Earthquake source models for earthquakes in Northern Iran

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1. Motivation (Fig. 1)

- double vergent mountain belt between two aseismic blocks
- complex system of thrust and strike slip faults
- good structural and geomorphic data base contrasts lacking or insufficient geophysical data base
- open questions concerning seismotectonics and seismic hazard assessment:
  - kinematics of faults and their geometry with depth
  - slip partitioning and its reasons/mechanism
  - regional stress field
  - active transtension in the internal domain of central Alborz
  - stress transfer and interaction between faults

2. Moment tensor inversion (Figs. 2 & 3)

- first tests on moment tensor inversion and velocity model
- moment tensor inversion of broadband waveforms for selected events
- inversion in frequency domain: avoid possible complications due to time shifting between data and synthetics
- frequency range 0.03 to 0.1 Hz (surface waves)
- comparison with P-wave polarities (Fig. 2a)

3. Perspectives

development of an extended algorithm using

- waveforms of surface and body waves from broadband data
- first motion body wave polarities from broadband and short-period data as well as accelerometers
- Amplitude ratios of P- and S-waves from broadband and short-period data as well as accelerometers

- comprehensive study of earthquake source parameters starting with M ≥ 3.8
- develop a scaling relation between M_L and M_w
- determining regional stress tensors using retrieved moment tensors

