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MOBNET in the AlpArray project

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2) Univ. Lausane, Switzerland
3) Univ. Vienna., Austria

AlpArray-EASI WG
AlpArray-IVREA WG
AlpArray WG

MOBNET

- pool of temporary seismic stations of the IG CAS, step by step developed since mid 90th
- financial support: grant agencies GACR, GAAV or Czech Academy of Sciences
- Since 2016 incorporated into the CzechGeo/EPOS infrastructure
- currently consists of 65 pairs of BB/SP seismometers and GAIA data acquisitions systems
- at present: **30 BB stations of the MOBNET involved in the AlpArray** project

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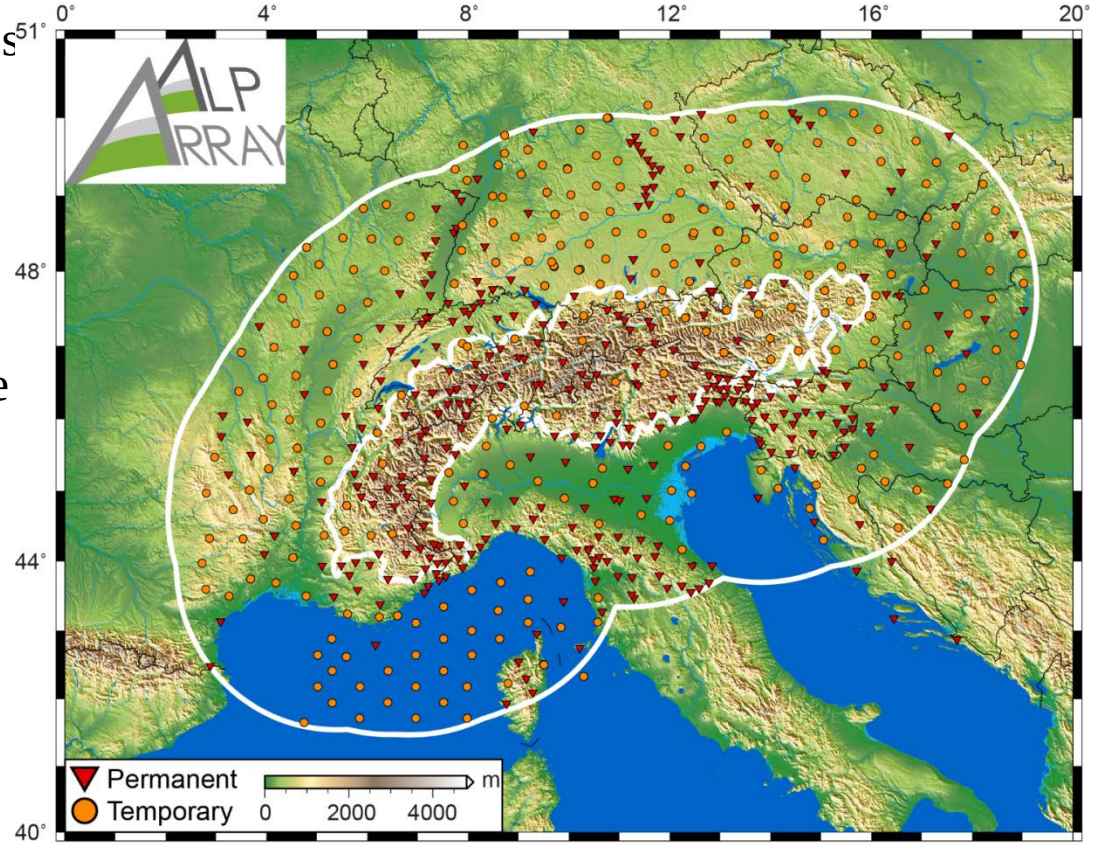
AlpArray – European initiative - advanced study of the **Alps-Apennines-Carpathians-Dinarides orogenic system**

- Relation to mantle dynamics
- Plate reorganizations
- Surface processes and seismic hazard
- High-resolution 3D images of structures and physical properties of the lithosphere and the upper mantle



AlpArray Seismic Network

~360 permanent stations
~260 temporary BB stations
30 OBS in Liguria

- homogeneous inter-station spacing of ~52 km, distance of any place to a station <30km

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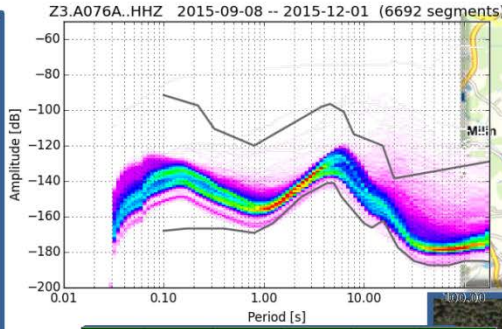
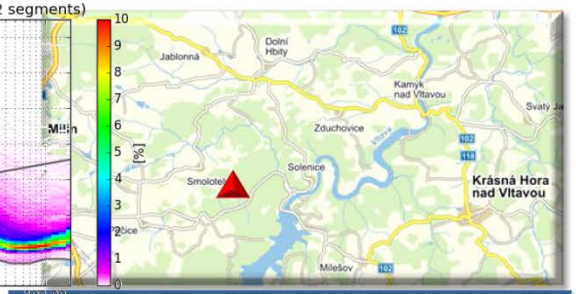
A076A

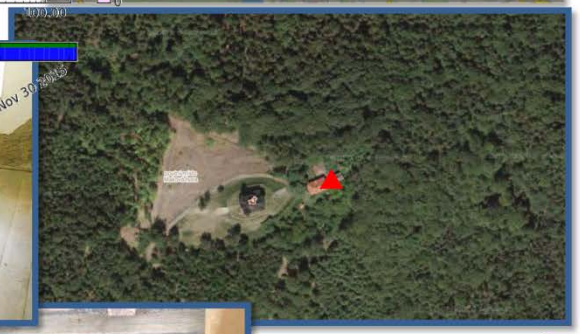
Maková Hora

INSTALLATION		EQUIPMENT	
Start :	8.9.2015	Sensor :	CMG-3T 120 s
Lat :	49.6168	Depth :	3 m
Lon :	14.1494	Recorder :	Gaia 1
Alt :	532 m	Power :	electricity grid

The station is located on the lower ground floor of the former rectory pilgrimage church at Maková Hora (Poppy Mountain). Upper ground floor is occasionally used for recreational purposes.
Seismometer is installed in the shaft on concrete pillars built on bedrock.
The GPS antenna is brought out through the window, length - 5 m, direction - S, view open.
Geomorphology: Benešov Uplands.
Subsoil: orthogneiss.



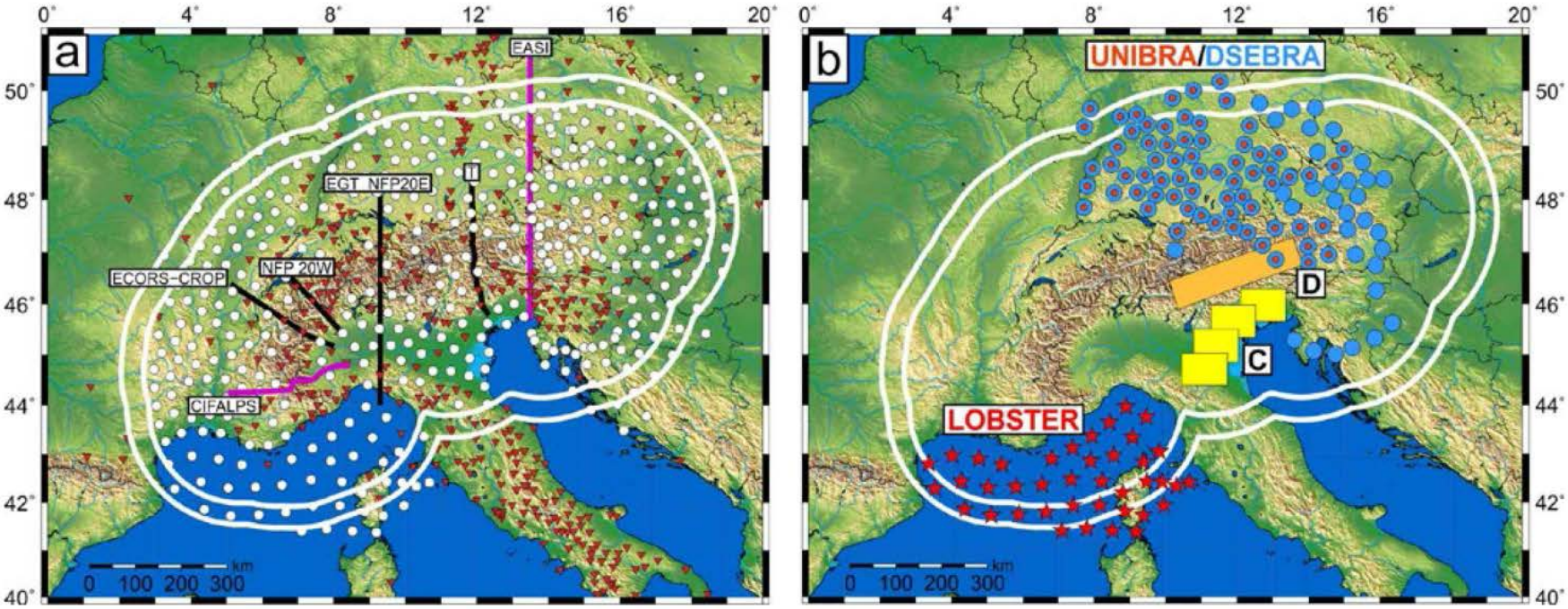




Passive seismic experiments are designed to help answer questions related to specific structural targets in different provinces

