Modeling seismic waves propagation for imaging Earth structure at regional scale

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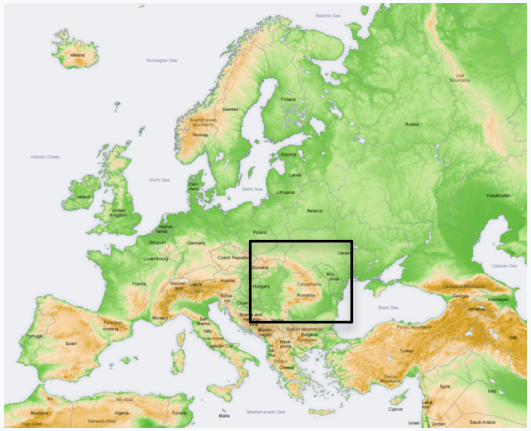
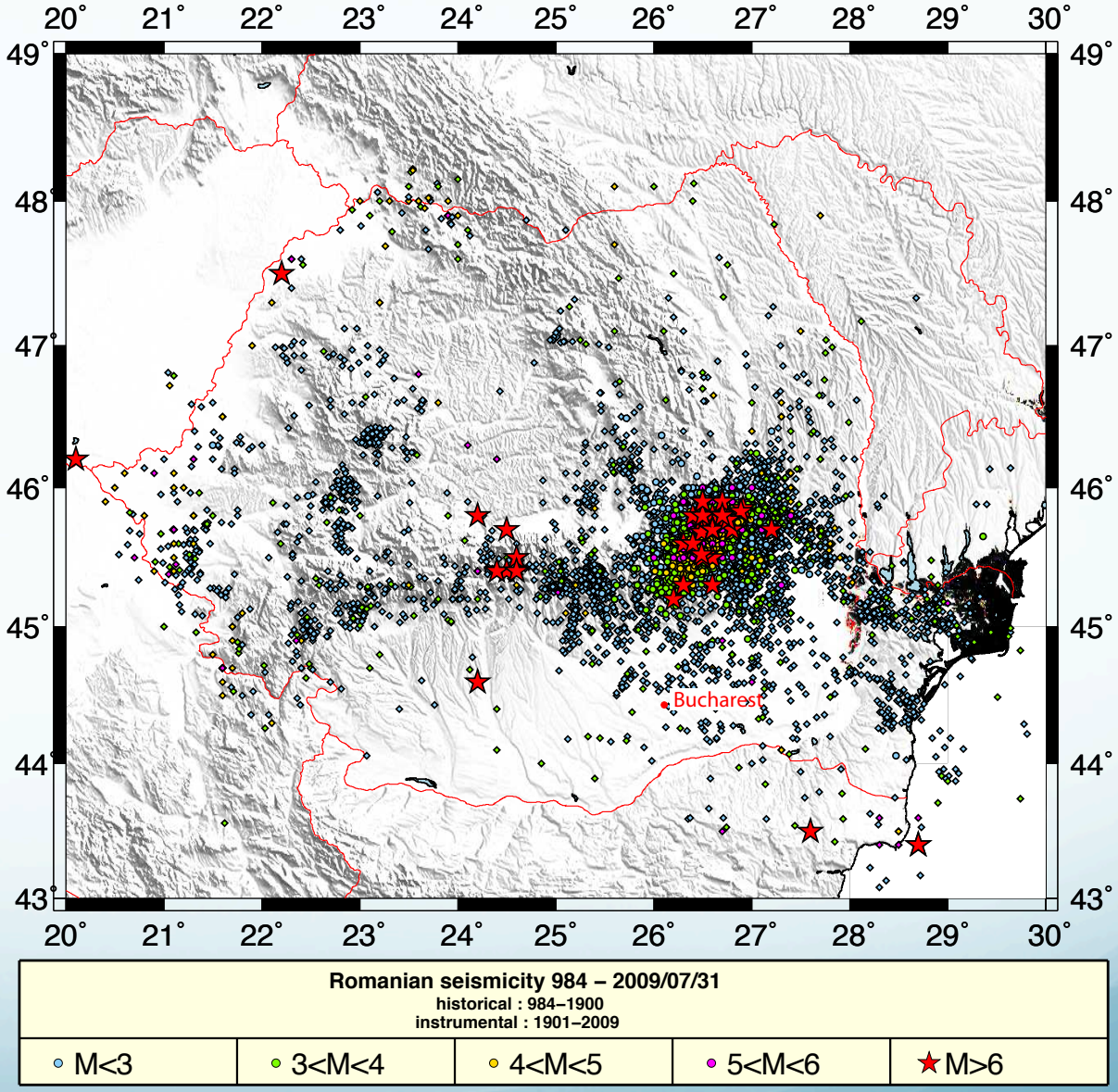
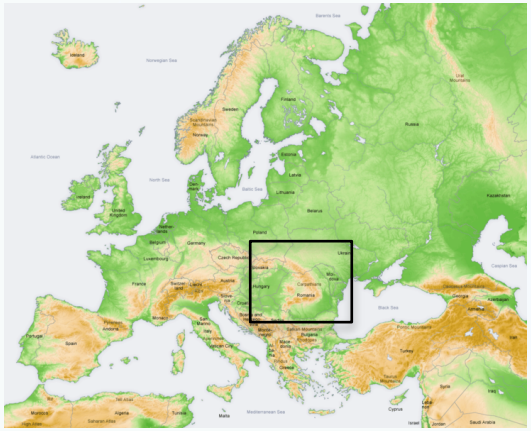
Start PhD: January 1st 2011



