26th IUGG General Assembly Prague 2015

International AlpArray science program calls for combined permanent and temporary seismic station array

unprecedented in quantity and quality

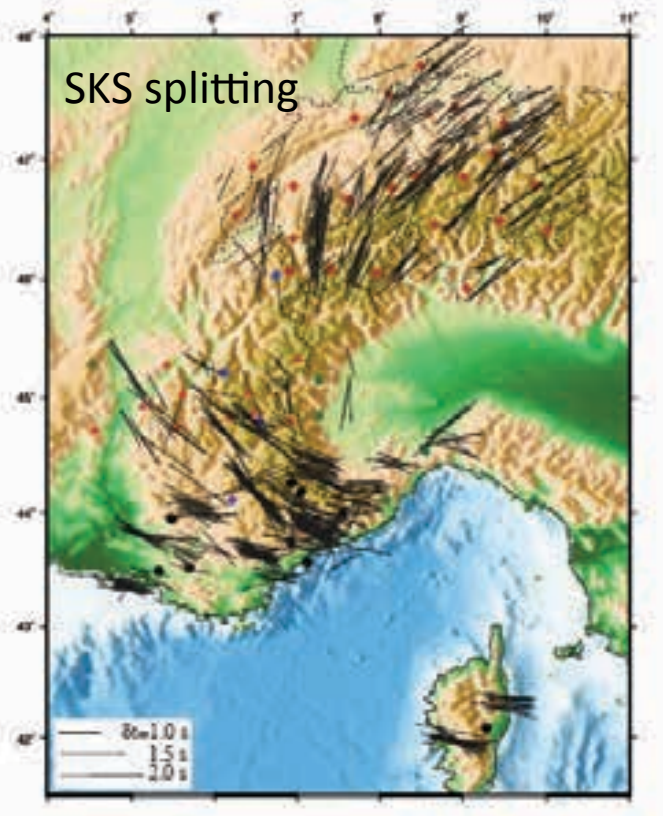
Edi Kissling, John Clinton and AlpArray Working Group

ETH Zürich

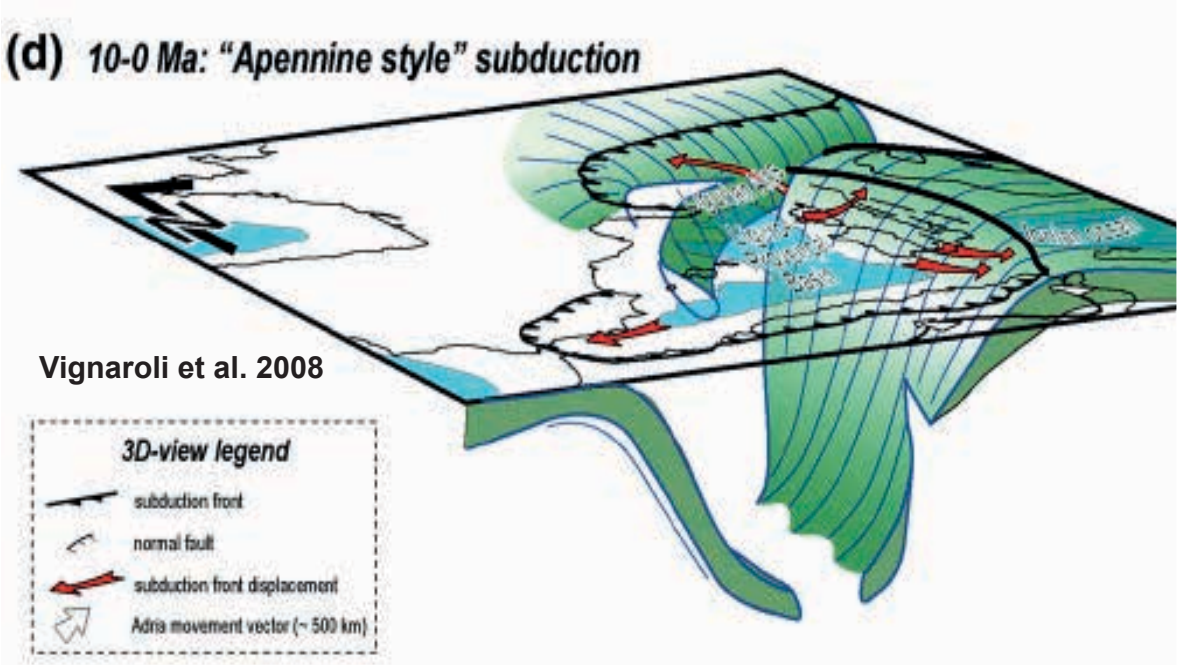
Scientific Goals and Interests (1a)

general and locally specific orogenic processes of Alpine-N Dinarides-N Apennines systems

f.e., linkage between orogenic evolution of Alps and N Apennines: mantle flow, roll-back slab dynamics and orogenic growth



