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Prof. Dr. Götz Bokelmann

Geophysik an den Wiener Universitäten





Topics:

Some earlier work

Geophysics at the university of Vienna

- People and infrastructure
- Scientific context in the Vienna area
- The Vienna basin
- The Alpes

Outlook

Prof. Dr. Götz Bokelmann: Some earlier work

Major Appointments:

- Head, Institute of Meteorology & Geophysics, Universität Wien
- Professor, **Universität Wien** (2010 -)
- Professor, **Université Montpellier** (2003 - 2010)
- Heisenberg-Stipendiat, DFG
- Visiting Assoc. Professor, **Stanford University**, 1998-2003
- Wiss. Assistent (C1), **Universität Bochum**, 1992-1998

Principal Honors

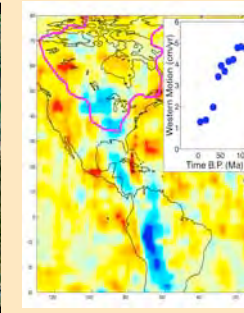
- PEDR, France 2004-2008, 2008-2012
- Fellow, Geological Society of America 2000
- Heisenberg-Stipendium 1998

Publications (as of 2/12)

- 55 publications.
- h-index 16; 618 citations, 118 in 2010 (ISI).
- 54 invited talks since 1999.

Previous Scientific Context:

Stanford University



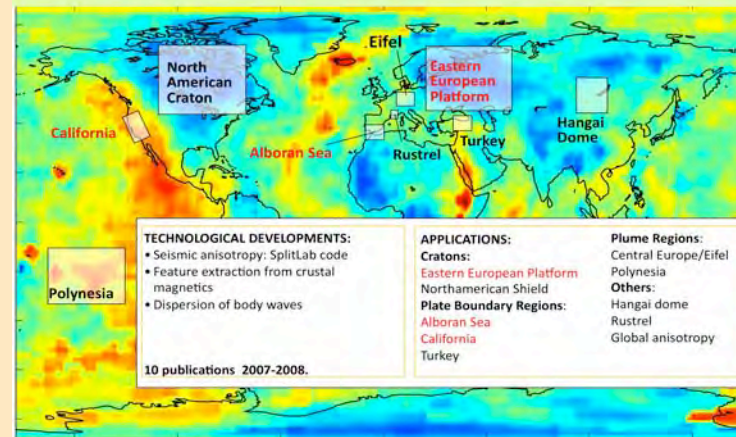
Motion of North America

>> The motion will come to a halt

Bokelmann, G., 2002, Which forces drive North America?, *Geology*, 30, 11, 1027-1030

Université Montpellier 2003-2010

*Géosciences Montpellier, Université Montpellier II
Bilan Prof. Bokelmann 2007-2008*





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91000 students, founded in 1365 – oldest and largest university in German-speaking part of the world

Institute of Meteorology and Geophysics

- head Prof. Dr. Götz Bokelmann
48 scientists, staff, research personnel

Chairs:

- **Geophysics:** Prof. Dr. Götz Bokelmann
- General Meteorology: Prof. Dr. Reinhold Steinacker
- Theoretical Meteorology: Prof. Dr. Vanda Grubisic



Zentralanstalt für
Meteorologie und Geodynamik
founded in 1851. First director Karl Kreil.

Directorship was combined with professorship at the university of Vienna during 155 years (until 2006). Geophysics teaching started in 1864.



Other Institutions in Geophysics (Vienna area):

- **Technical University of Vienna** (25000 students)
- Univ. for Natural Resources and Life Sciences BOKU (11000 students)
- **University of Bratislava** (30000 students)
- Geological Survey of Austria GBA
- Comprehensive Test Ban Treaty Organization CTBTO
- Oil industry: OMV, RAG, ..
- Slovak Academy of Sciences Bratislava
- ...



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University of Vienna Geophysics:

Scientists:

Prof. Dr. Götz Bokelmann	*
Ao. Prof. Dr. Bruno Meurers	
Dr. Michael Behm (z.Zt. CSM)	*
Dr. Irene Bianchi	*
Dr. Simon Lloyd	*
DI Maria-Theresia Apoloner	*
Dipl.Geoph. Andreas Gerner	*
Dipl. Geoph. Ehsan Chegeni	*
Dipl.Geoph. Patrick Arneitz	*

Technical/Administrative:

Mag. Herta Gassner	*
Ing. Johann Huber	
Ing. Peter Jordakiev	
DI Wolfgang Pichler (external)	*

Technical University Geophysics:

Scientists:

Prof. Dr. Ewald Brückl (emeritus)	
Dr. Zuzana Alasonati Tasarova	*
Dipl.-Geowiss. Ingrid Kreuzer	*
Dr. Werner Chwatal	
DI Stefan Mertl	

Technical/Administrative:

Sonja Böcksteiner	
Ing. Walter Loderer	

* Stellenbeginn in den letzten 1.5 Jahren.