Vrancea

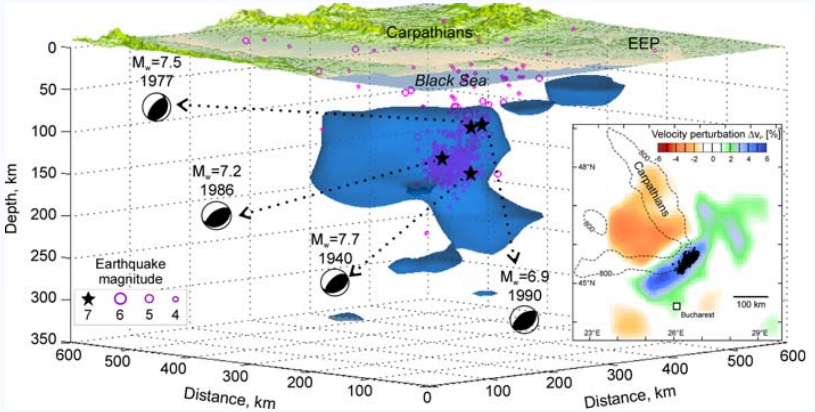
- ✓ A particular seismicity





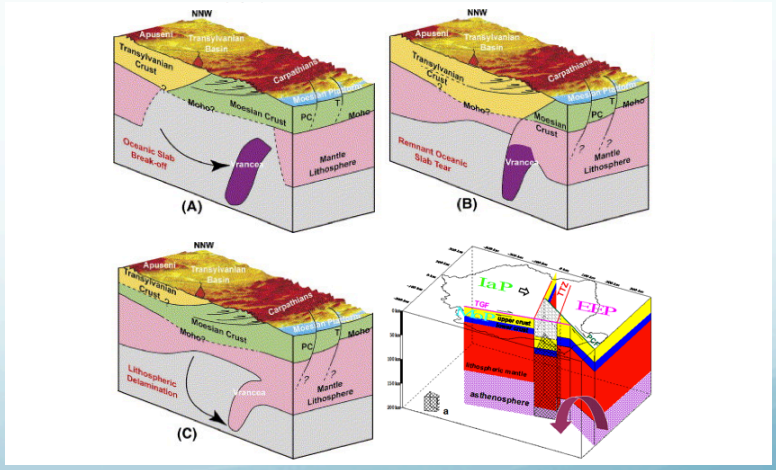
Vrancea

- ✓ A particular distribution of temperatures and velocities
- ✓ Geodynamic model to be assessed



Martin et al. 2005

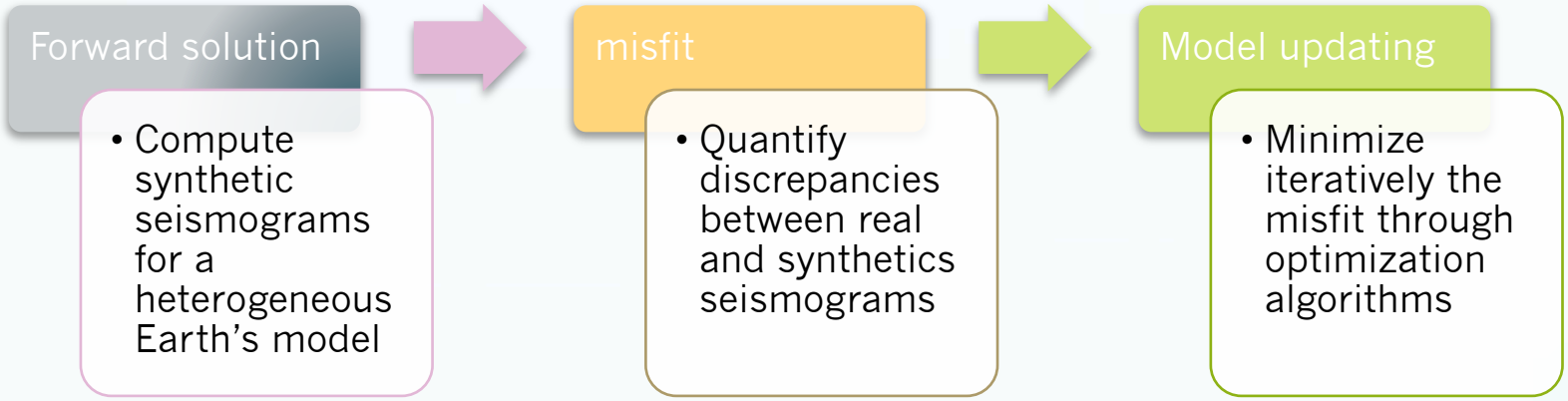
Velocity distribution correlated with the seismogenic volume underneath Vrancea