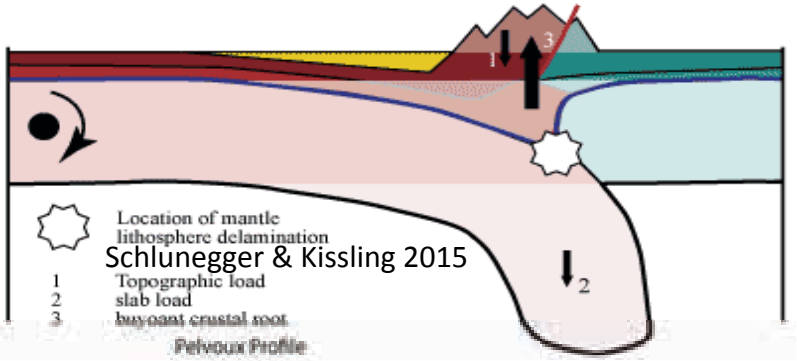
Barruol et al. 2010

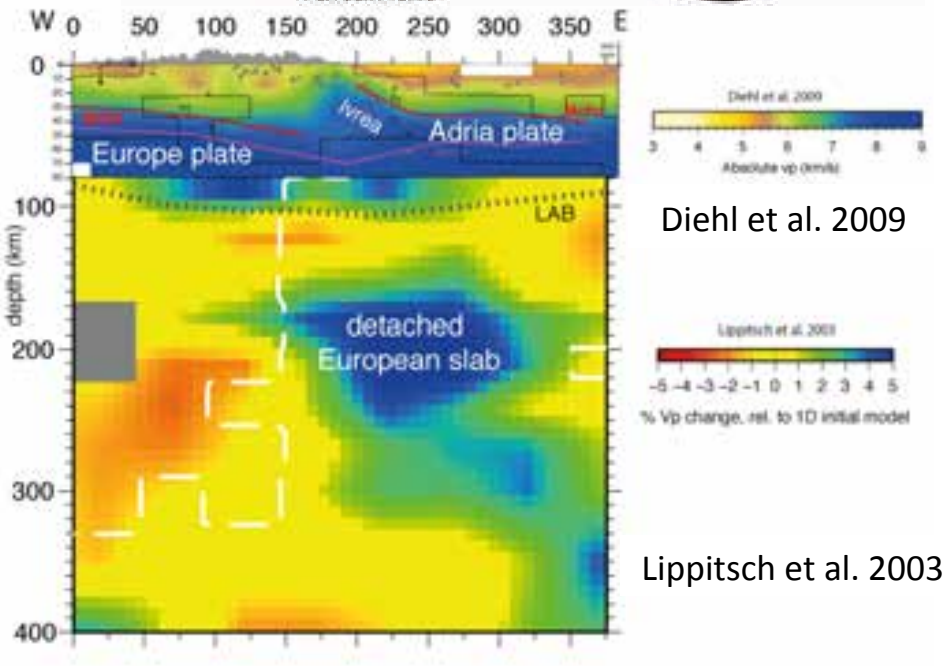


Scientific Goals and Interests (1b)

general and locally specific orogenic processes of Alpine-N Dinarides-N Apennines systems

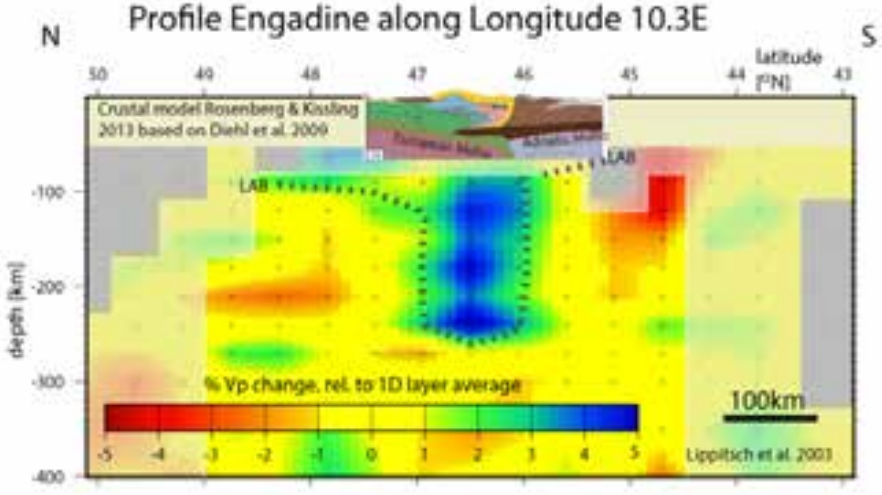
f.e., linkage between roll-back slab dynamics, crustal convergence and evolution of topography