Universitätsstellen /Andere

Infrastructure

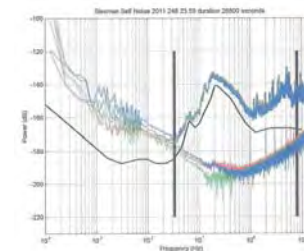
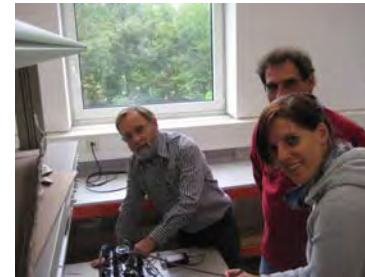
Instruments (UW, TUW, ZAMG, GBA):

Gravimeter: absolute GWR 25 (superconducting),
relative Scintrex CG3, CG5, 3 Lacoste
Ground-penetrating radar: SIR 2, SIR 3000
Induced Polarisation
Electromagnetics: EM SIROTEM MK3, SATx-1
Geonics EM38, EM31, EM34, GSSI GEM300
Goelectrics: Geolog 2000?, AGI Sting/Swift 100
Borehole geophysics: Geonics EM39
Magnetics: several Scintrex
Aerogeophysics (...)

Portable seismometers: Short-period >37 Sensors
29 BB-Recorders, 31 Texan SP-Recorders
Seismic: Seistronix RAS 24

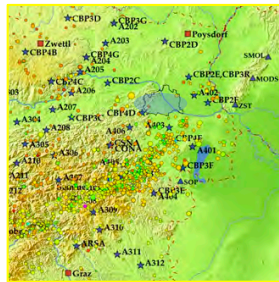
University of Vienna:

15+ portable broadband seismometer stations

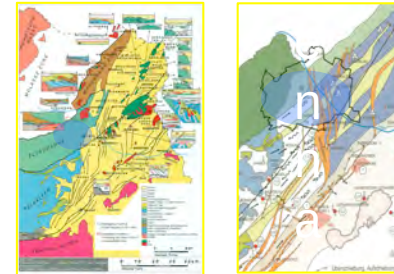


Scientific context in the Vienna area

SEISMIC HAZARD



RESOURCES



University of Vienna Geophysics

INTERNATIONAL ORGANIZATIONS
(UNO, OPEC, CTBTO, ..)



Comprehensive Test Ban Treaty Organization CTBTO

United Nations Vienna



Global network
(seismic etc)



Seismologists and Diplomats



Questions:

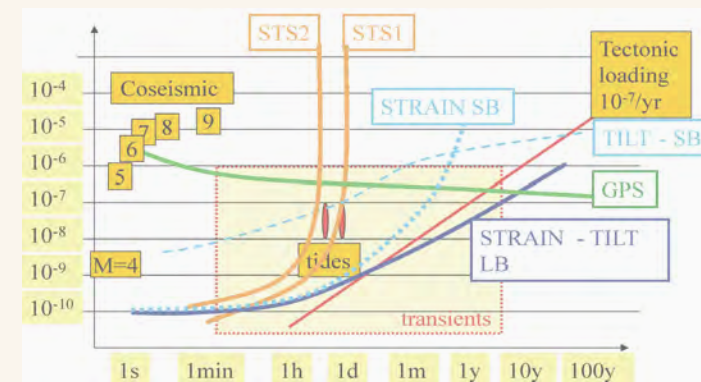
- Improve understanding of seismic events
- Use the data to study Earth's interior, e.g. Kiraly et al. (2012).

National Networks and Conrad Observatory

ZAMG

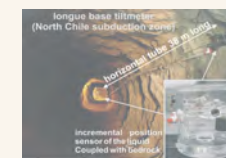


Conrad-Obs.



Seismology Geodesy Geology

Long-baseline strain- and tilt measurement in the Conrad Observatory?