cyberdyn.geodin.ro

Several geodynamic models proposed

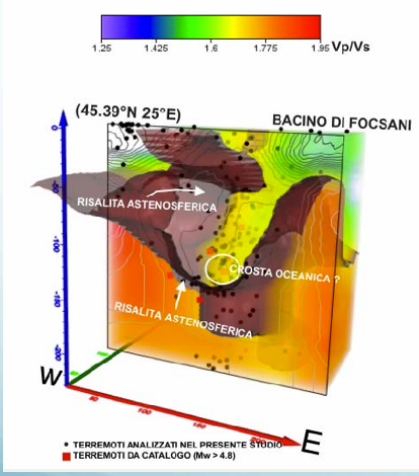
Tomographic inversion scheme



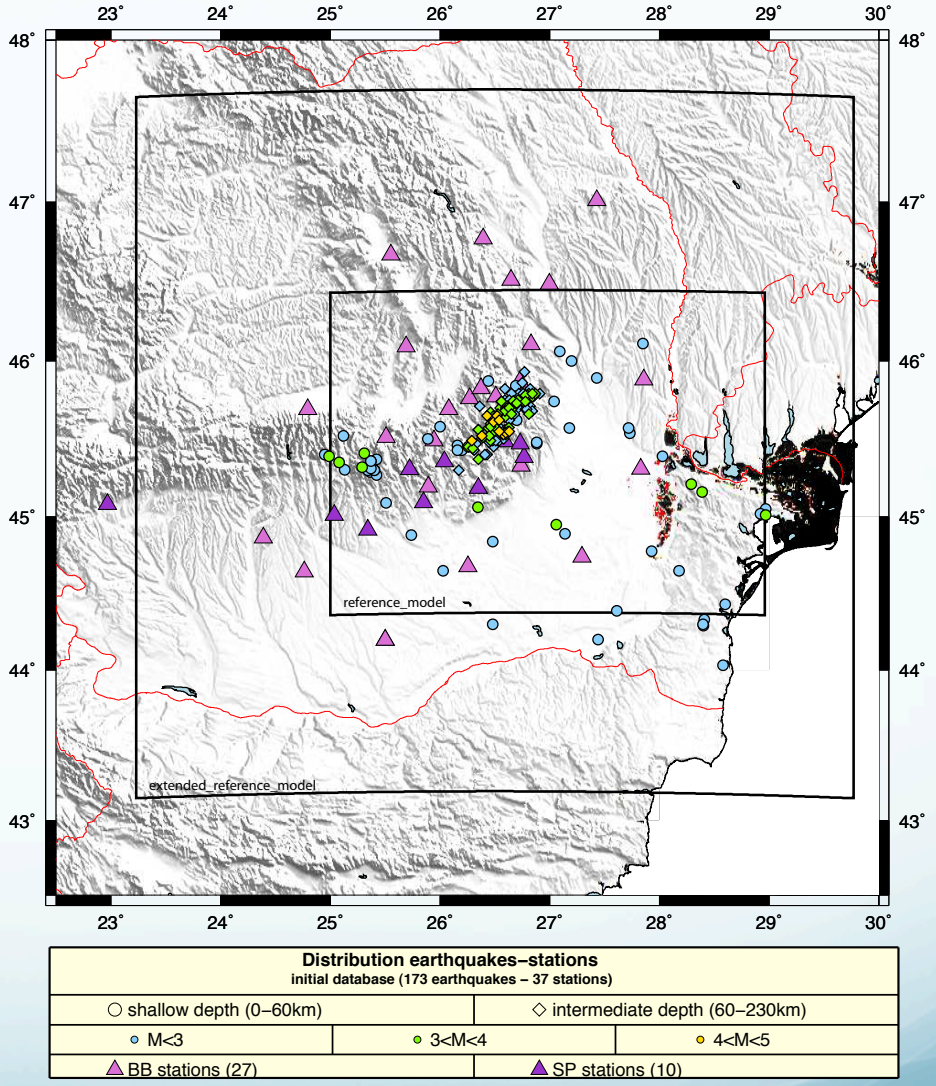
Database

- Seismograms from the CALIXTO 1999 experiment
- 3D model from Tondi et al. 2009

- ✓ 6 months
- ✓ 120 seismic stations
- ✓ 173 local events recorded



Tondi et al. 2009



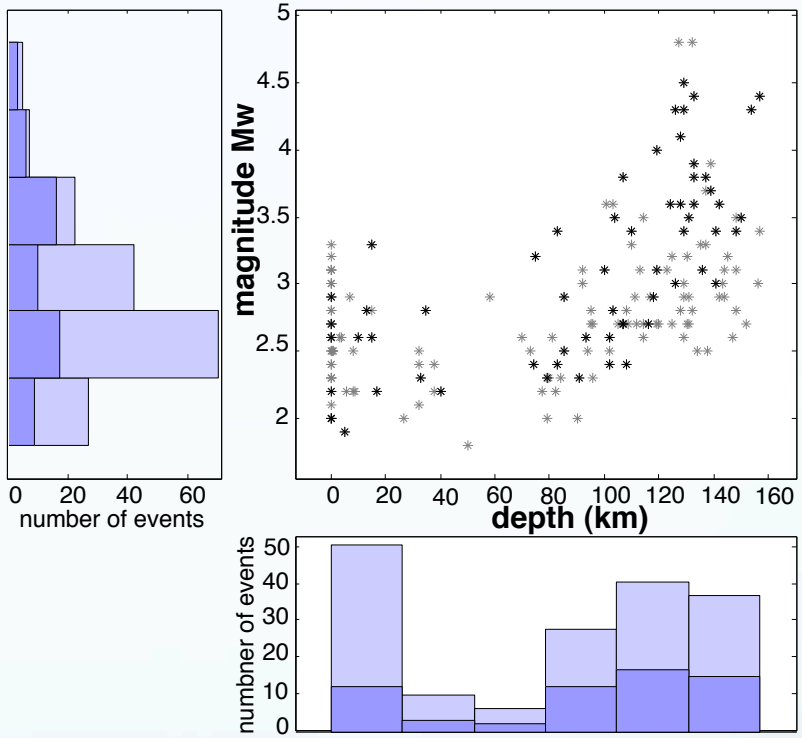
First processings and first weaknesses

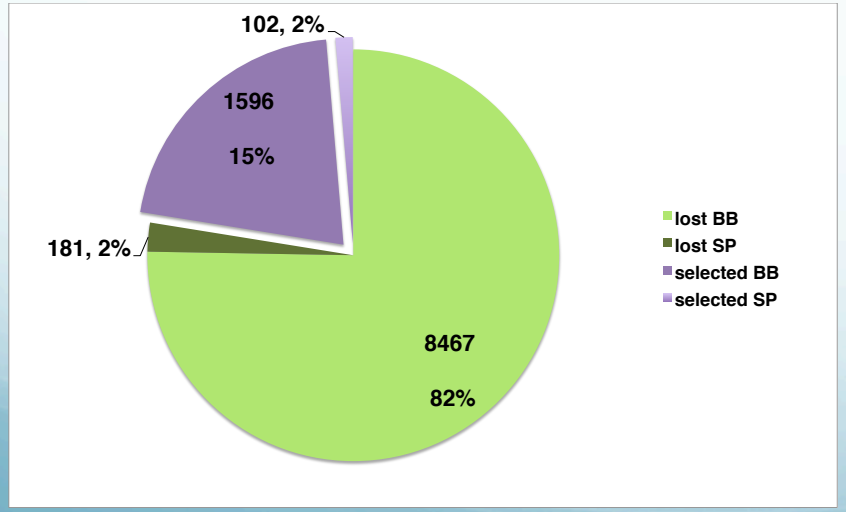
Database

- Seismograms from the CALIXTO 1999 experiment

✓ 2<Mw<4.8

✓ 0 <depth<154 km

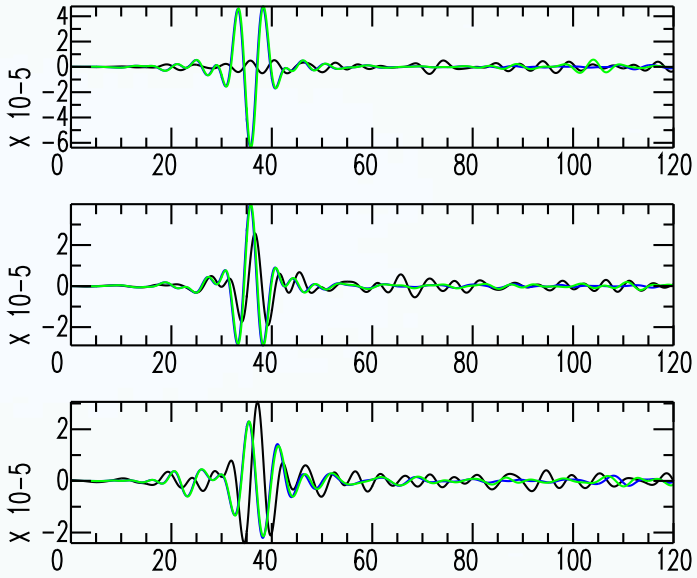


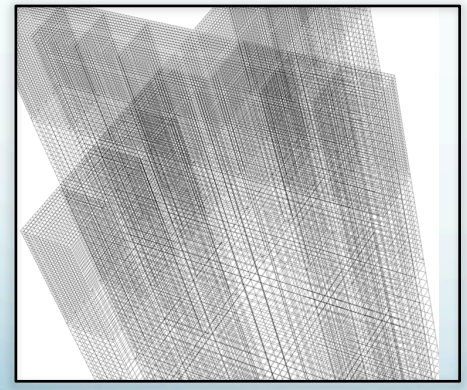


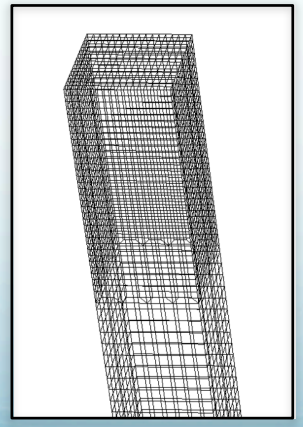
→ Number of usable traces
1596 BB
102 SP