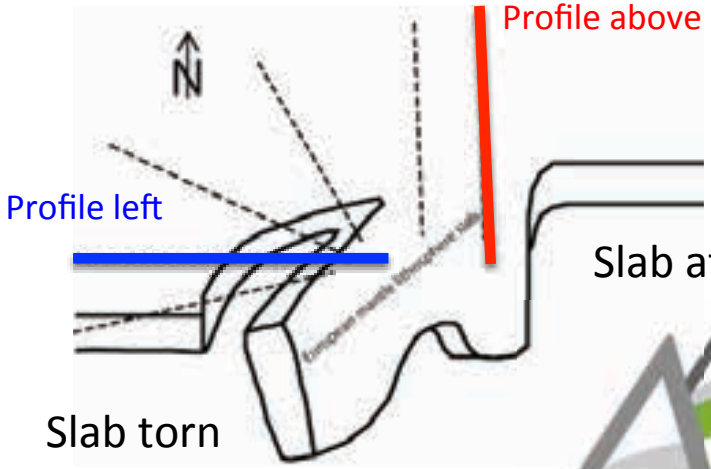




Diehl et al. 2009

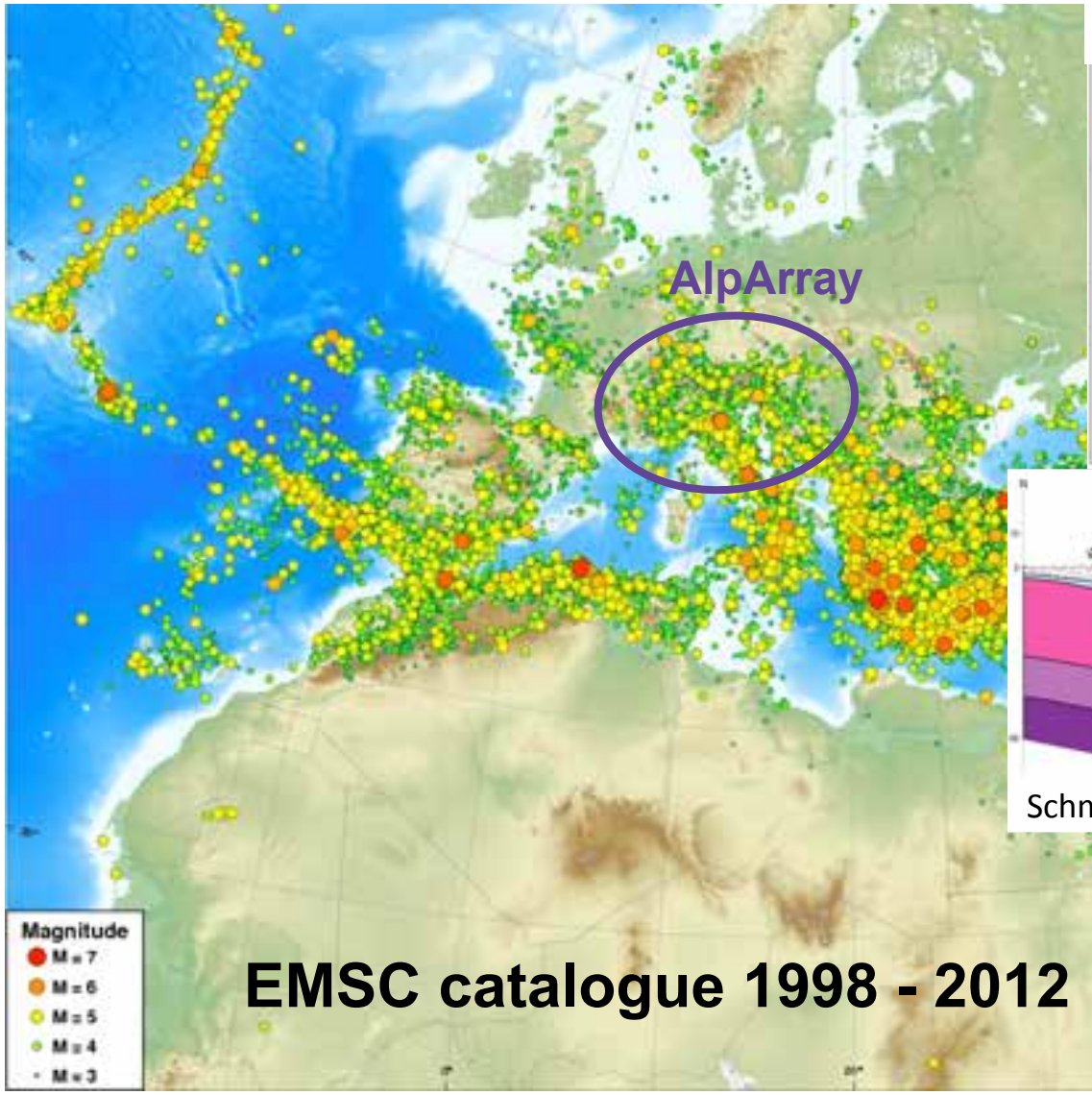
Lippitsch et al. 2003



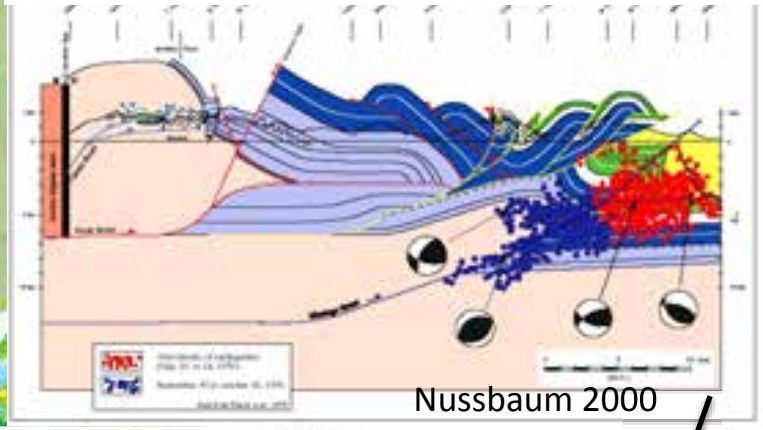


Scientific Goals and Interests (2)

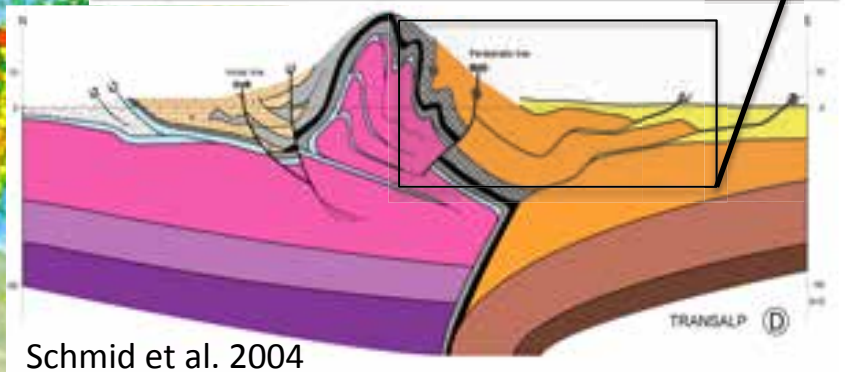
Seismicity and seismotectonics in greater Alpine region



f.e., neotectonics in the Friuli area



Nussbaum 2000



Schmid et al. 2004

Scientific Goals and Interests (3)

methodological interests and usage for global studies

methodological improvements of specific seismic methods (f.e., ambient noise seismic tomography; earthquake source parameters definition using consistently identified multi-phase seismic data, ...)

Combination of various seismic imaging methods to improve resolution capabilities for common targets (f.e., establish 3D P-S-anisotropic reference crustal models from combined surface waves-ambient noise-local and teleseismic earthquake tomography, ...)

Incentive to further improve geodynamic modeling (f.e., including 3D geologically realistic top layers for better comparison of plate tectonic scenarios with near-surface geologic record, ...)