Boudin (2008)

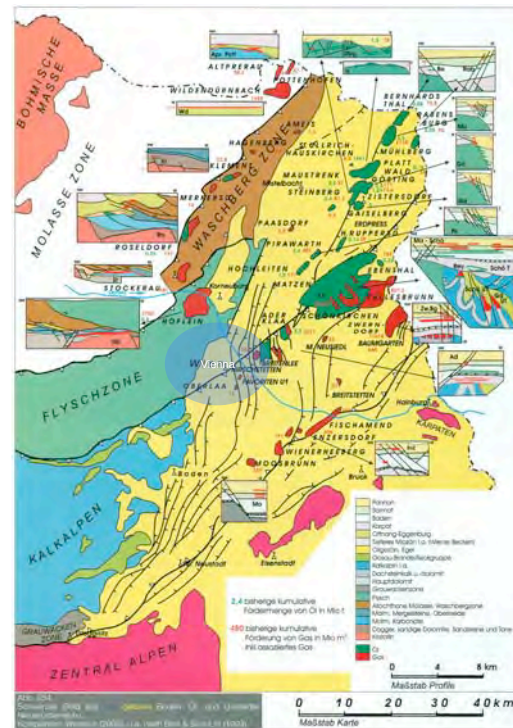
Questions:

- Better understand seismicity in Austria region
- Understand regional deformation

Scientific context in the Vienna area

RESOURCES

Oil and gas



Water and geothermal energy



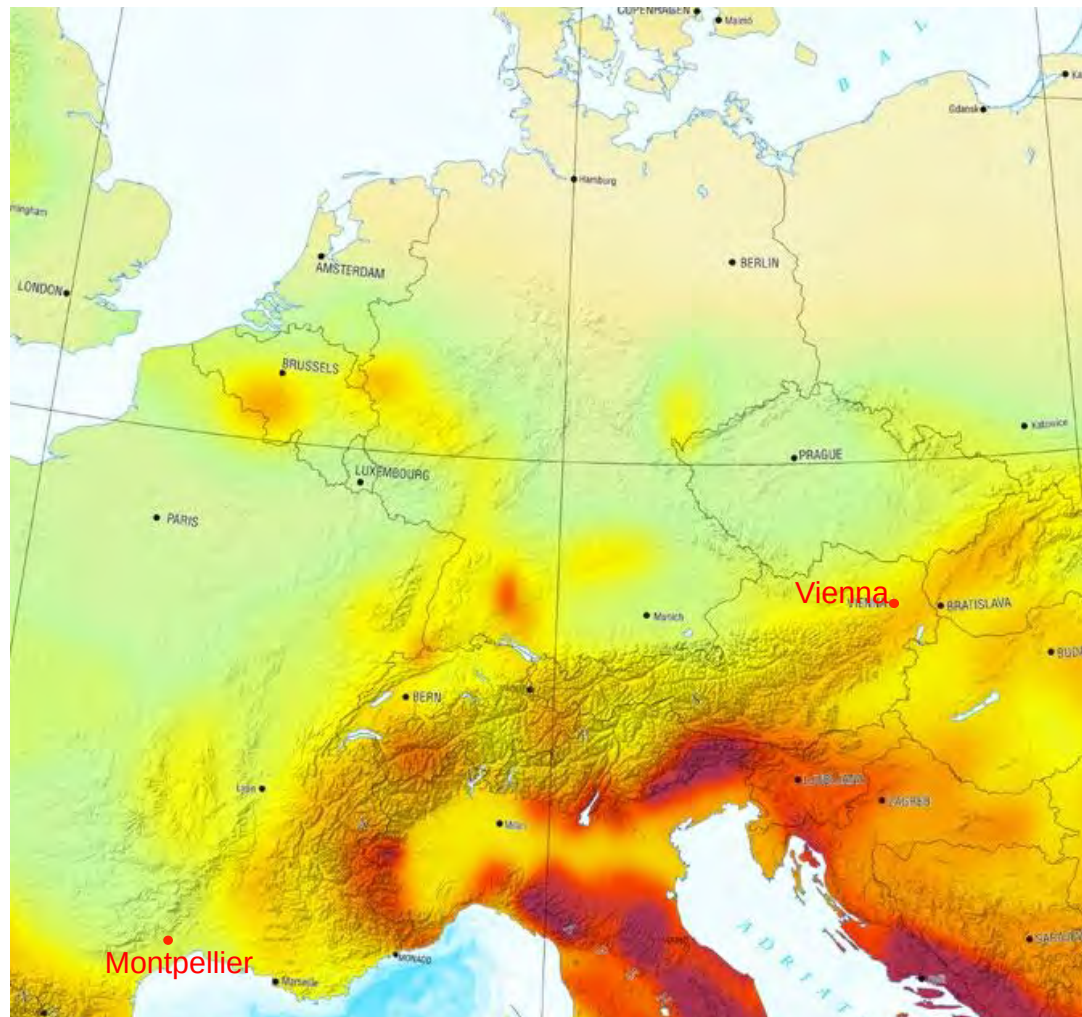
Questions:

- How can we help to satisfy societal demands of resources (oil, gas, water, energy)?