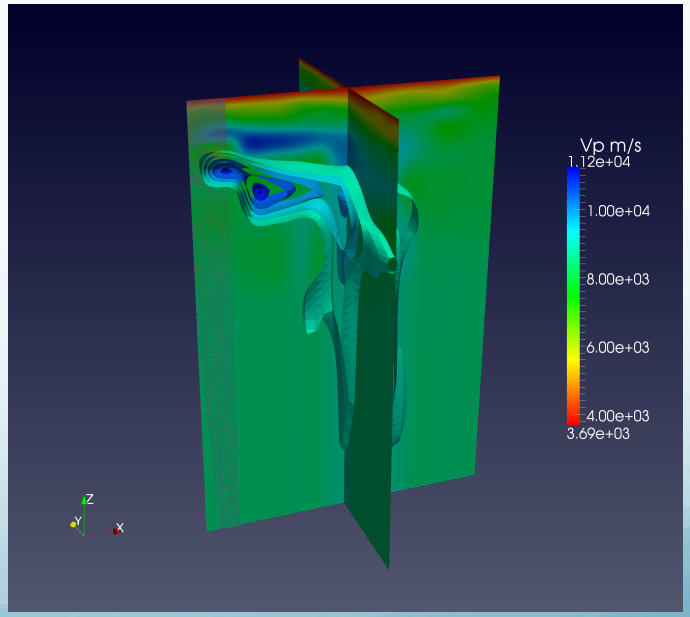
Forward solution

- Compute synthetic seismograms for a heterogeneous Earth's model









Forward solution

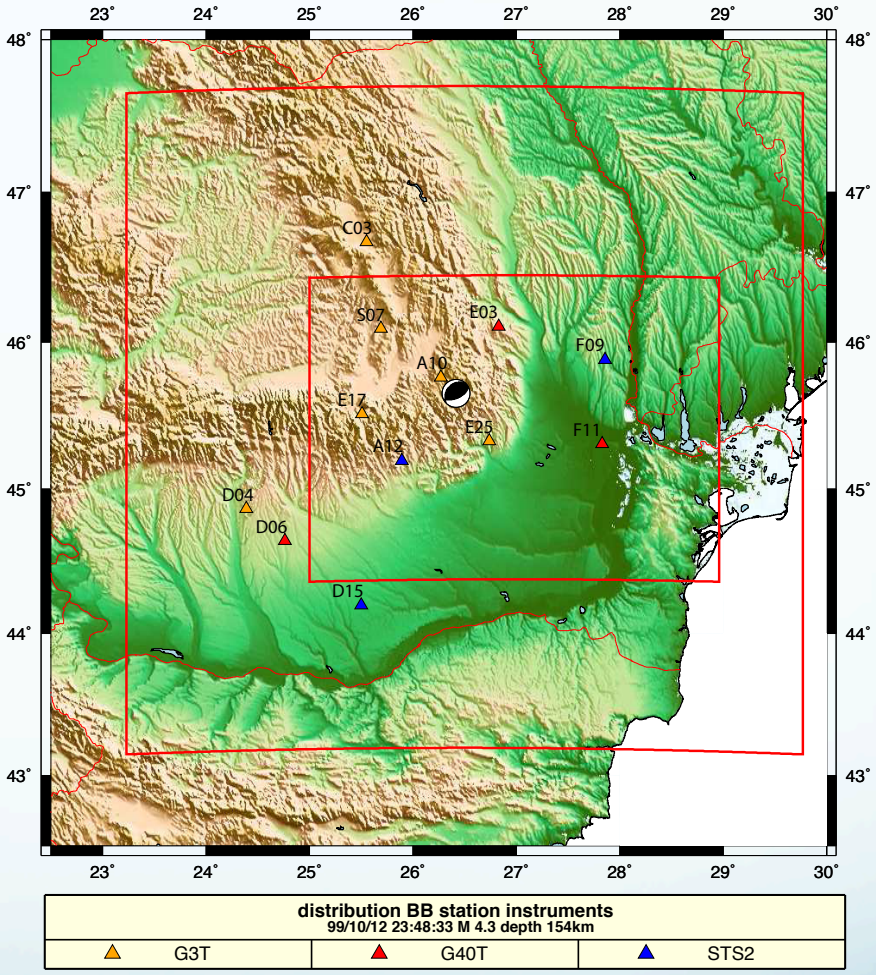
- Compute synthetic seismograms for a heterogeneous Earth's model