usage of AA seismic station array as antennae for global studies

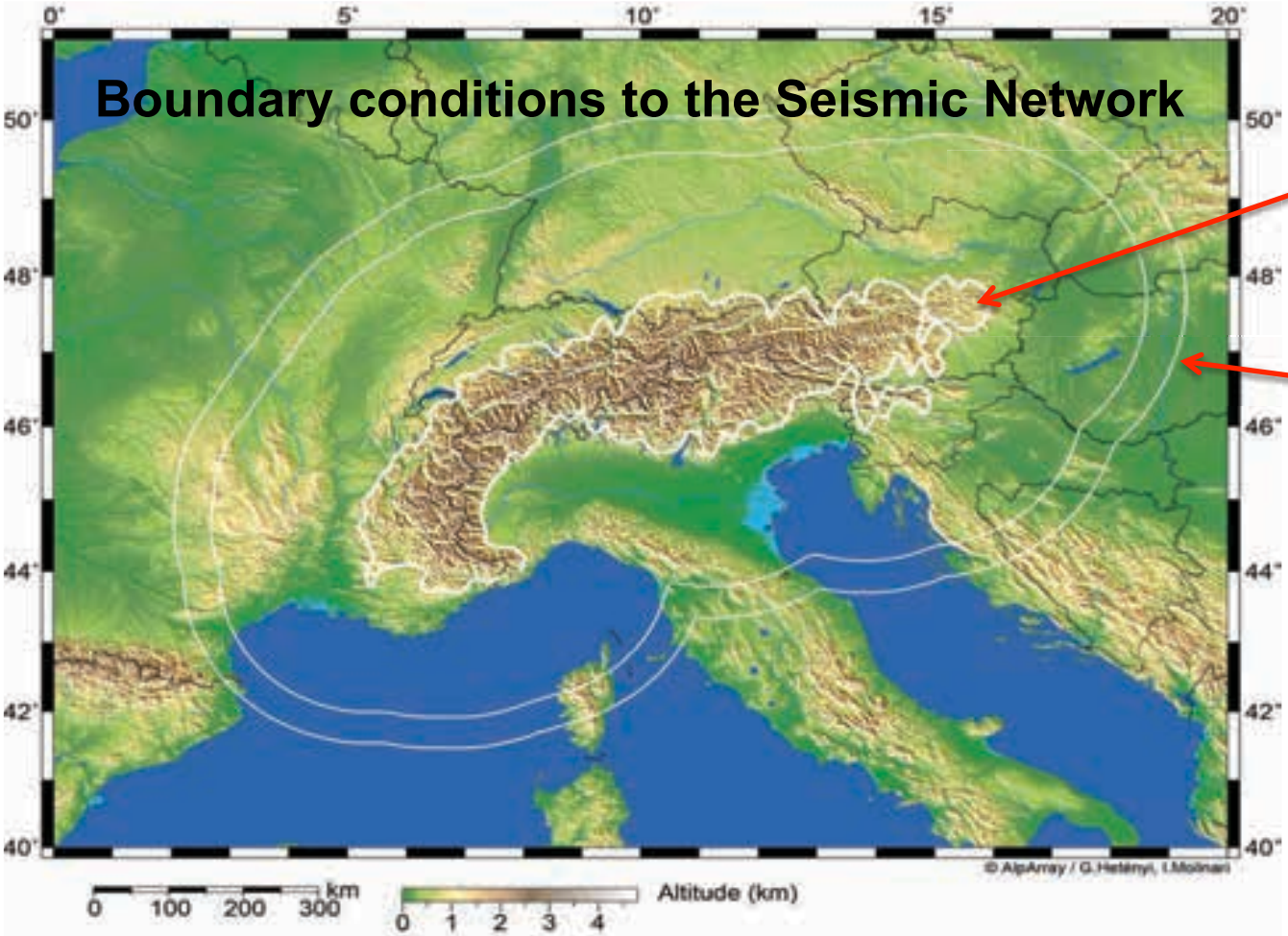
Collaborative Effort by 3 Groups

Earth scientists of all interests

(f.e., field geologists, geodynamic modellers, geodesisists, ...)

Seismologists from Seismological Observatories

Seismologists engaged in temporary field experiments

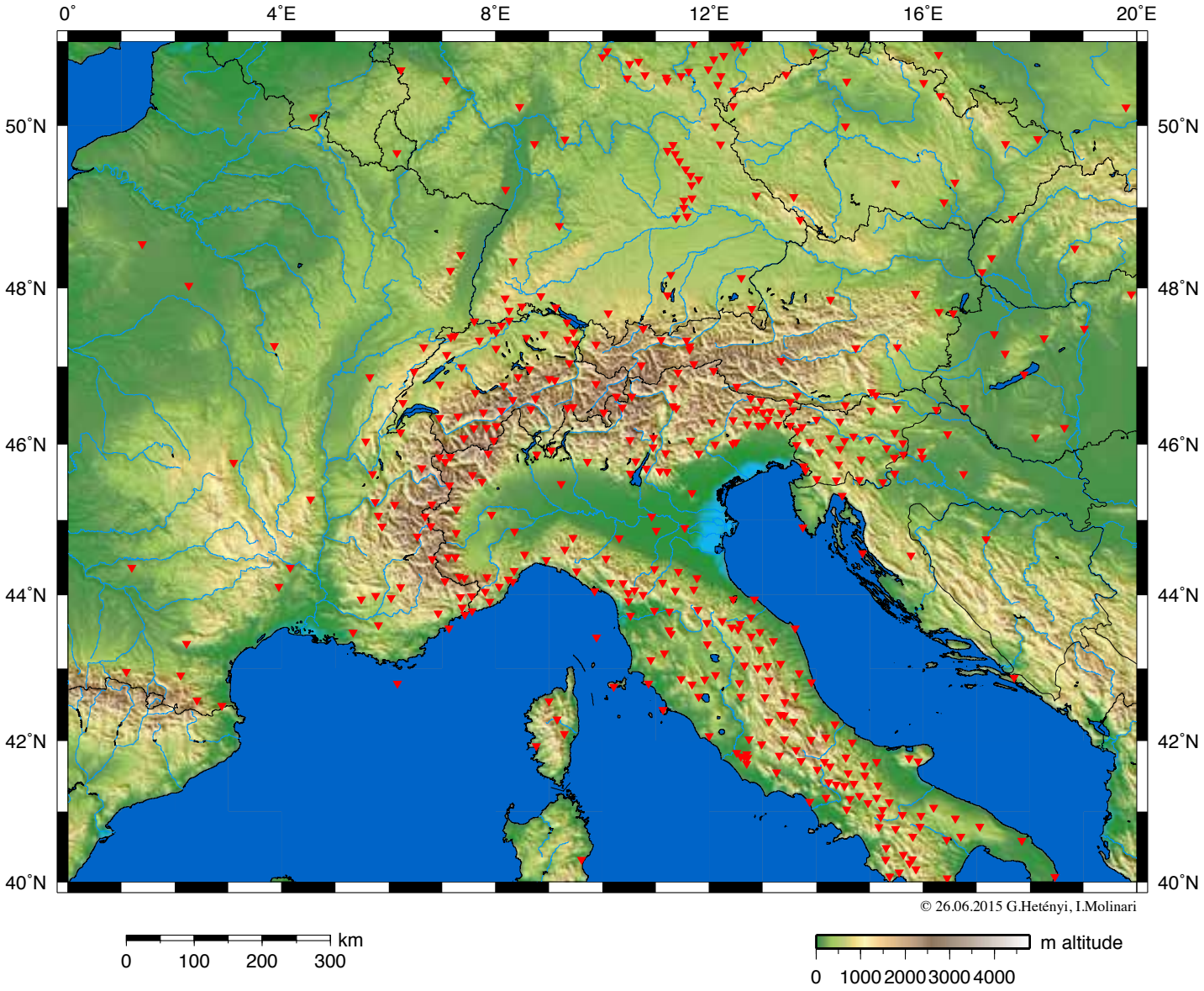


800 m altitude line of the Alps

250 km distance contour (d_{250})