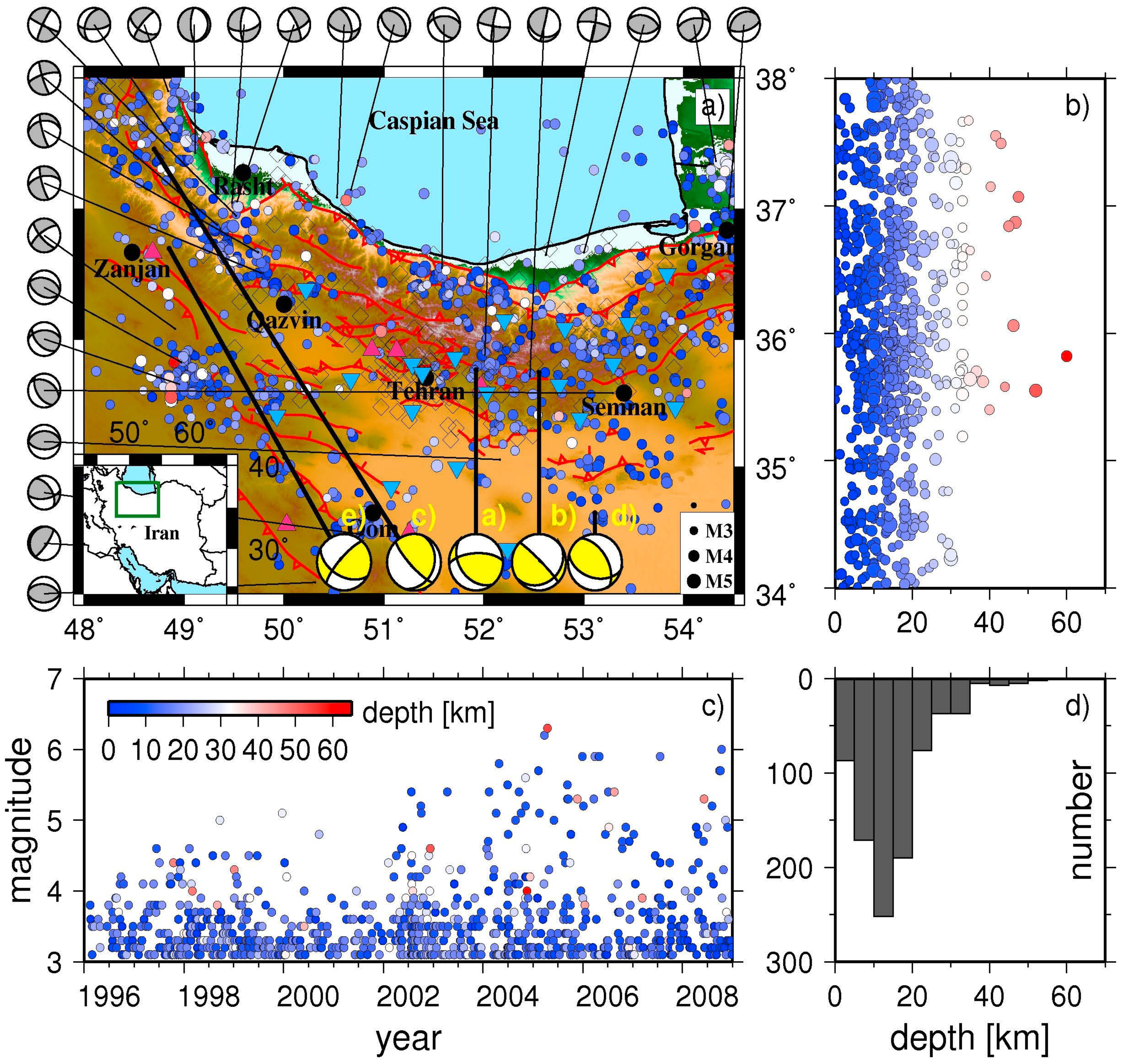

Fig. 1- Seismicity (M ≥ 3) of Alborz Mountains and surrounding areas of a compiled catalogue (Refs. 1-9). Circles mark earthquakes between 1996 and 2008. **Symbol size**: magnitude; **symbol colour**: depth; **red lines: main faults**; **purple triangles: broadband station**; **blue reversed triangles**: **short-period stations**; **transparent squares**: accelerometers; **grey focal mechanisms: Harvard CMT**. **Yellow solutions** correspond to solutions in **Fig. 2**.

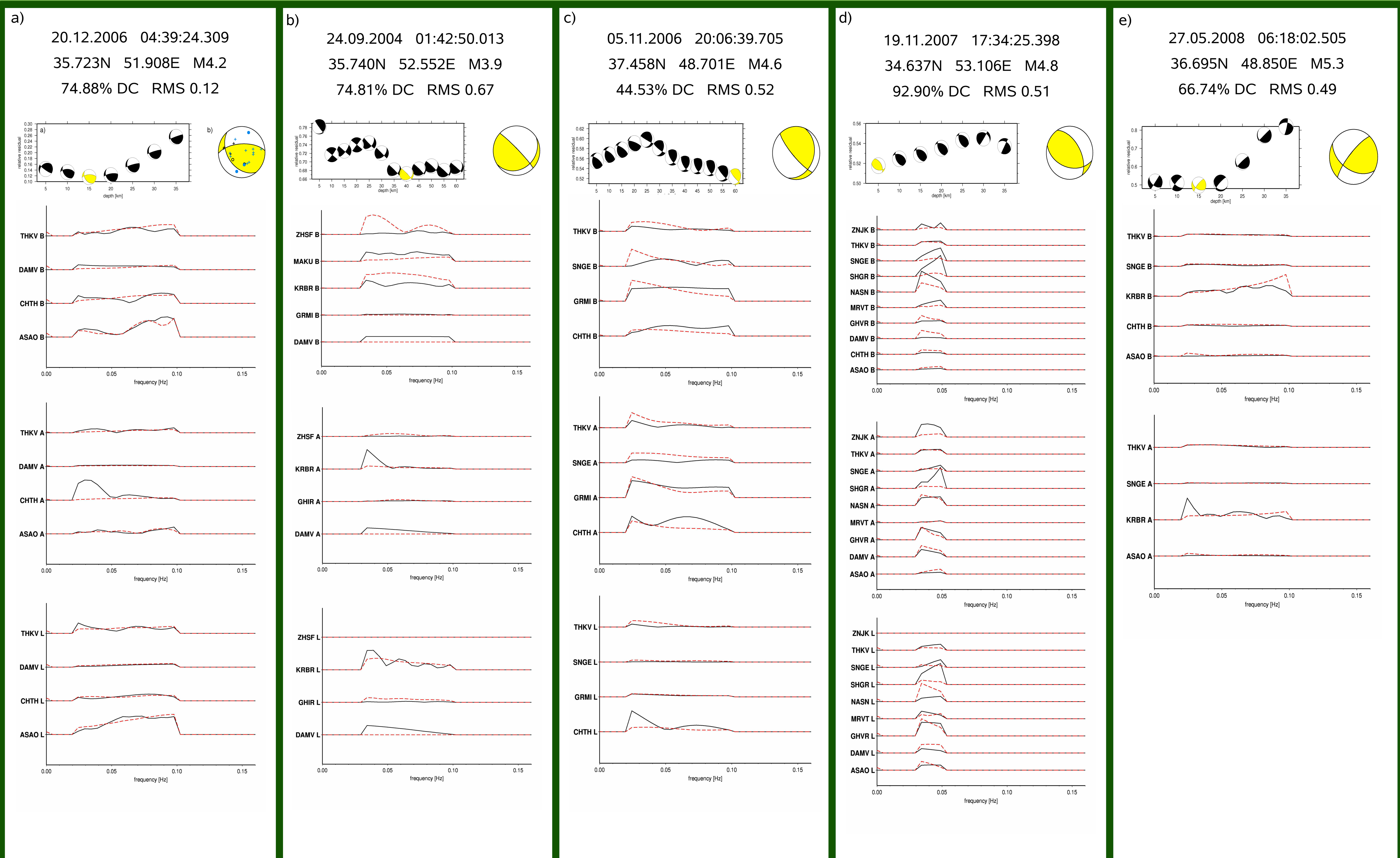

Fig.2 - Preliminary inversion results: Inversion of amplitude spectra of broadband surface waves within the shown frequency ranges. **Black: data**, **red: synthetics**. For event locations see yellow solutions in Fig. 1. Quadrants of compression and dilatation are ambiguous up to now and thus set arbitrarily (except a). Observed P wave polarities in a) – **black**: **broadband data**, **blue**: **short-period data**, **circles**: **dilatation, crosses: compression**.