- ***tools to study upper mantle fabrics*** **– body-wave anisotropy** evaluated from directional dependences of **travel time deviations** of teleseismic P waves and **shear-wave splitting** (analogy of optical birefringence)
- 3D **tomography images of velocity** in the crust and upper mantle
- to map **LAB** and delimit **boundaries of mantle lithosphere domains**
- **RF –** to map velocity discontinuities in the crust and upper mantle

Complementary experiments



Figures from SPP 4D-MB, M. Handy

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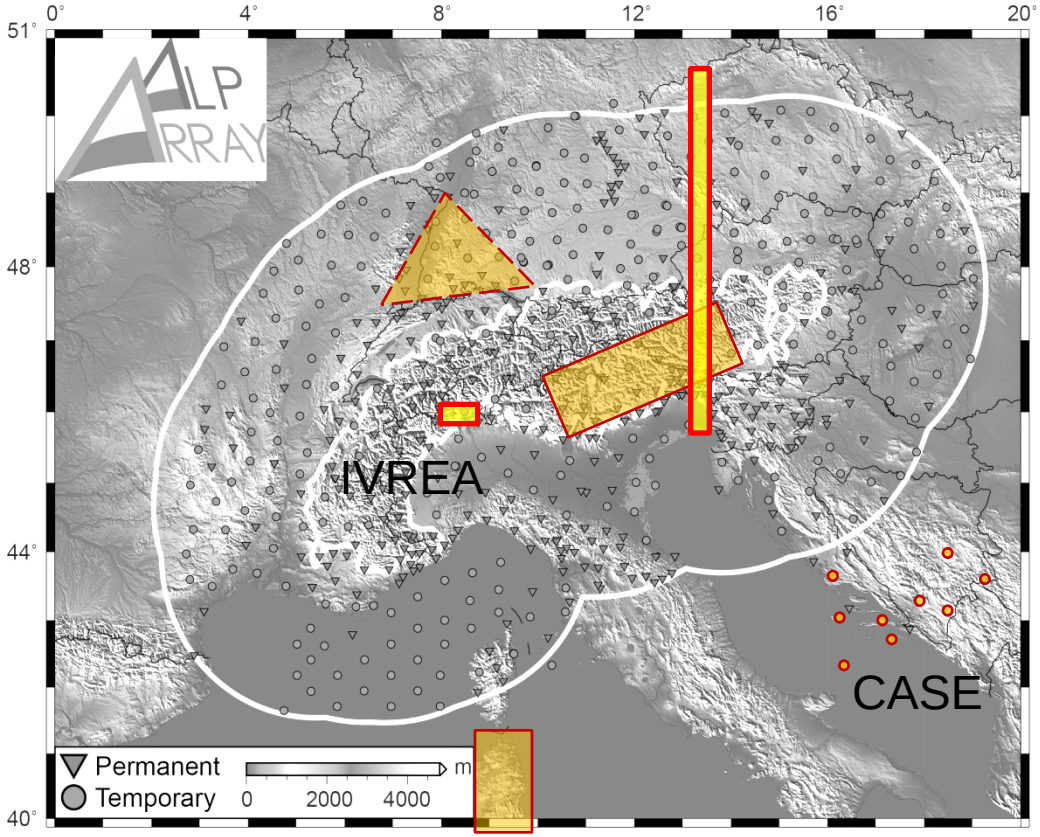
Complementary experiments



AA-EASI

10 BB stations from MOBNET
2014-2015

AA-IVREA

10 BB stations from MOBNET
Installed June 2017

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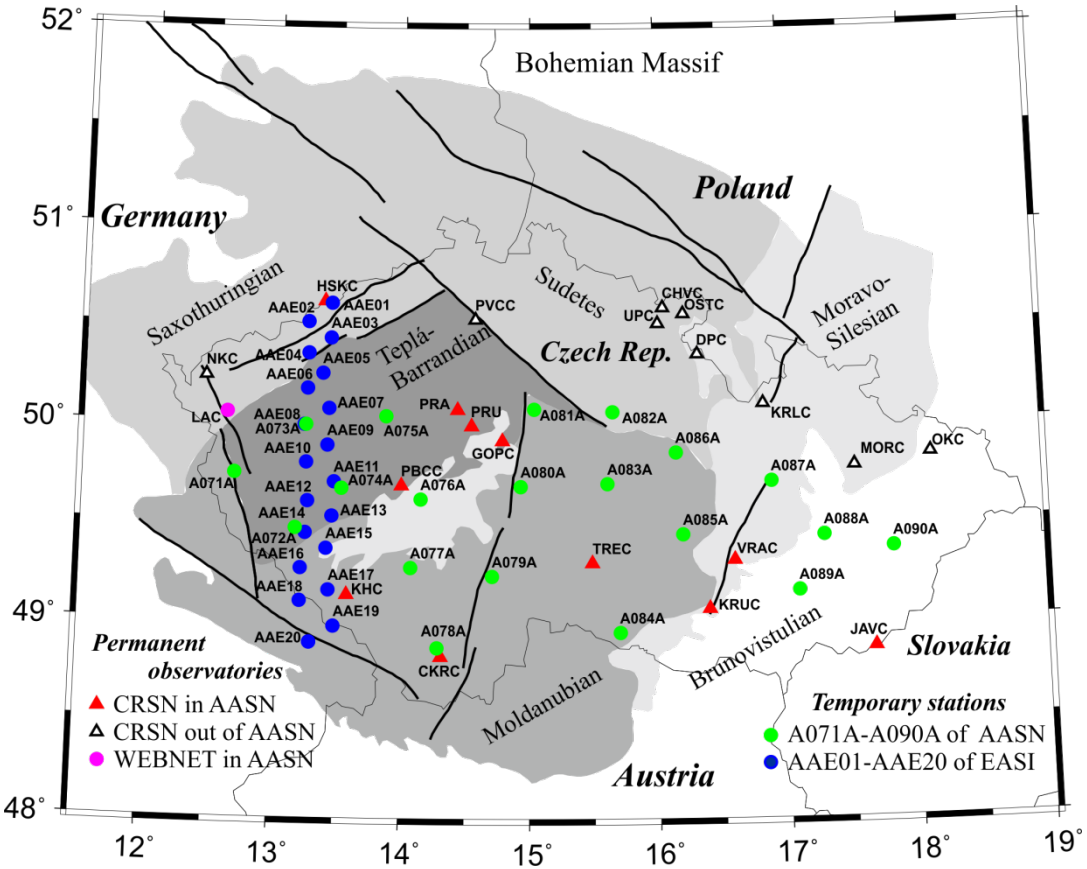
MOBNET for AlpArray in the Bohemian Massif



EASI 2014- 2015

ch-cz-at-i

Data: *ETH* (EIDA node)

data access restricted for 3 years

after the data collection is completed

AlpArray

autumn 2015 onward

Data: *ORFEUS* (EIDA node)

data access restricted for 3 years

after the data collection is completed

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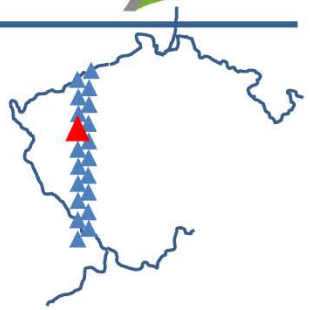
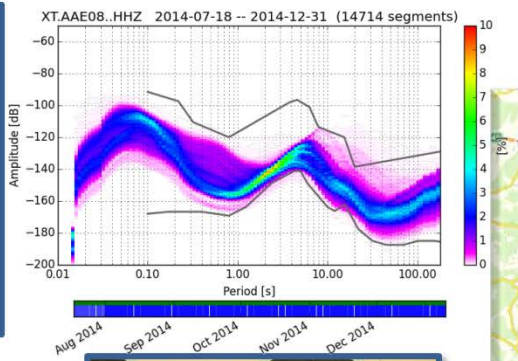
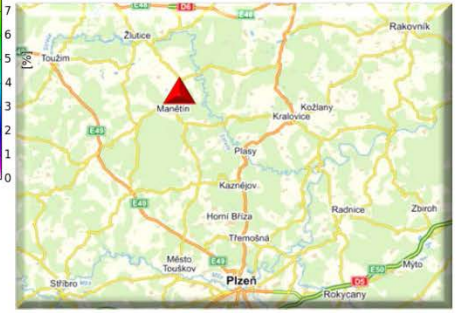
AAE08
Manětín

INSTALLATION		EQUIPMENT	
Start :	17.7.2014	Sensor :	STS 2 120 s
Stop :	23.9.2015	Depth :	0m
Lat :	49.9910	Recorder :	Gaia 1
Lon :	13.2322	Power :	electricity grid
Alt :	409 m	Data :	miniSeed, 6 GB



The station is located in the former stables of Manětín chateau.
Seismometer is built on a concrete floor.
The GPS antenna is brought out through the window, length - 5 m, direction – S, view partially obscured.
Geomorphology: Rakovník Uplands.
Subsoil: phyllite.