AlpArray Seismic Station Network

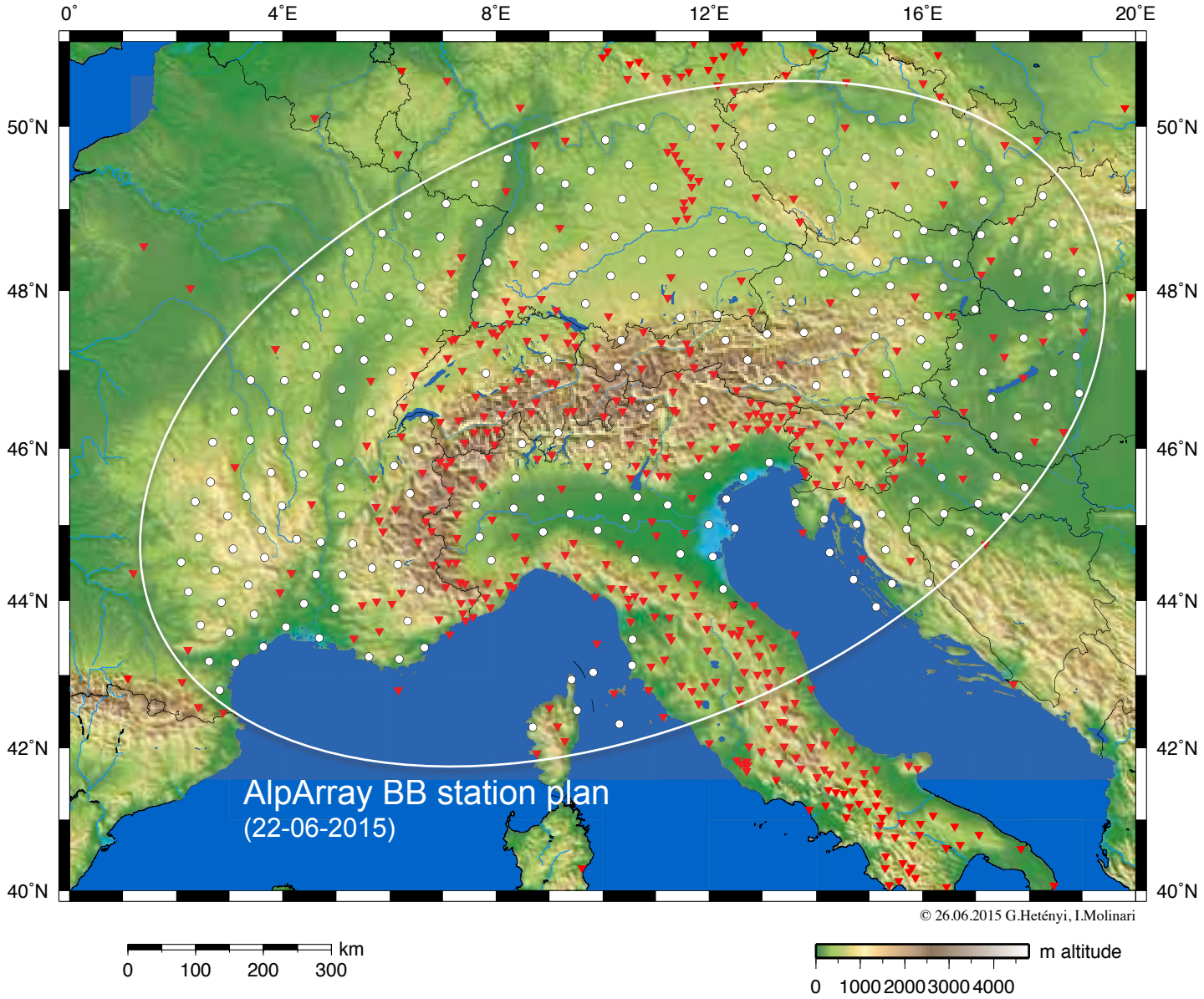
Seismic BB (>=30sec) stations permanently operated by observatories



(in total 440+ stations shown on map, focussing only on observatories within AlpArray region)

