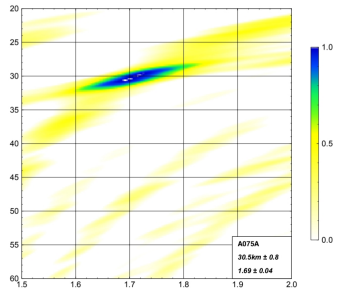
Moho depths from Ps time delays

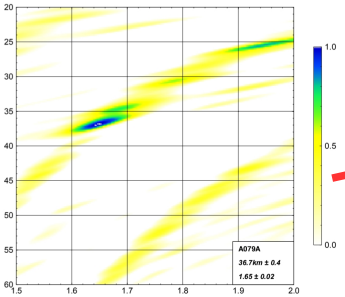
- P-to-S RFs were calculated using the deconvolution method (Kind et al., 1995; Kind and Yuan, 2011)
- RFs were summed on single stations
- Ps time delays were converted using iasp91 model

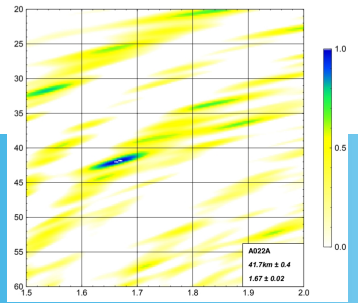


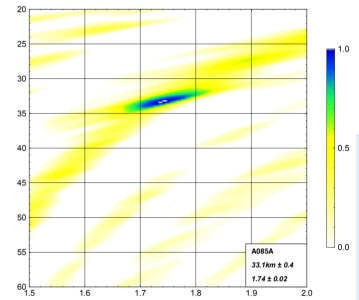
Moho depths from H - κ

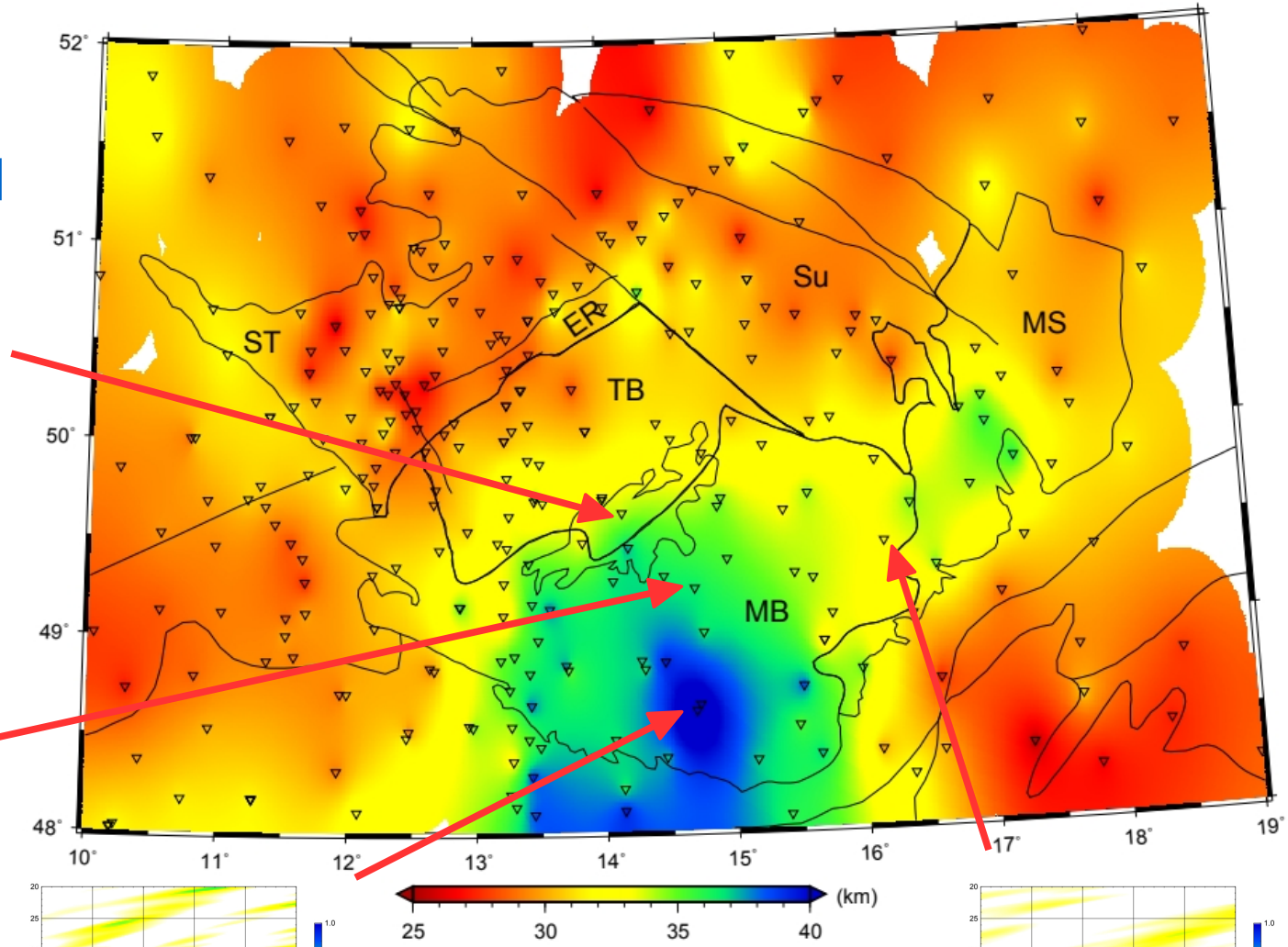
- Standard Zhu – Kanamori (2000) method was applied