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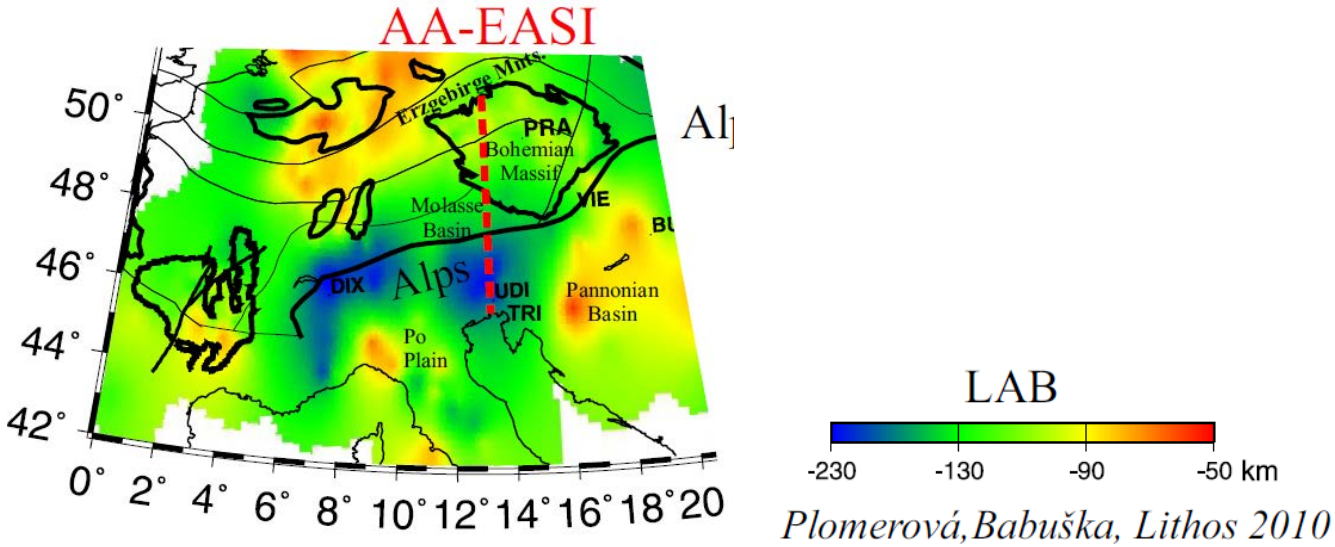
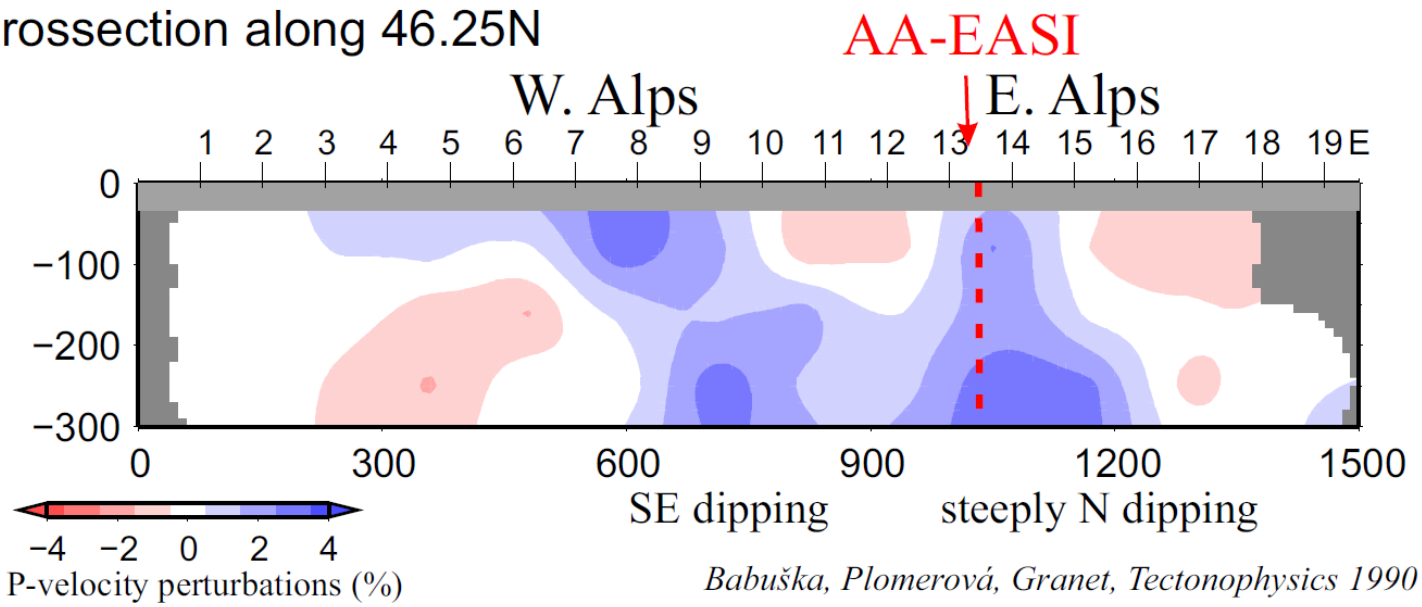


Plomerová, Babuška, Lithos 2010

Crossection along 46.25N



Babuška, Plomerová, Granet, Tectonophysics 1990

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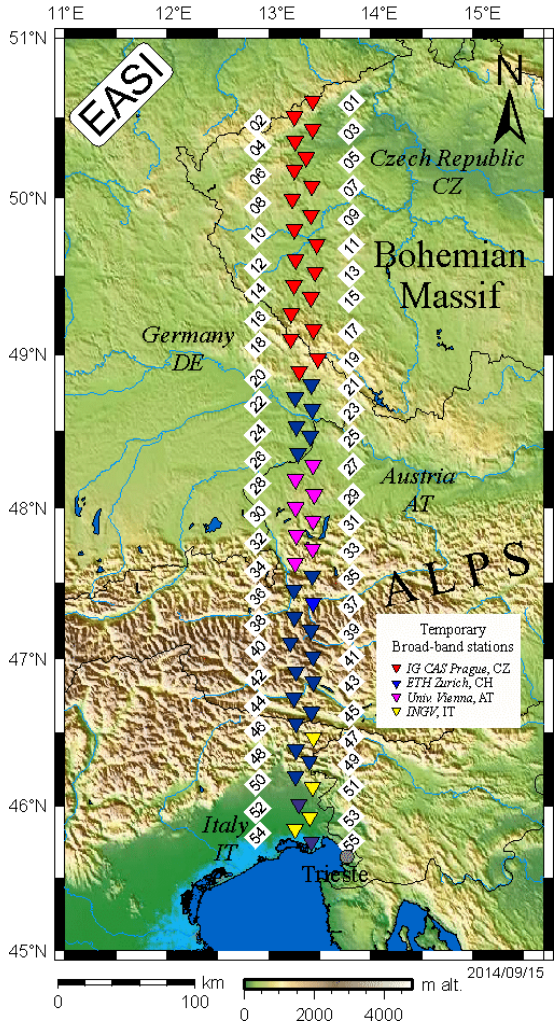
AlpArray - EASI 2014-2015



mseed data (292 GB) from all 20 CZ stations → in EIDA ETHZ

Research topics:

Crust:

Reciever Functions – Ps, Sp
in cooperation with
G. Hetenyi ETH/UniL
I. Bianchi (Univ. Vienna)

ms. Hetenyi et al. under preparation

Ambient noise study (*J. Kvapil etal.*)