AlpArray Seismic Station Network

Network of BB stations operated for 2 year period



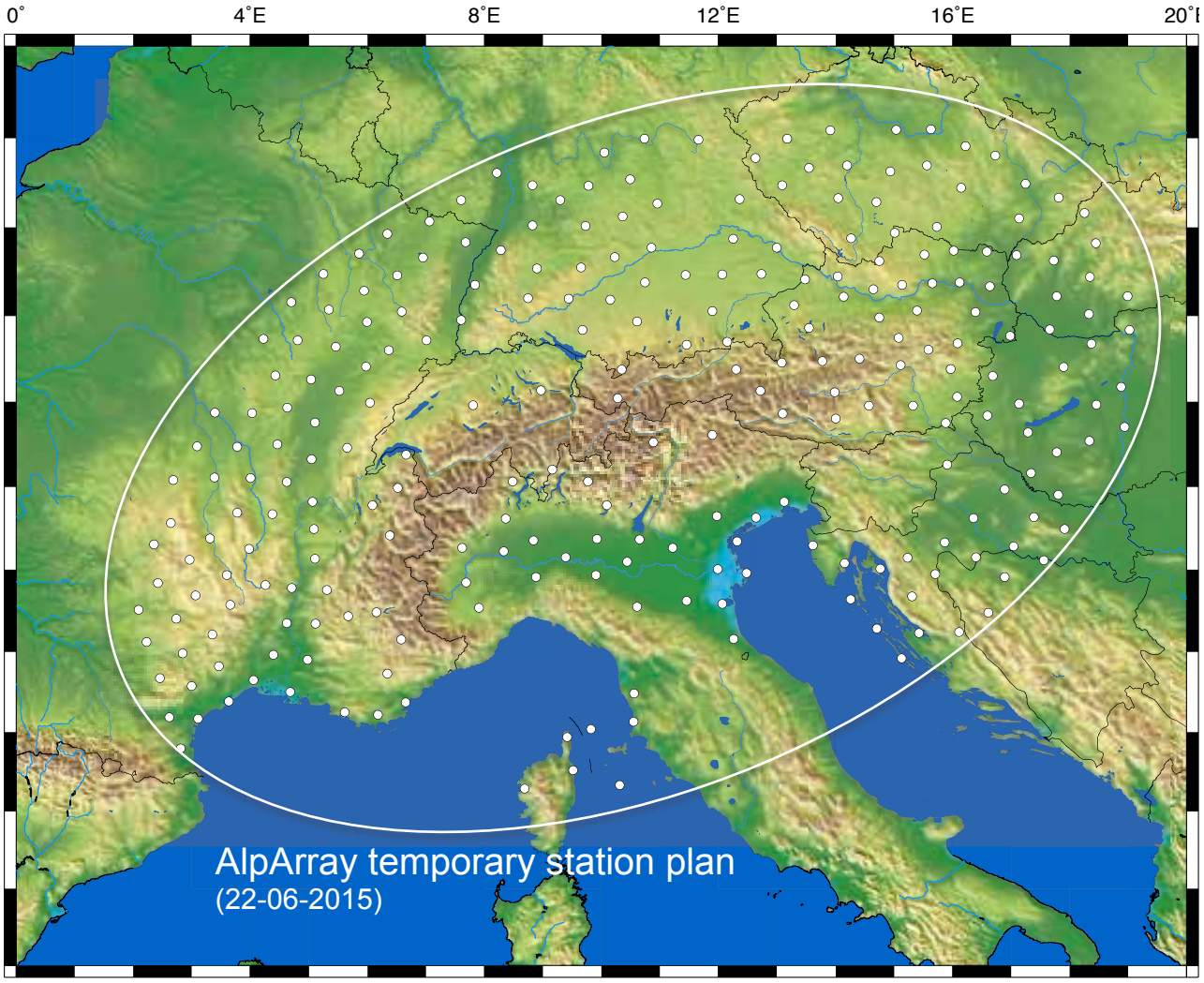
Stations within d_{250}

298 permanent
257 temporary
555 TOTAL

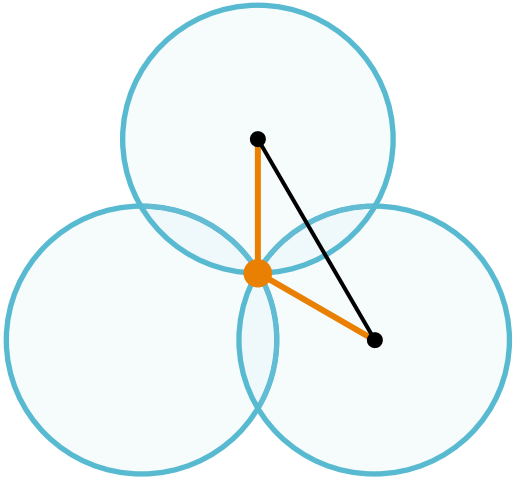
(in addition 20+ OBS in Ligurian sea operated for 6 months)

AlpArray Seismic Station Network

Deployment of 257+ temporary BB stations



"compacted" hexagonal



- farthest point at 30 km
- circle centres at 2 * 25.98 km
  no void left

AlpArray Seismic Station Network

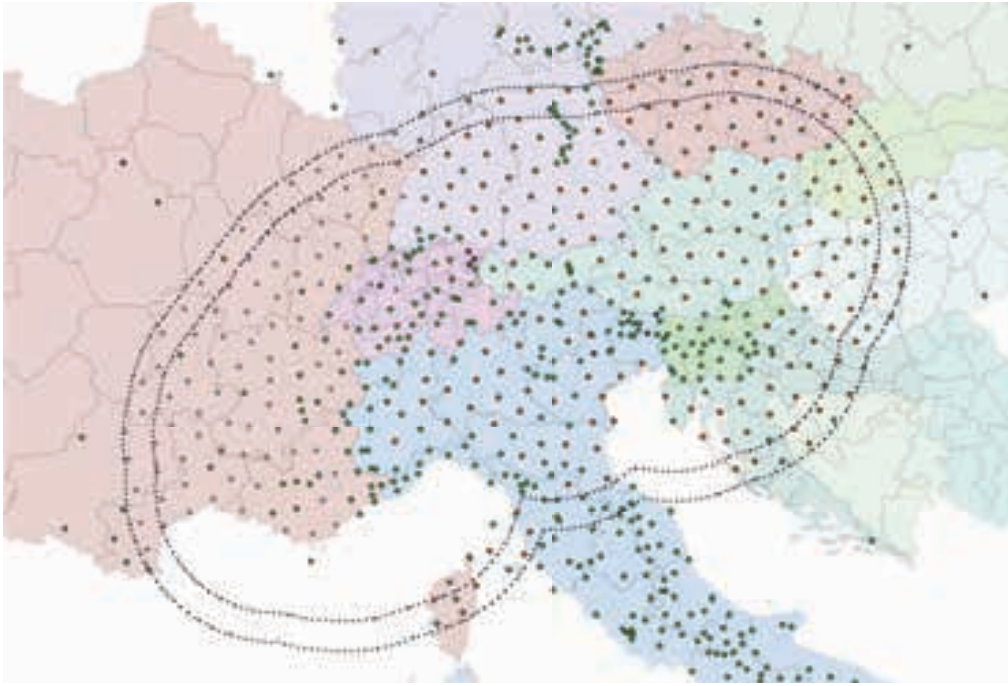
555 land stations

441 (298) permanent stations

257 temporary stations

(172 now; 85 next phase)

→ **698 (555)** total



Due to availability of temporary BB stations:

We start (Aug2015) AA Seismic Network from the East using

ALL permanent

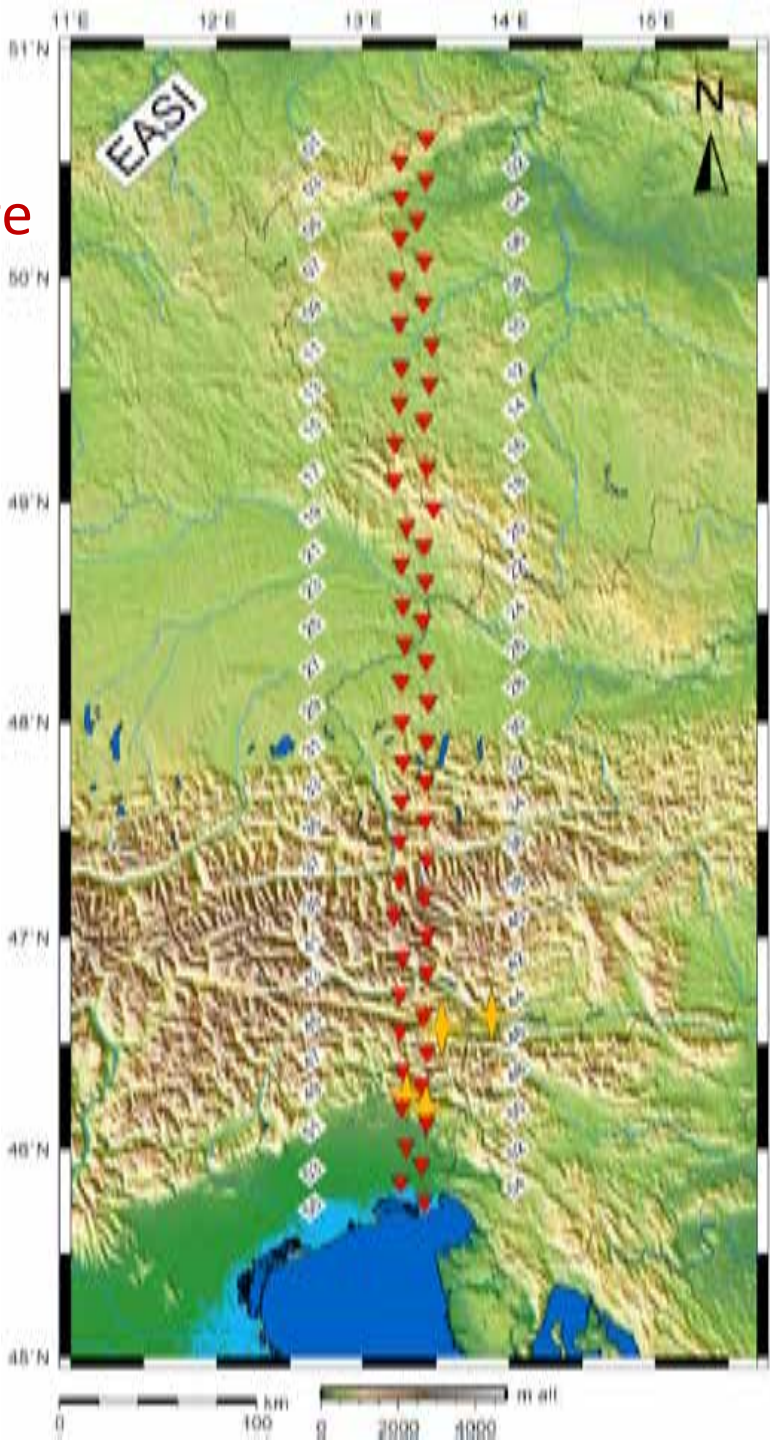
+172 temporary

stations by 25 institutions from 12 countries

In addition to the AA Seismic Network there are Complementary Seismic Experiments dedicated to specific targets:
f.e. EASI

Eastern Alpine Seismic Investigation

- "Complementary Experiment"
- Summer 2014 – Summer 2015
- 55 stations at 10 km spacing
- ETH (23), IG Prague (20),
  U. Vienna (8), INGV (4)
- only 5 sites located >3 km from plan



AlpArray Seismic Network Standards

Technical strategy for the mobile seismological components of AlpArray

Recommendations of the AlpArray Working Group 1 Procedures and data management

October 2013

Alex Brisbourne, John Clinton, György Hetényi
Damiano Pesaresi, Coralie Aubert, Götz Bokelmann, Krisztian Csicsay,
Zoltán Gráczer, Christian Haberland, David Hawthorn, Marijan Herak,
Miriam Kristeková, Victoria Lane, Wolfgang Lenhardt, Lucia Margheriti,
Anne Paul, Catherine Péquegnat, Jaroslava Plomerová, Joachim Ritter,
Reinoud Sleeman, Luděk Vecsey, Jérôme Vergne, Antonio Villaseñor,
Joachim Wassermann, Monika Wilde-Piórko and Mladen Živčić

AlpArray Seismic Network Standards

hardware

- truly broadband sensors flat to velocity at min 20Hz – 30s (120s preferred)
- 24bit dataloggers with GPS timing, >130dB dynamic range
- Known response in dataless format
- min sampling rate 100sps
- Huddle tests before deployment

station

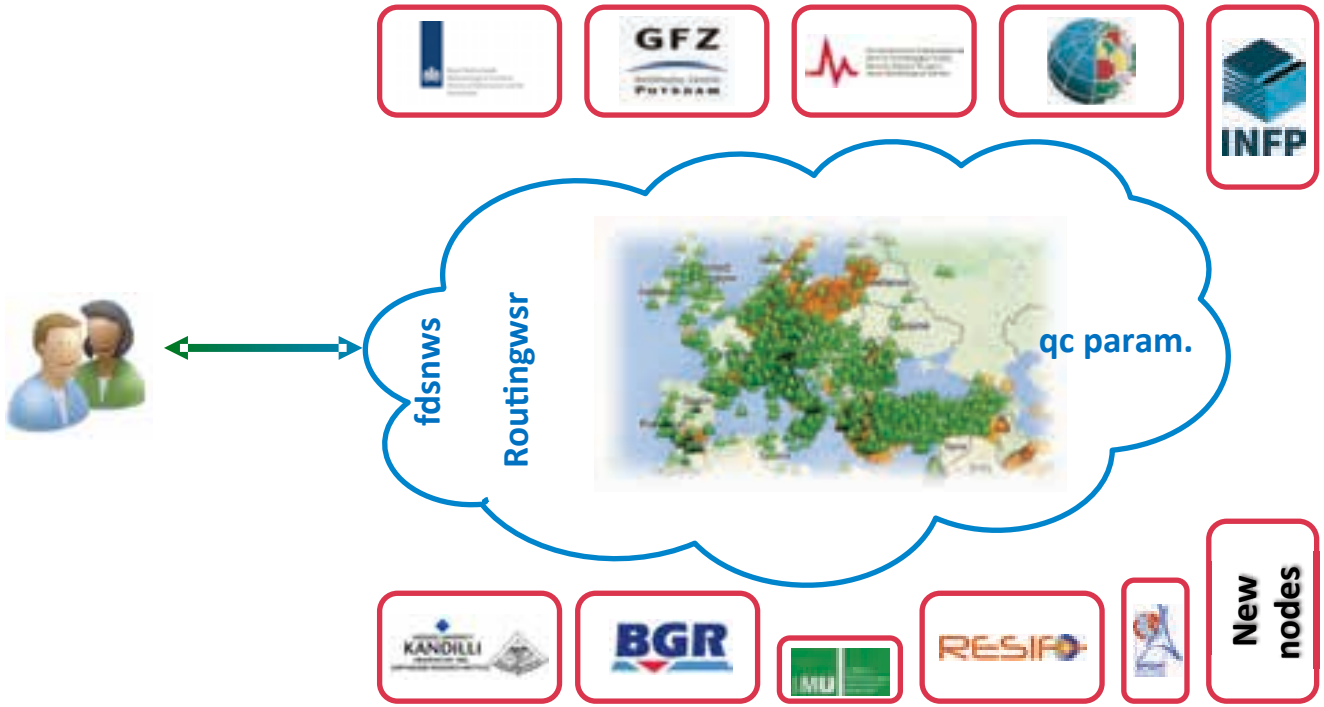
- Experienced installers
- no vault specified, *just meet noise limits*
- *Realtime communications where possible.* If no real-time, visit every 3 months
- If noise limit is not reached, must be moved within 3 months.
- Stations ***within 3km*** of planned spot