Preliminary tests with CALIXTO events

10/12/1999

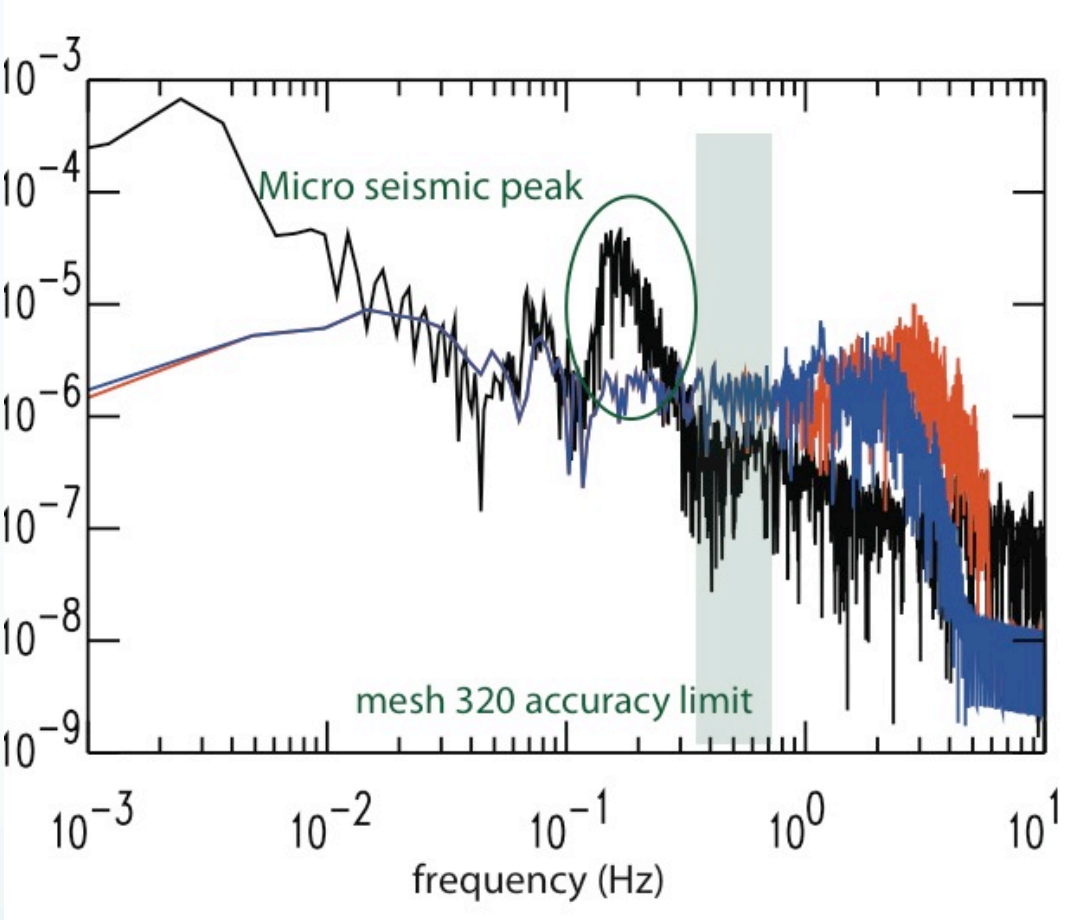
Mw= 4.3

Depth= 154 km



Misfit

- Quantify discrepancies between real and synthetics seismograms



Preliminary tests with CALIXTO events

10/12/1999

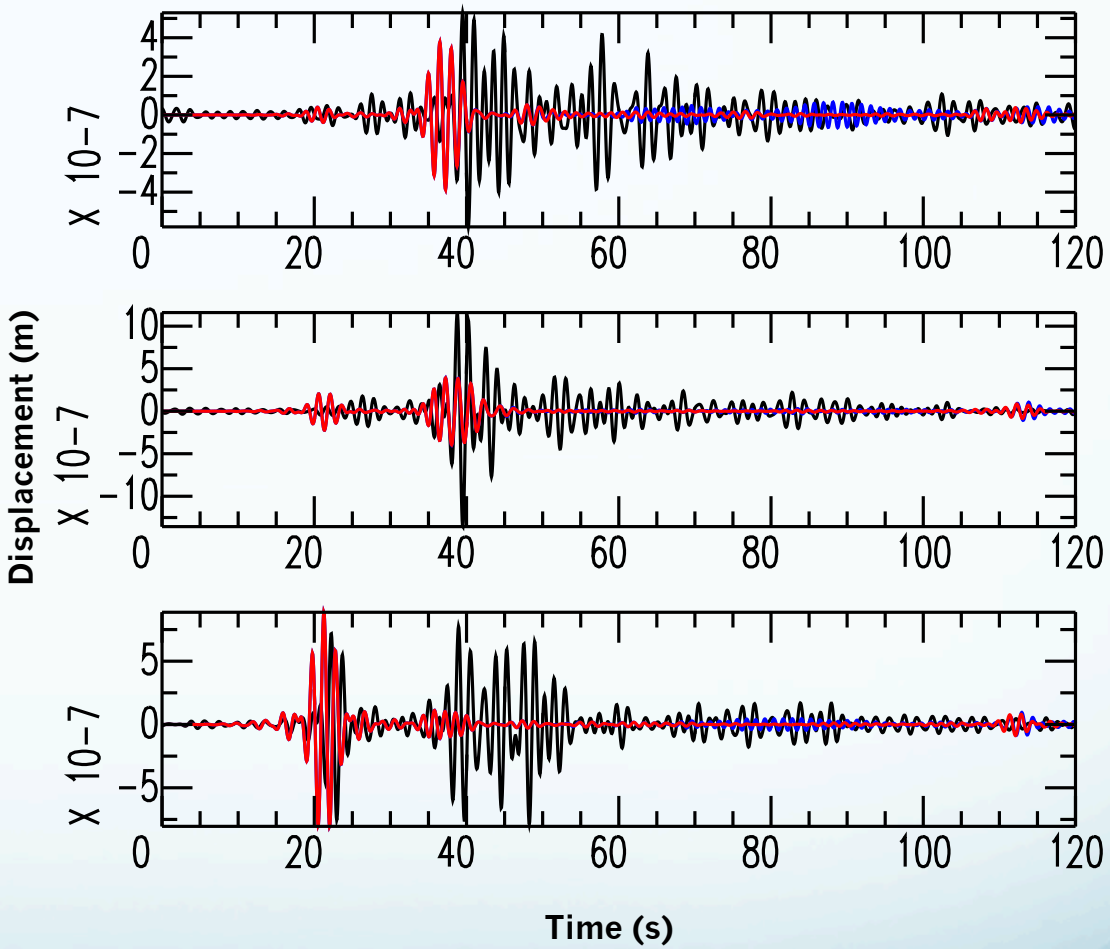
Mw= 4.3

Depth= 154 km