Structure of the upper mantle:

Anisotropy - SKS splitting
- P spheres

Tomography P velocity

Along with surrounding permanent stations running in 2014-2015

AA-EASI station installation

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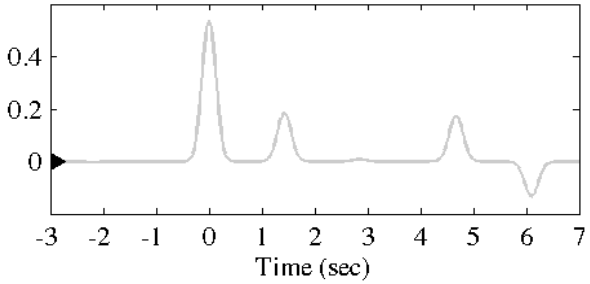
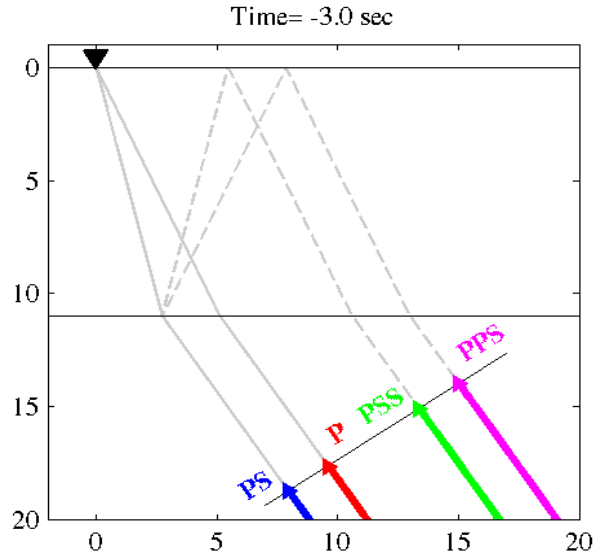
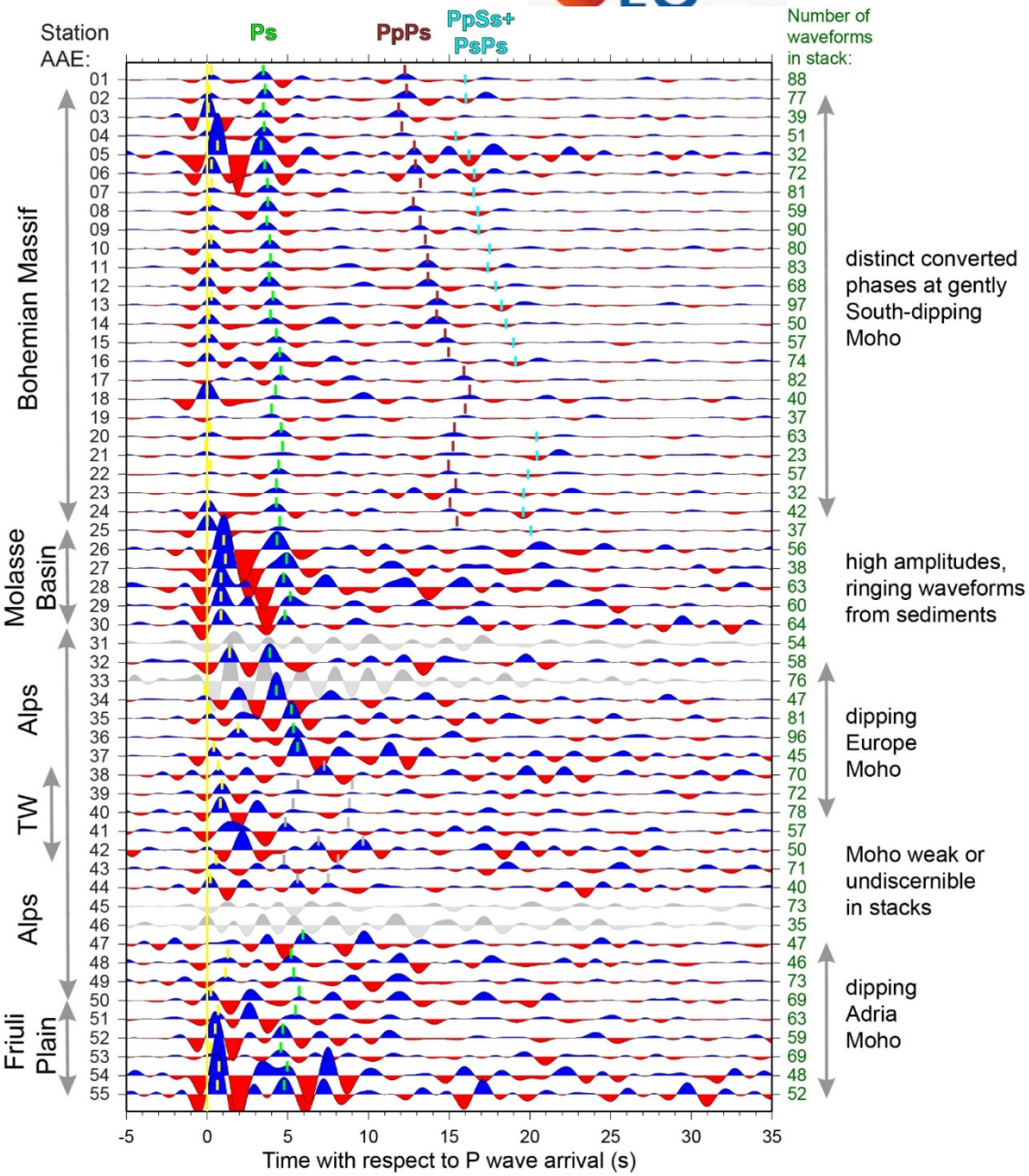
- delay time observations