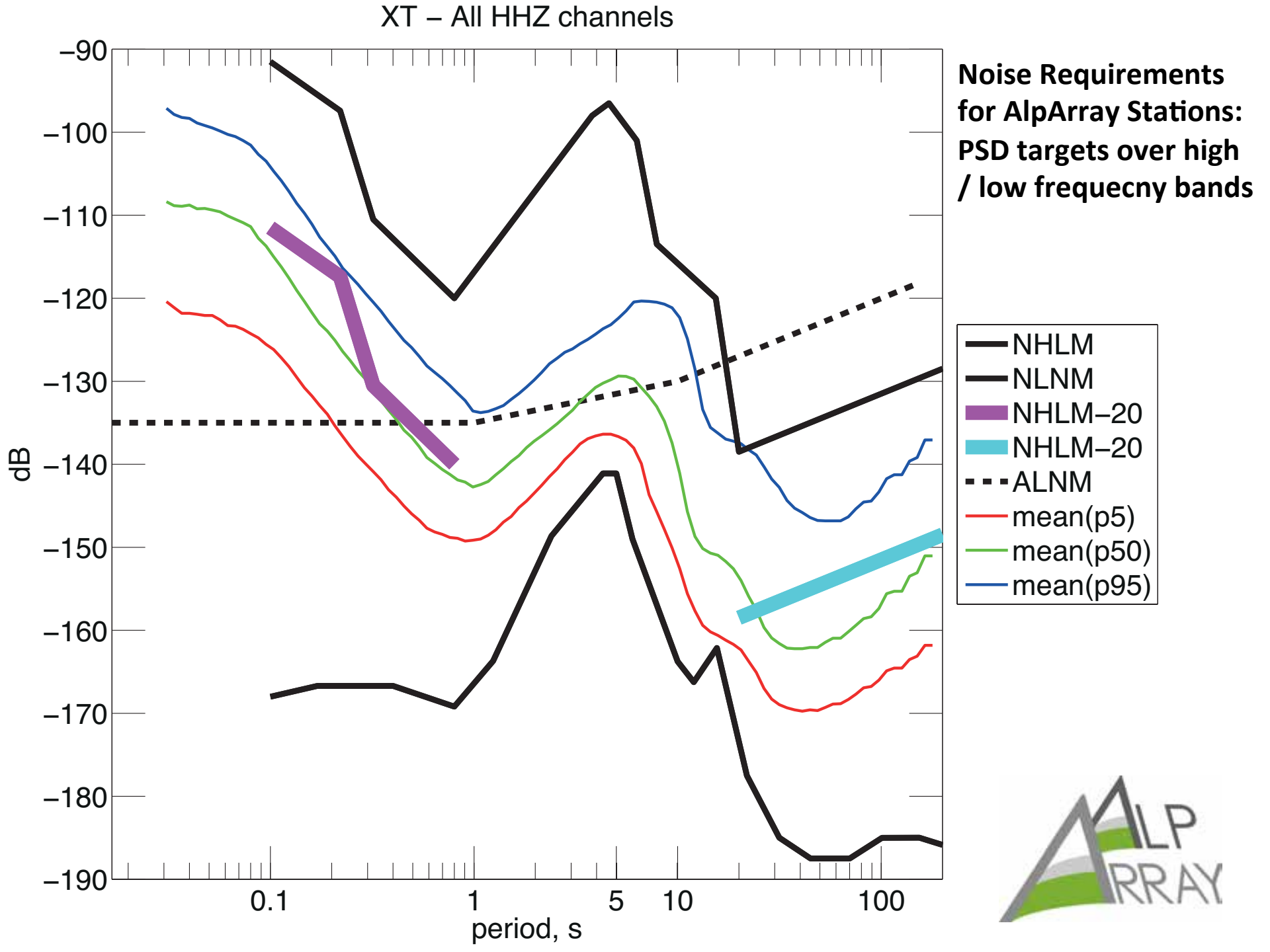
data

- Metadata done by each network / parent EIDA node
- Waveform data: mseed format, transmitted to relevant parent EID
- Data disseminated via EIDA (embargo period)

AlpArray Seismic Network Standards

http://www.orfeus-eu.org/eida/eida.html




XT – All HHZ channels
dB
−90
−100
−110
−120
−130
−140
−150
−160
−170
−180
−190
0.1
1
5
10
100
period, s
NHLM
NLNM
NHLM–20
NHLM–20
ALNM
mean(p5)
mean(p50)
mean(p95)
Noise Requirements for AlpArray Stations: PSD targets over high / low frequecny bands
ALP ARRAY

AlpArray Working Group is currently established

- Memoranda of Understanding signed by 35+ institutions
- Technical strategy for operation and management defined
- AlpArray seismic network
  - all 441 permanent + 172 temporary stations from East deployment: Summer-Autumn 2015