→ Quite strict limitations on the investigable frequency range : [0.5 - 0.8]Hz

Misfit

- Quantify discrepancies between real and synthetics seismograms



Preliminary tests with CALIXTO events

10/12/1999

Mw= 4.3

Depth= 154 km

Misfit

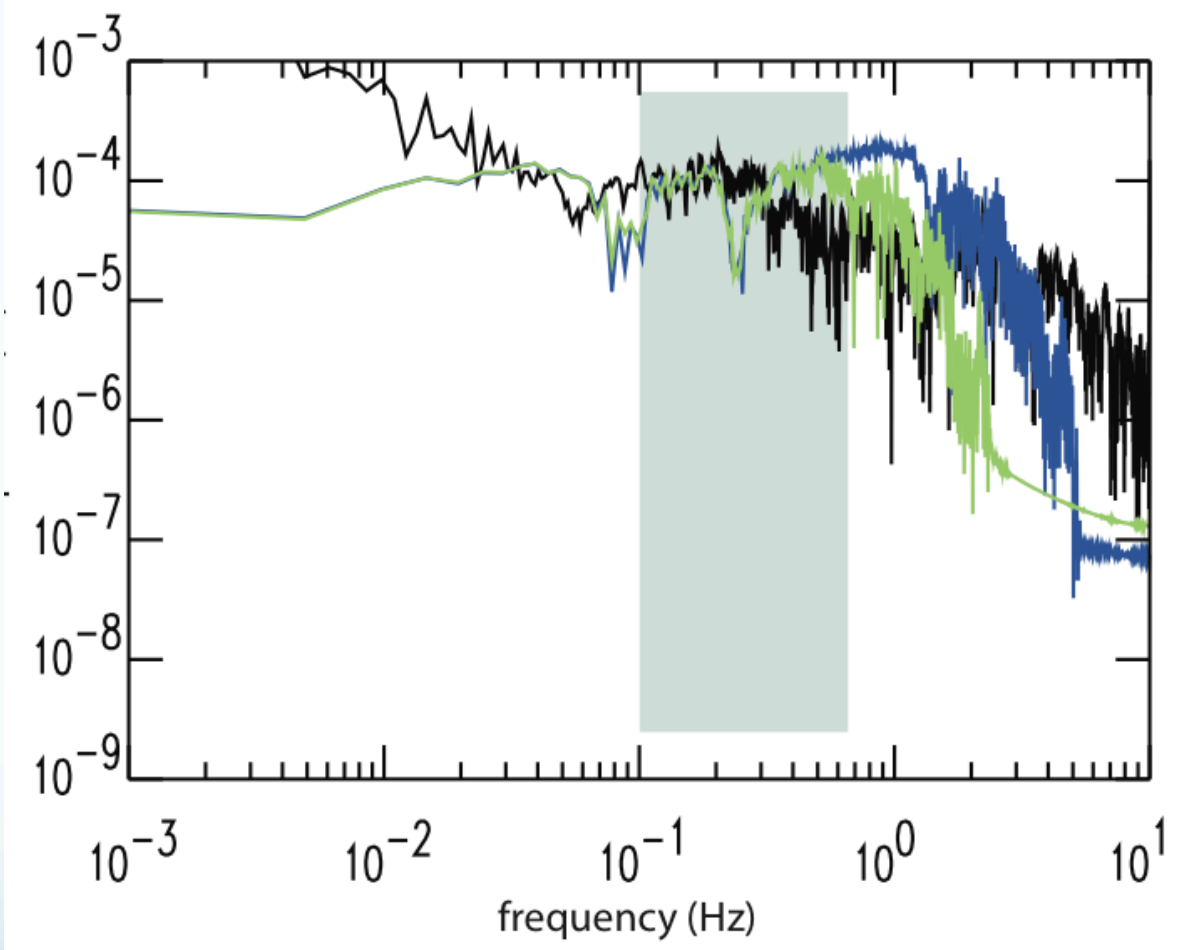
- Quantify discrepancies between real and synthetics seismograms