Station stacks of Ps







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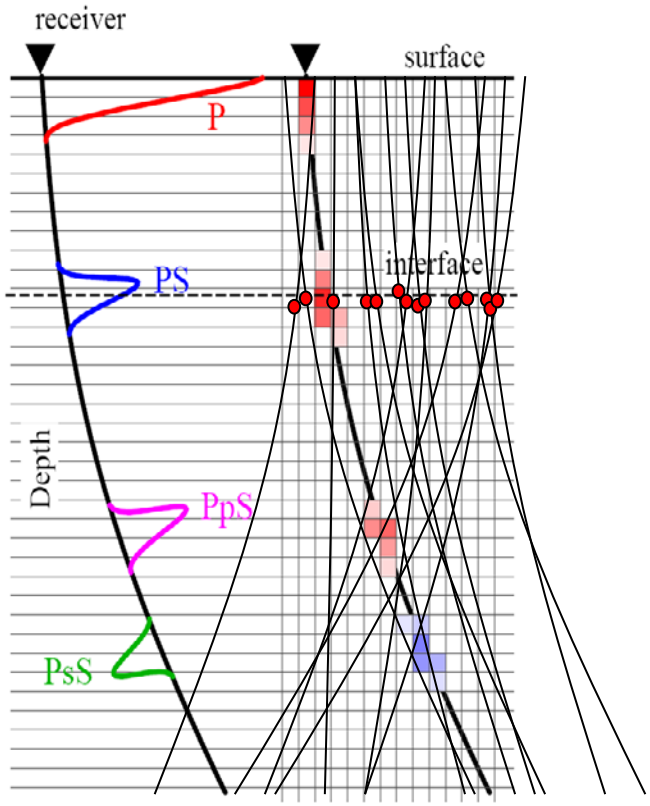
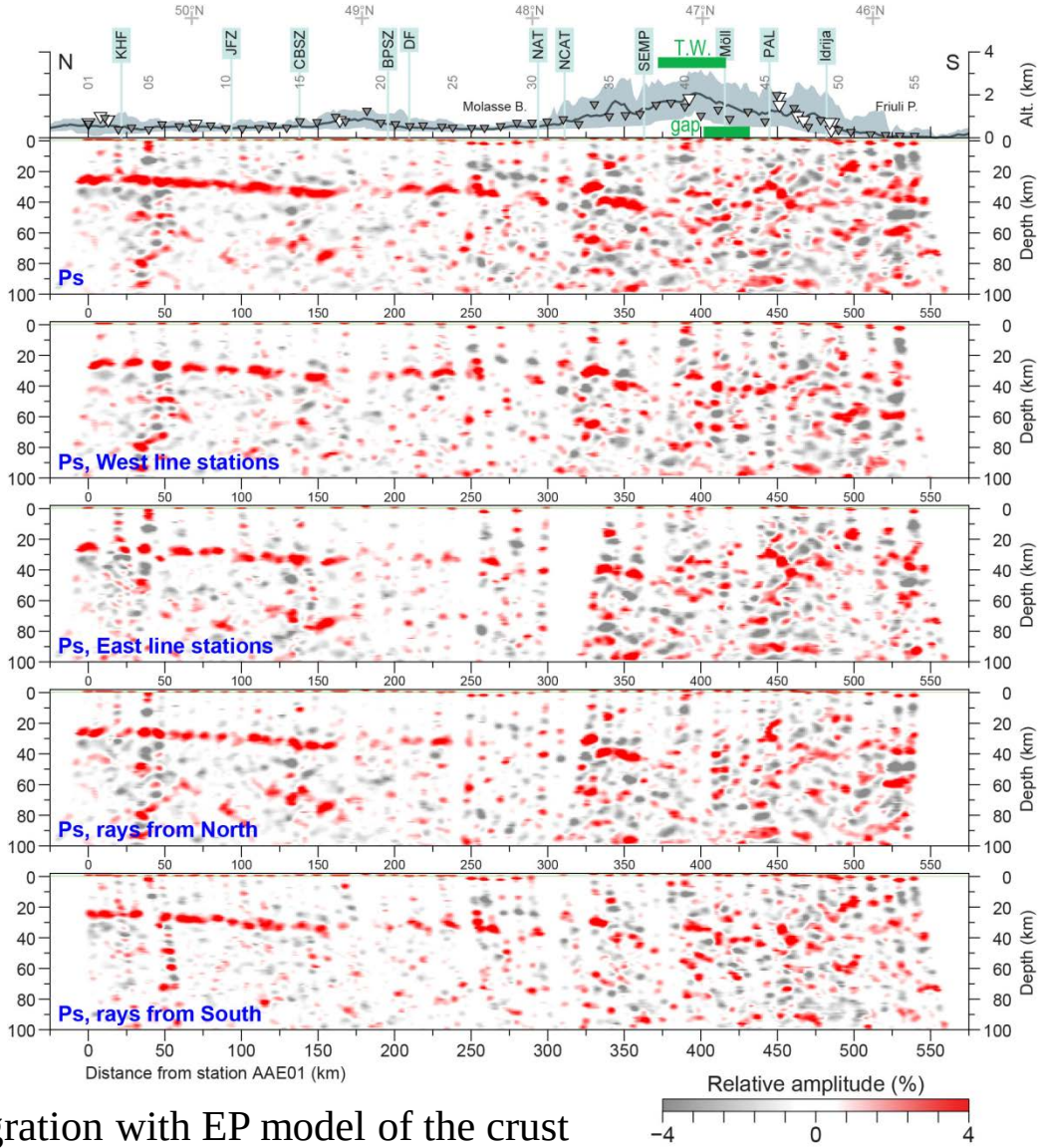
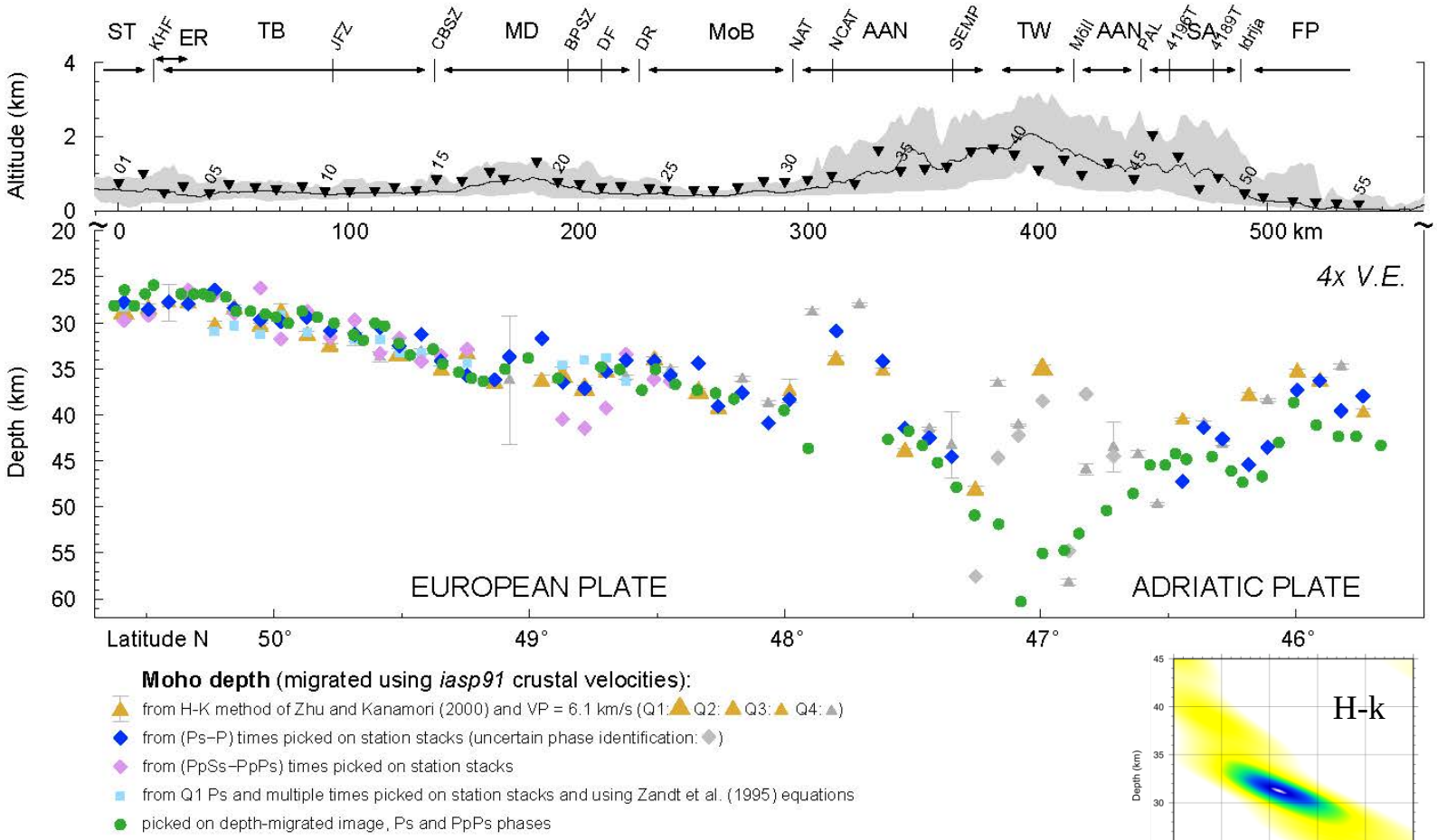
- time-to-depth migration