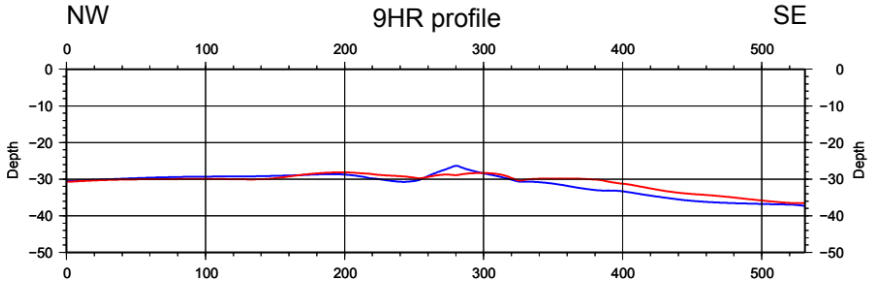


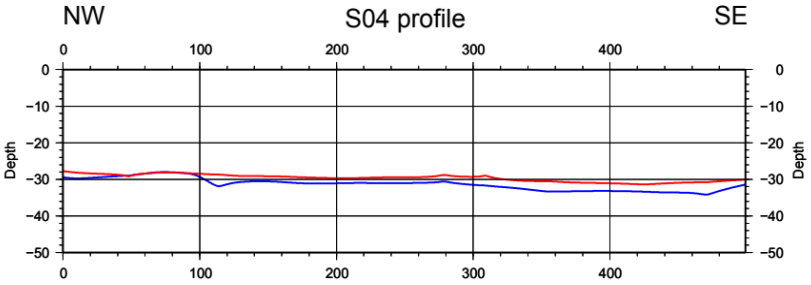


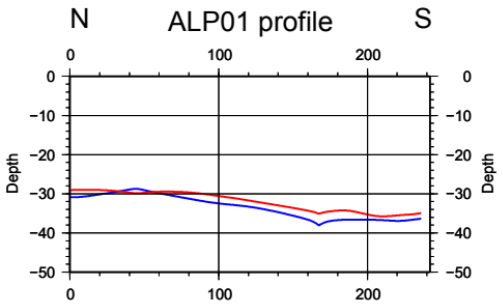


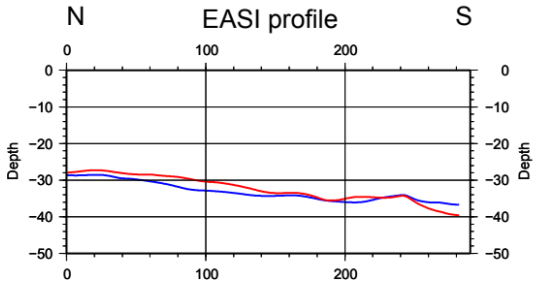


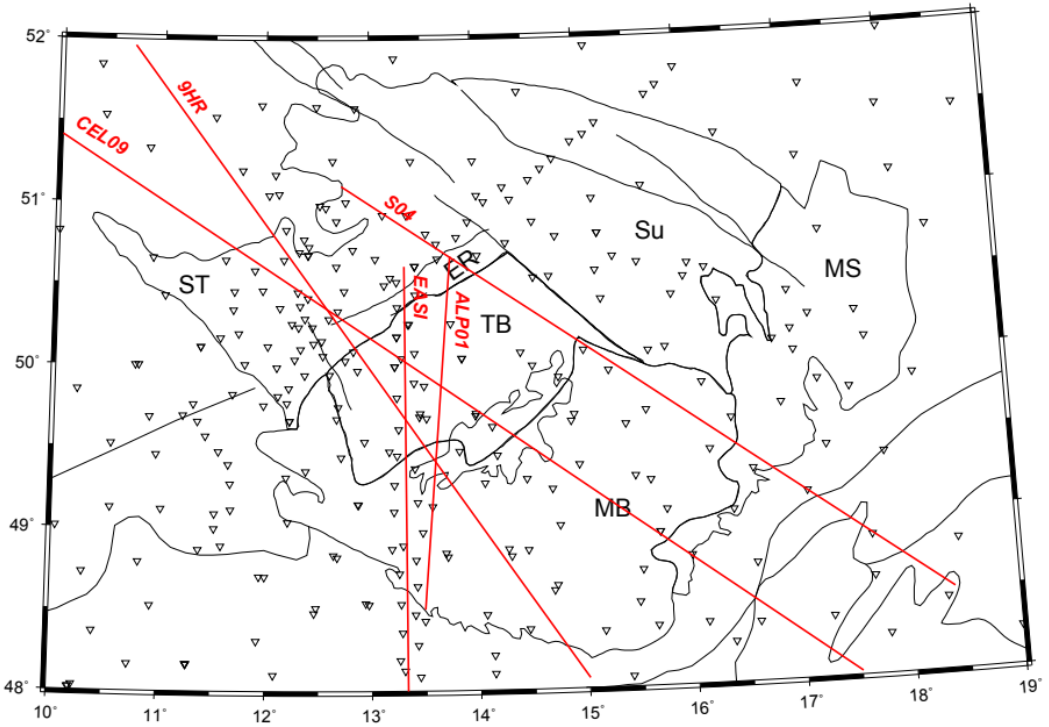
Comparison of results





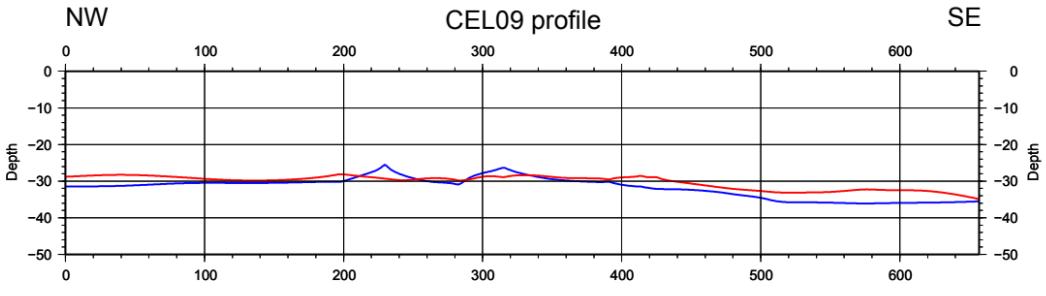






Moho depths from Ps time delay

Moho depths from Zhu − Kanamori



Conclusion

Different velocity models, including the new one retrieved from ambient-noise study (see Kvapil et al. SM4.3 D1431, EGU2020-7916) will be tested in the time-depth migration procedures.

Regional variations of the Moho depth correlate with main tectonic units of the BM. The crust thickens significantly in the Moldanubian part of the BM and thins along Eger Rift in the western part of the massif.

Detailed variations of the Moho depth from several receiver functions profiles will be compared with crustal sections retreved from the ambient-noise tomography.