Comparison with recent events recorded on the permanent network

25/04/2009

Mw= 5.2

Depth= 106 km



→ investigable frequency range : [0.1 - 0.25] Hz

Misfit

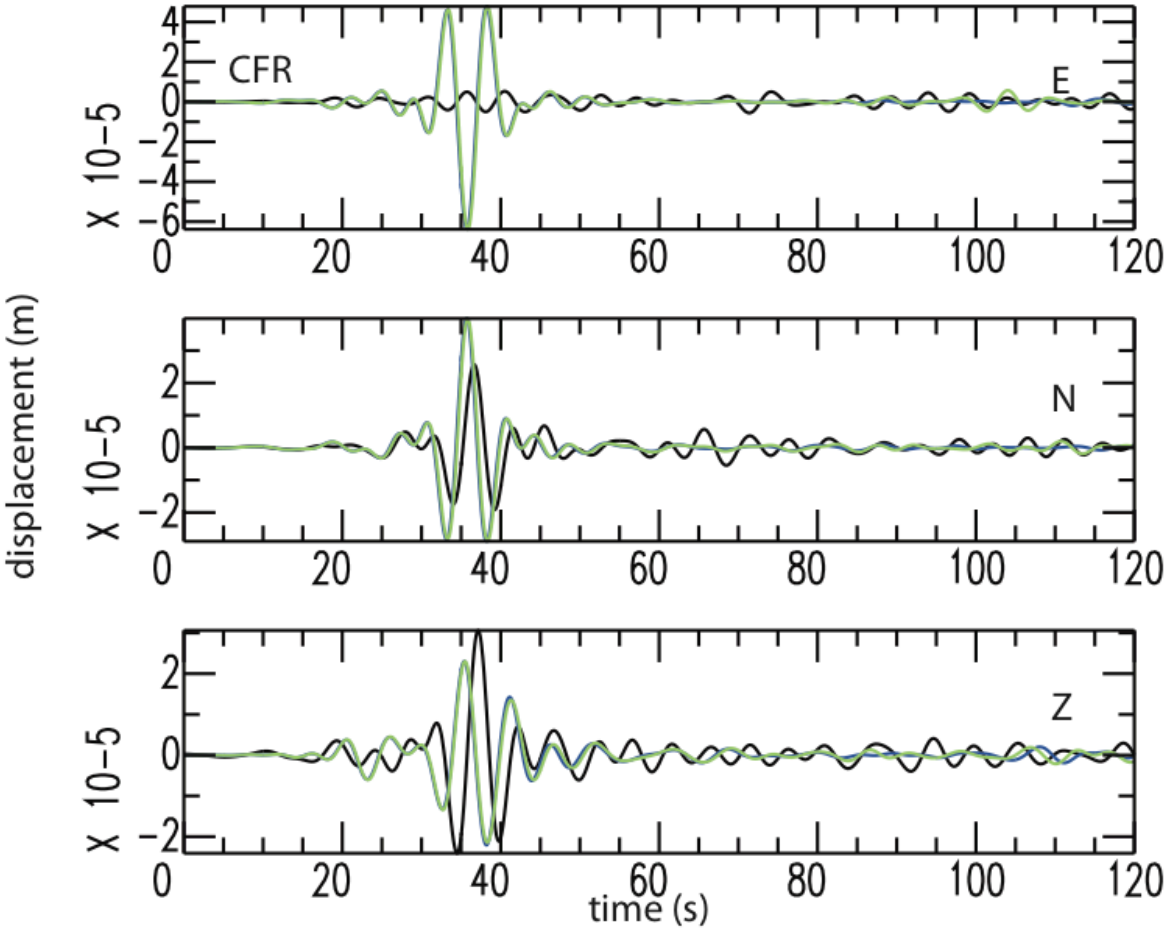
- Quantify discrepancies between real and synthetics seismograms