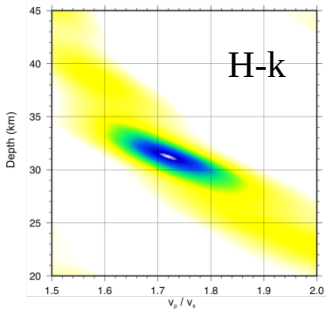




Depth migration with EP model of the crust

Moho depth estimates from different methods





Zhu, Kanamori, 2000

Interpretation of Depth migrated P-RF

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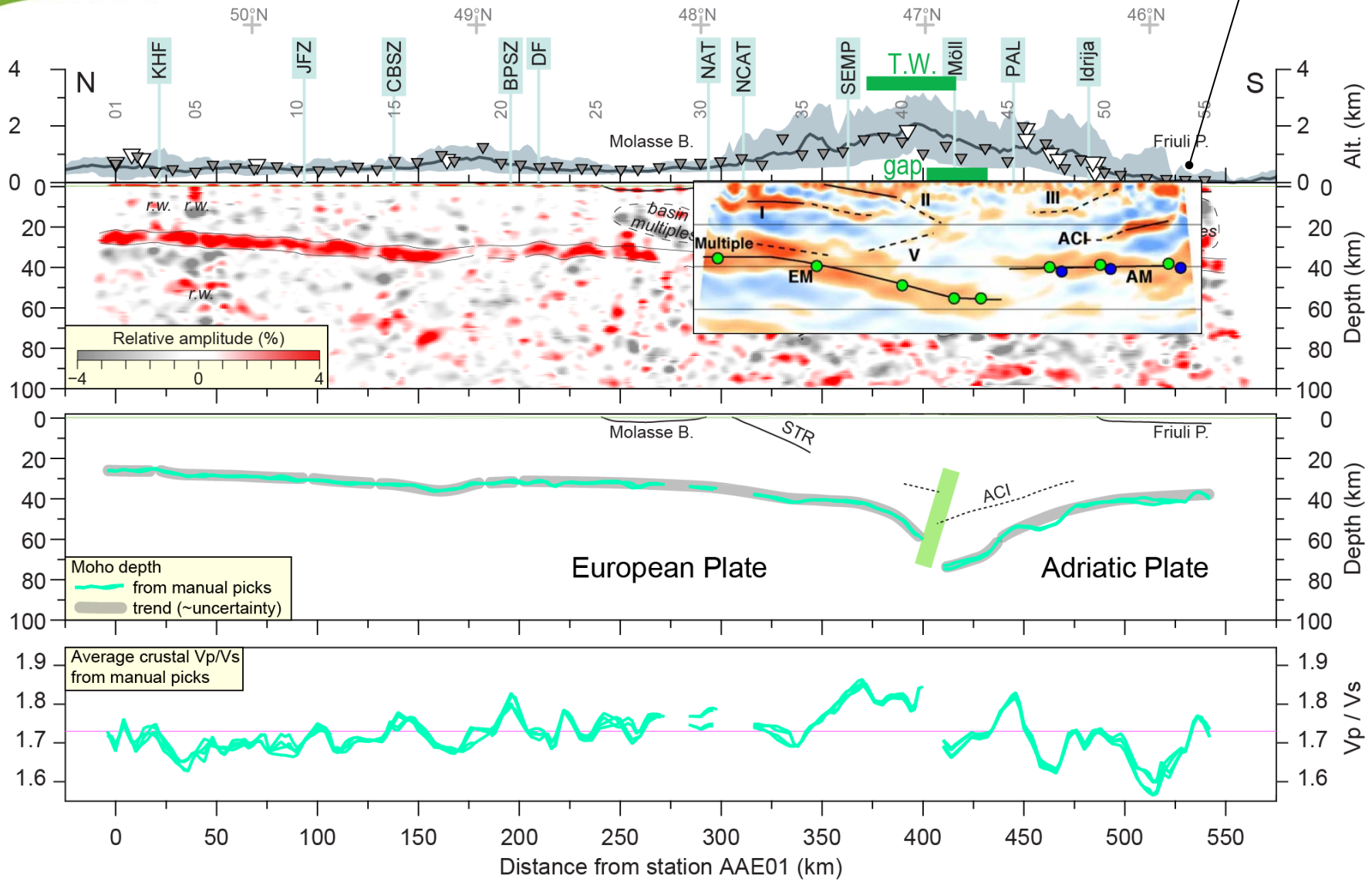
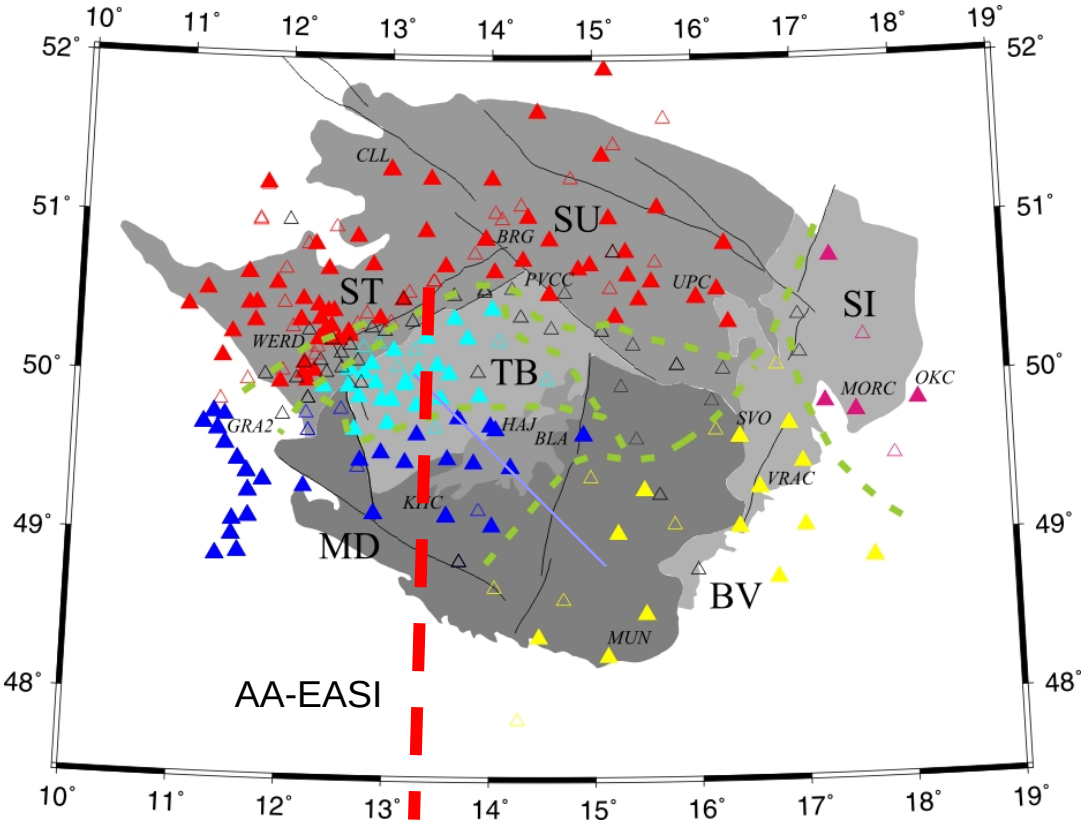
TRANSALP RF at 12°E
Kummerow et al. 2004



Domains of mantle lithosphere - each with consistent fabric



Previous passive seismic experiments in the BM

Exp'92 *1992 CZ*
MOSAIC 1998-1999 CZ-F
BOHEMA 2001-2003 CZ-F-G
BOHEMA II 2004-2005 CZ
BOHEMA III 2005-2006 CZ
ALPASS 2005-2006 intern.
PASSEQ 2006-2008 intern.
Eger Rift 2007-2011 CZ

- stations grouped according to their P-sphere patterns

  Babuška and Plomerová., Gondwana Res. 2013

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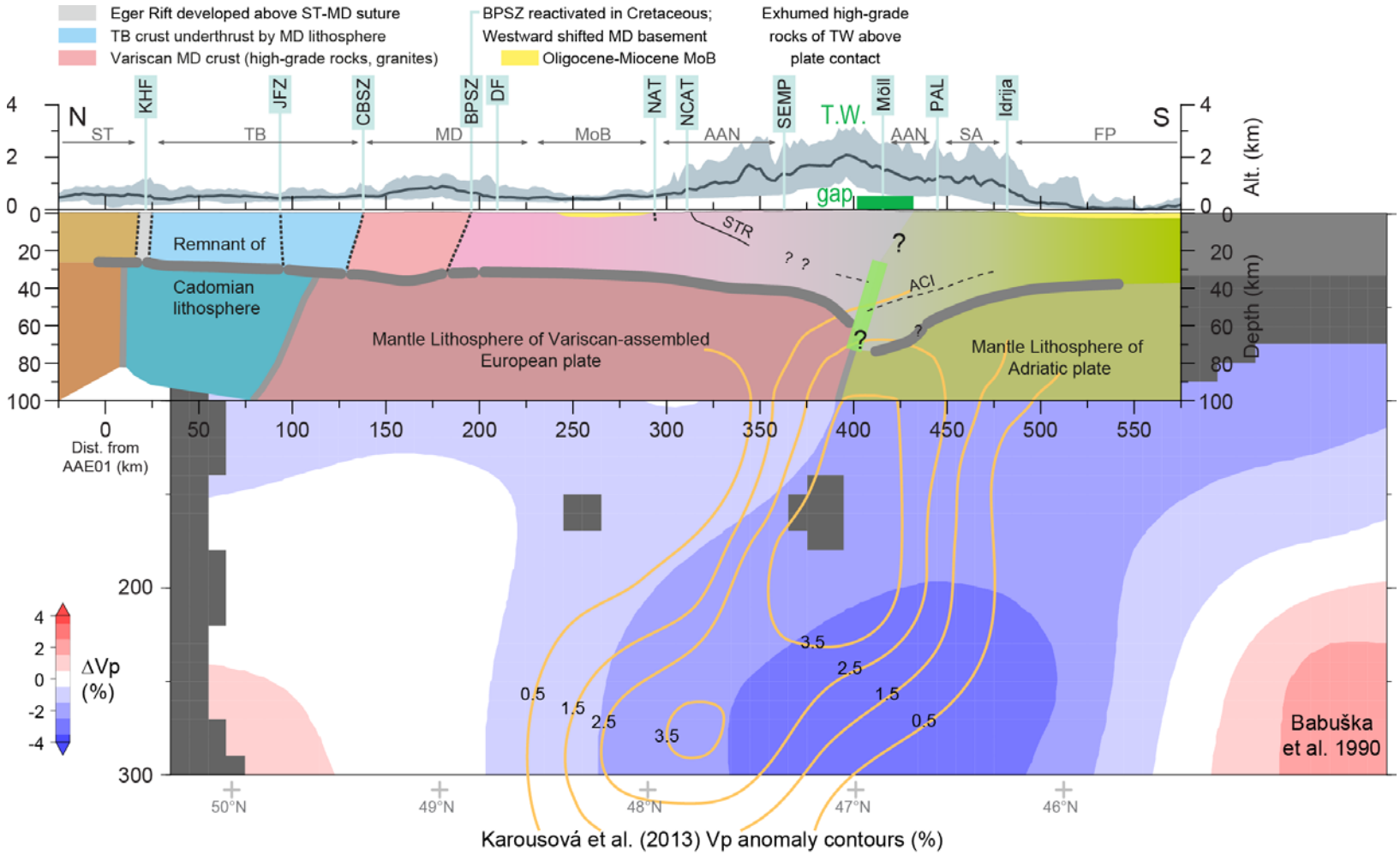