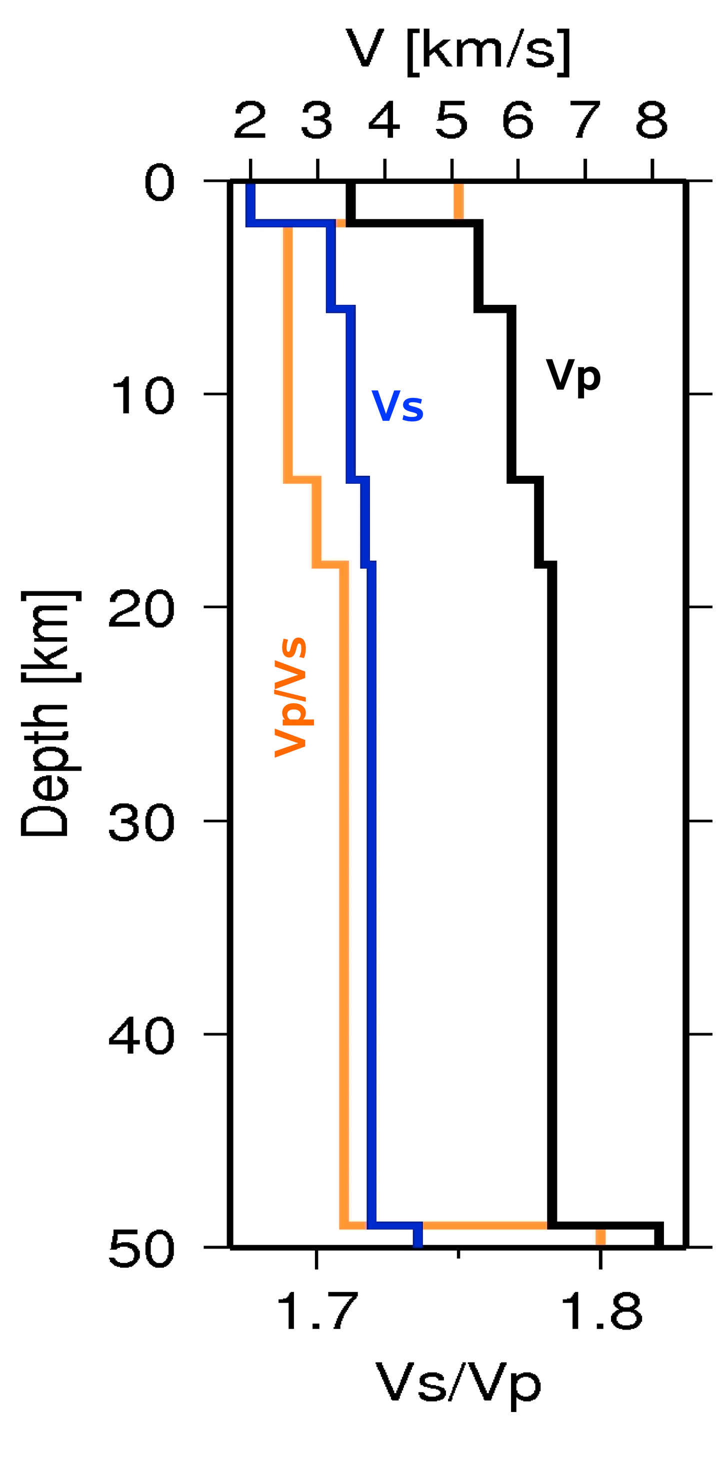

Fig. 3 – velocity model: Currently for inversion used velocity model. Modified global ak135 model. **Black**: **P wave velocity**, **blue**: **S wave velocity**, **orange Vp/Vs relation**.

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References:

[1] Engdahl et al. (2006) Relocation and assessment of seismicity in the Iran region. Geophys. J. Int. 167, pp. 761-778
[2] ETH Zurich online at http://www.seismo.ethz.ch/mt
[3] IIEES online at http://www.iiees.ac.ir
[4] Iranian Seismological Centre online at http://irsc.ut.ac.ir
[5] Iranian Strong Motion Network online at http://www.bhrc.ac.ir
[6] ISC online at http://www.isc.ac.uk
[7] Harvard CMT catalogue online at http://www.seismology.harvard.edu
[8] EMSC online at http://www.emsc-csem.org
[9] NOAA online at http://www.ngdc.noaa.gov