Comparison with recent events recorded on the permanent network

25/04/2009

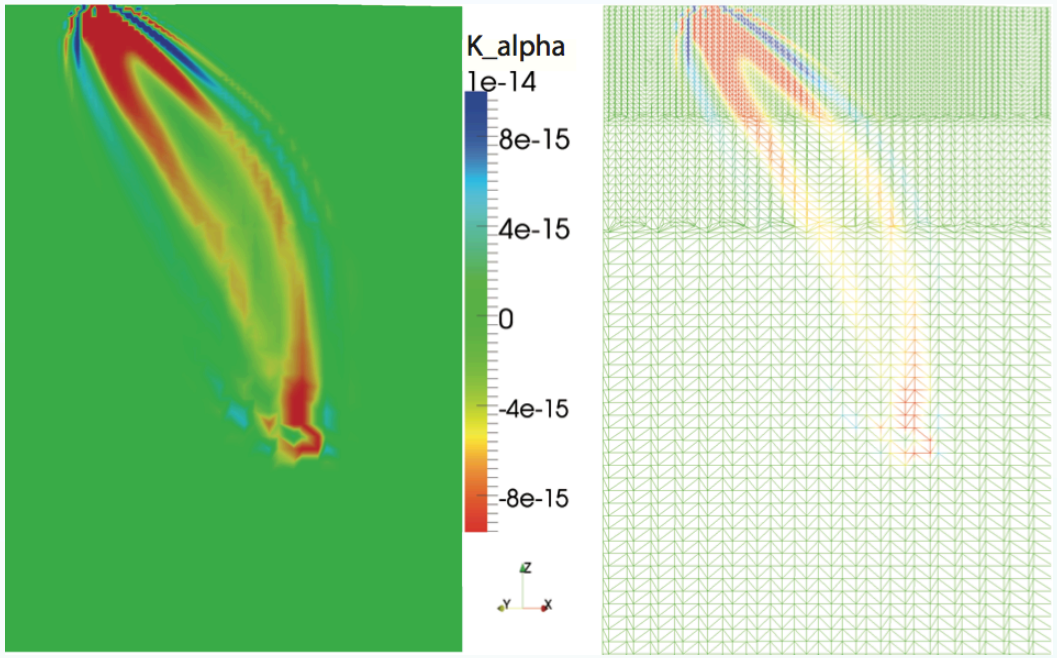
Mw= 5.2

Depth= 106 km



Towards model updating

- Computation of travel-time sensitivity kernel using the adjoint method



Preliminary tests with CALIXTO events

10/12/1999

Mw= 4.3

Depth= 154 km

→ Computational challenges for:
3D wave field simulation
3D sensitivity kernel construction

→ Lack of low frequencies

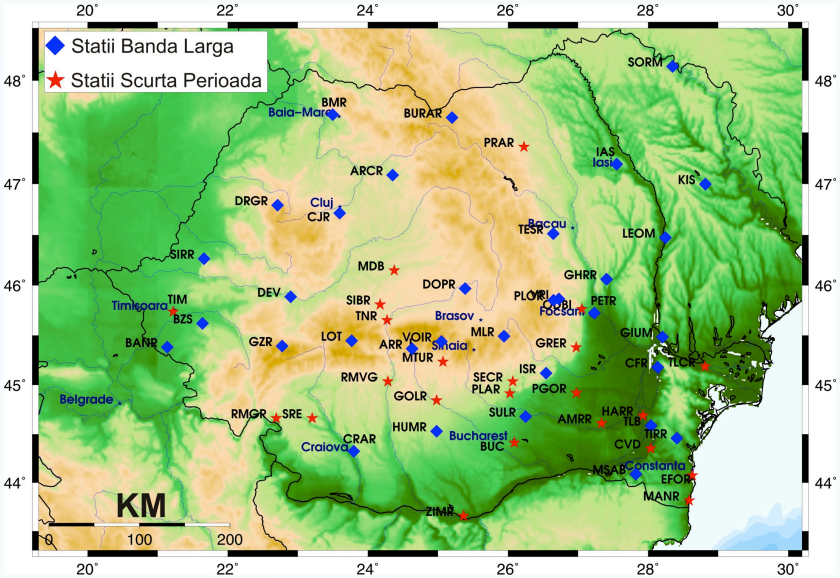
→ NEED TO EXTEND THE DATABASE

Database extension

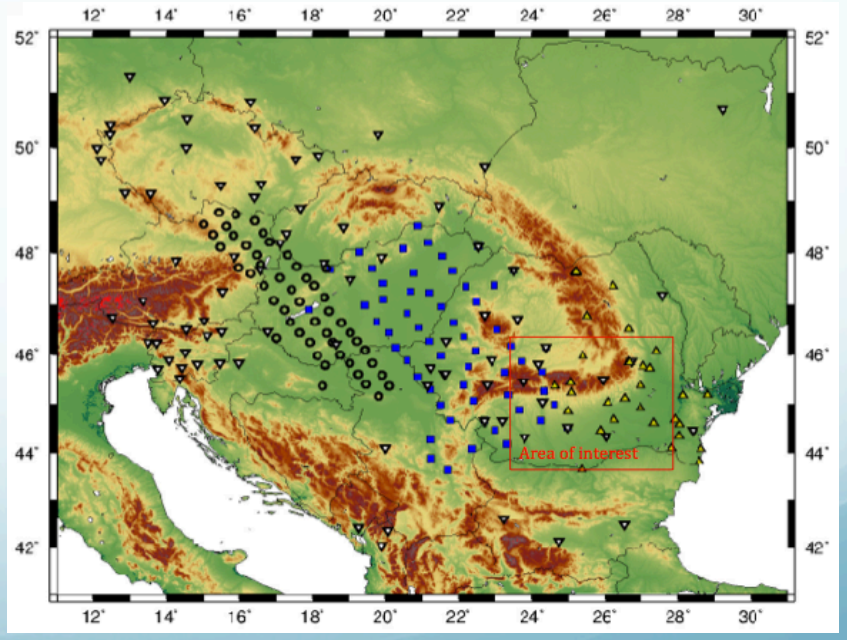
NERA
Network of European Research Infrastructures for Earthquake Risk Assessment and Mitigation

From 2000/01/01 to 2011/12/30:

Mw ≥ 4 130 events
Mw ≥ 4.5 25 events
Mw ≥ 5 5 events



From NIEP website



With the courtesy of Ren et al. 2012 (submitted)

✓ Romanian seismic network

32 permanent BB stations

✓ South Carpathian Project (june 2009 - june 2011)

54 temporary BB stations

Thanks !