Karousová et al. (2013) Vp anomaly contours (%)

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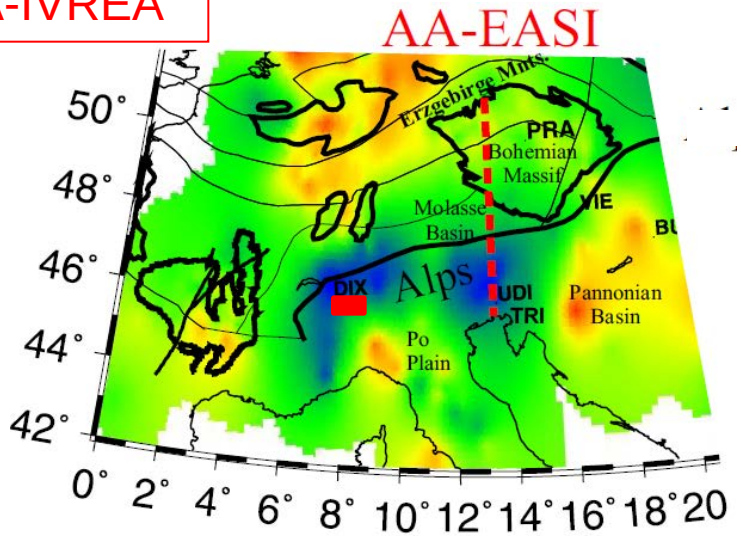
Hetényi, Plomerová, Solarino, <u>Scarponi</u>, Munzarová, Babuška, Vecsey, AlpArray-IvreaArray WG

AA-IVREA



- Joint UNIL + IG Prague + INGV Genova project
- 10 BB stations from MOBNET
- Summer 2017 + 1 year at least
- Joint seismology and gravity field measurents
- Ivrea Geophysical Body – fast velocity anomaly beneath the Ivrea-Verbano Zone

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AA-IVREA station installation

IA04 - installation of solar panels

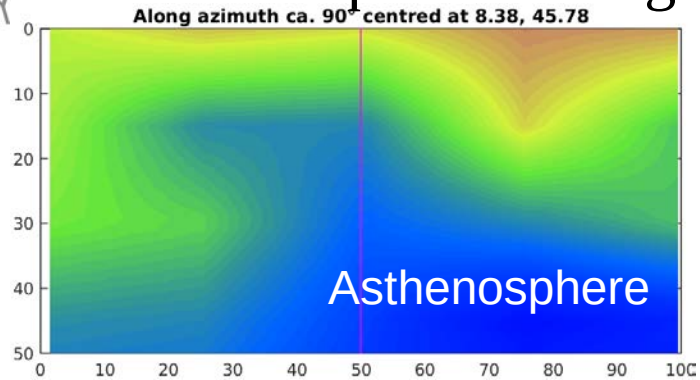
IA01A deep vault of municipal house

IA10 - vault with rock outcrop

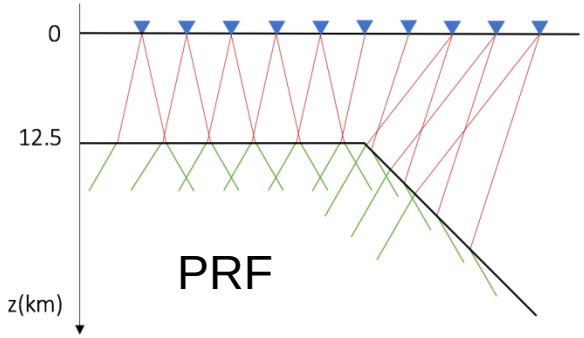
IA03A cemetery on a hill

IA05A crypt of a church

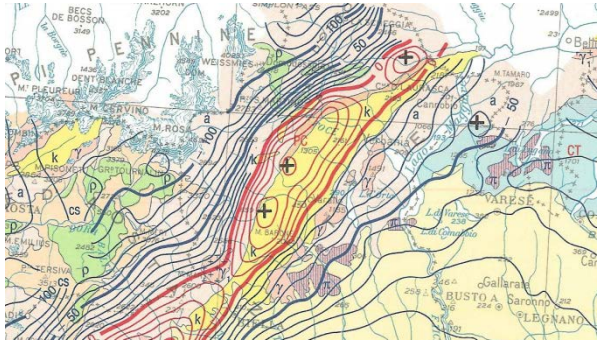
Local Earthquake Tomography

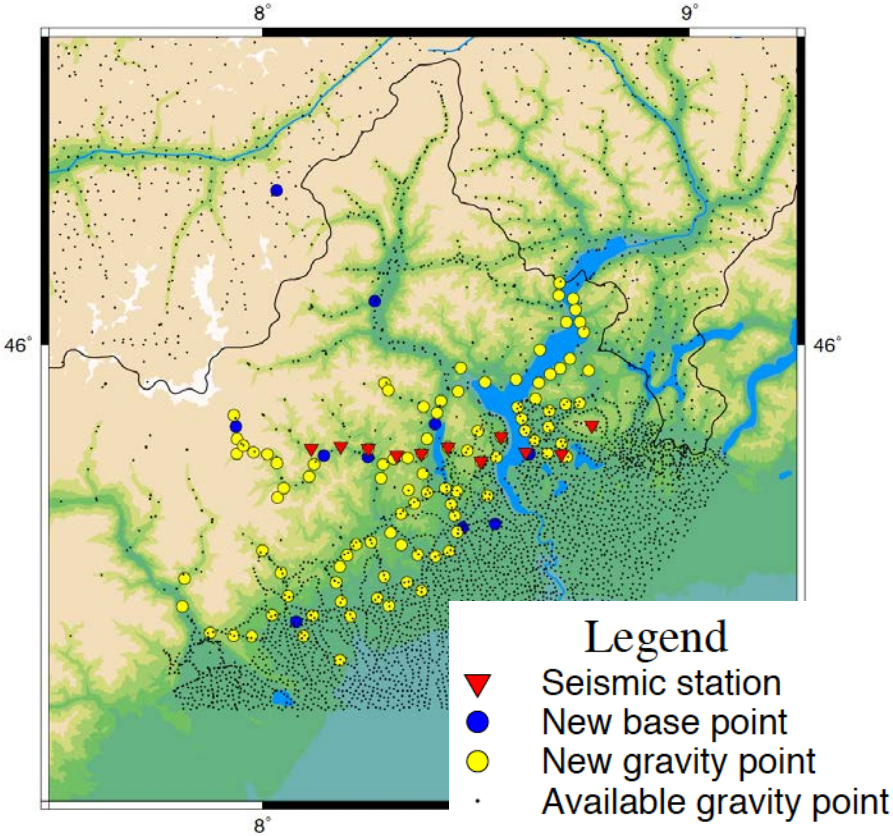


Diehl et al., 2009



Bouguer positive gravity anomaly



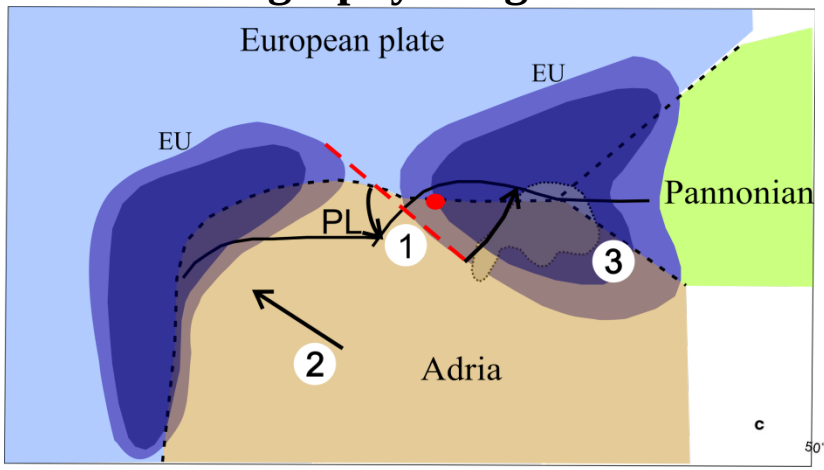


The goal of *IvreaArray* project is to provide a better image of the structure, first by means of Receiver Functions analysis and 3D joint/separate inversion of gravity data and PRF

From Scarponi et al., poster at 2017_SwissGeosciMeeting

Potential scenario for the two-root Alpine architecture

Interpretation of upper mantle tomography images

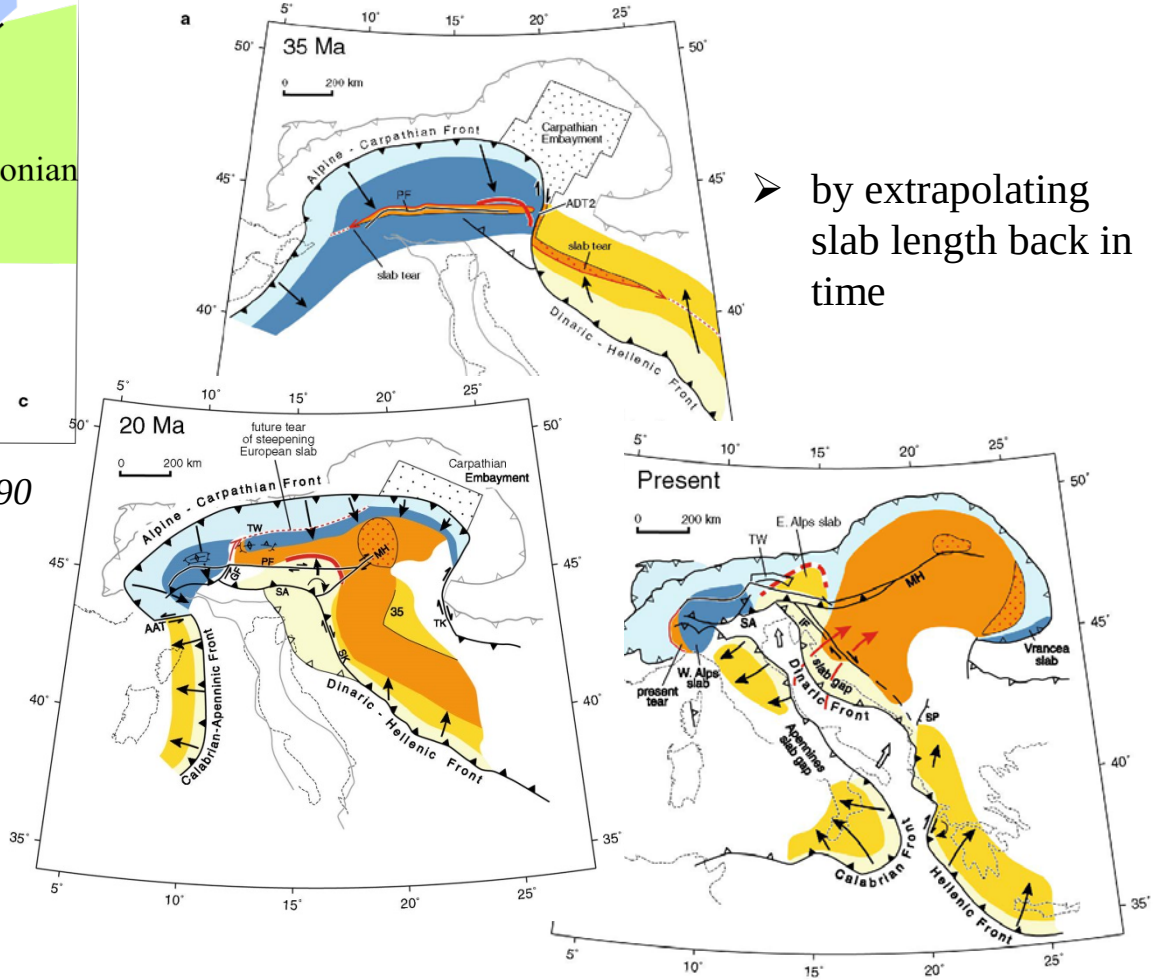


Babuška, Plomerová, Granet, Tectonophysics 1990

Tectonic processes involved

(1) Collision of the Adria, driven by Africa, with EU and subduction of NE margin of Adria
(2) Fragmentation of the northern Adria and a shift along a deep right-lateral fault
(3) Counterclockwise rotation of the Adria

Slab motion maps by Handy et al., 2015



- by extrapolating slab length back in time

Handy, Ustaszewski, Kissling, IJES 2015

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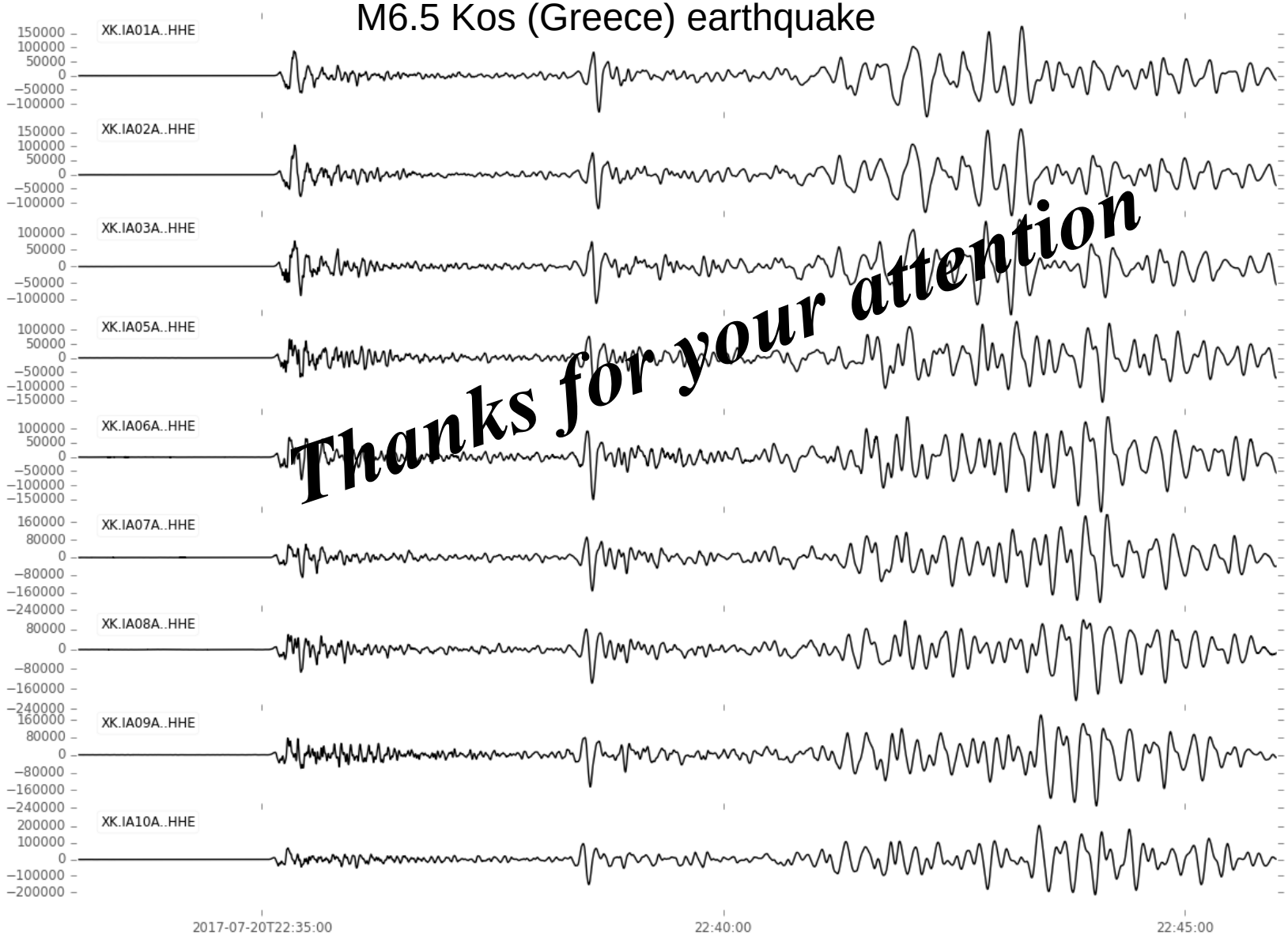
AA-IVREA Array

2017-07-20T22:33:00 - 2017-07-20T22:46:00

M6.5 Kos (Greece) earthquake



Thanks for your attention