Scientific context in the Vienna area

SEISMIC HAZARD

European Seismic Hazard Map



Vienna (1.8 ME) is the **only large city*** with a notable seismic risk, in the German-speaking part of the world.

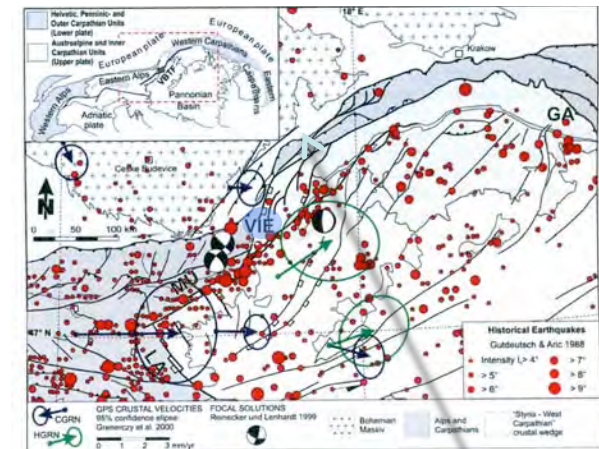
* larger than 1.5 million inhabitants.

Seismic Hazard in Vienna area

Vienna after the 1590 earthquake



Instrumental seismicity
after Hinsch und Decker (2007)

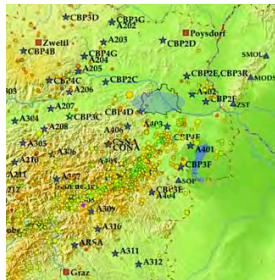


Markgrafneusiedler Fault

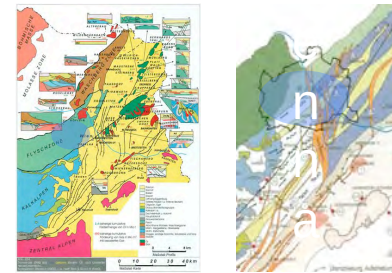


Vienna basin

SEISMIC HAZARD



RESOURCES



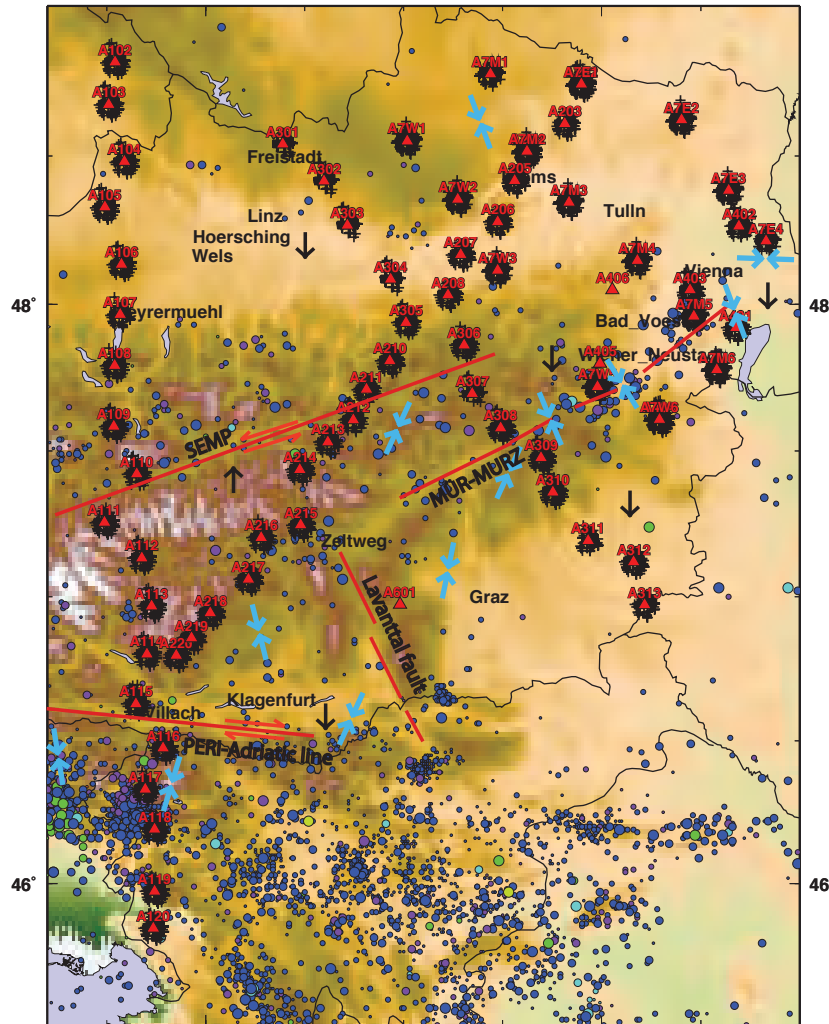
Our Current work:

- Anisotropic receiver functions
- Crustal S-wave structure from seismic noise
- Earthquake depths from later phases
- Microseismicity
- Gravity
- Mantle anisotropy/deformation under Eastern Austria
- Structural/geophysical model of the Vienna Basin

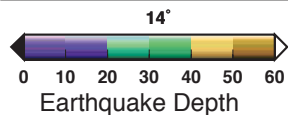


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Seismological data sets in Eastern Austria



- ▲ Seismic stations (permanent and temporary)
- Piercing points at 20 km depth for teleseisms
- Seismicity

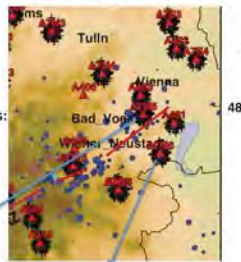


SH orientation
(Reinecker & Lenhardt 1999)
↓ ↑
Subsidence Uplift

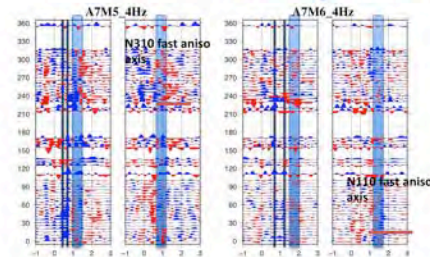
Earthquakes since 1973 from NEIC catalogue

Receiver Functions and the Vienna Basin

Preliminary study of the datasets:
-2 interfaces in ~ the first 3km depth
-anisotropy NW-SE oriented

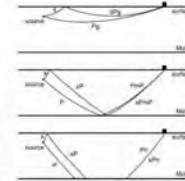


Do we see different structure and deformation on the two sides of the faults?



Earthquake depths from regional depth phases

- How can we determine earthquake depths,
- if the regional network is not very dense?



Ma and Eaton (2011)

arrival time differences
Pg & sPg, PmP & sPmP, Pn & sPn

Only 1 pair of depth phases needed
Phases are well-developed at regional distances

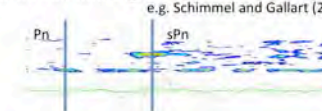
Ma and Eaton (2011)



→ Depth phase enhancement with

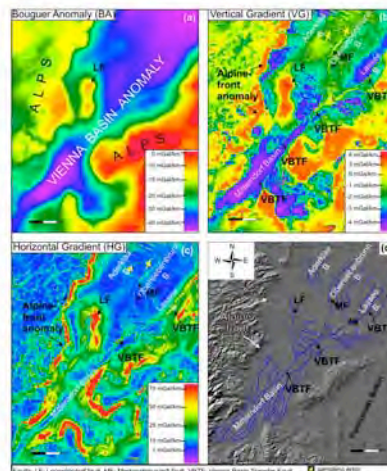
- Trace stacking and/or
- Polarization filtering

e.g. Schimmel and Gallart (2004)



Bruno Meurers

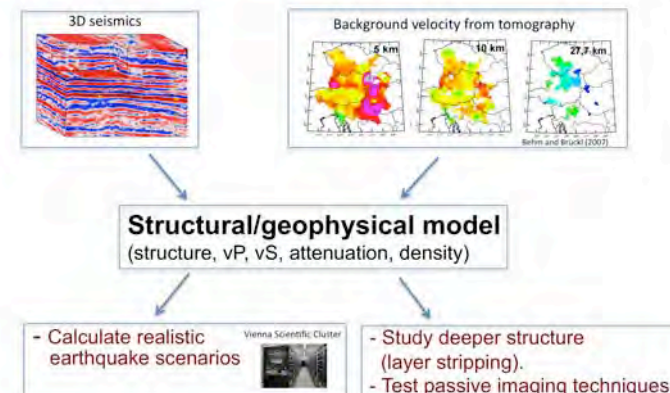
Gravity Derivatives in the Vienna Basin



The application of Bouguer gravity derivatives to analyze near surface structures: Quaternary tectonics and basin formation along the Vienna Basin strike-slip fault

Salcher et al., 2011, submitted to Tectonics

The Vienna basin: Structural/geophysical model



earth
scope

www.eorihscope.org

Exploring the Structure
and Evolution of the
North American Continent

USArray

Transportable
Array Status
June 2008

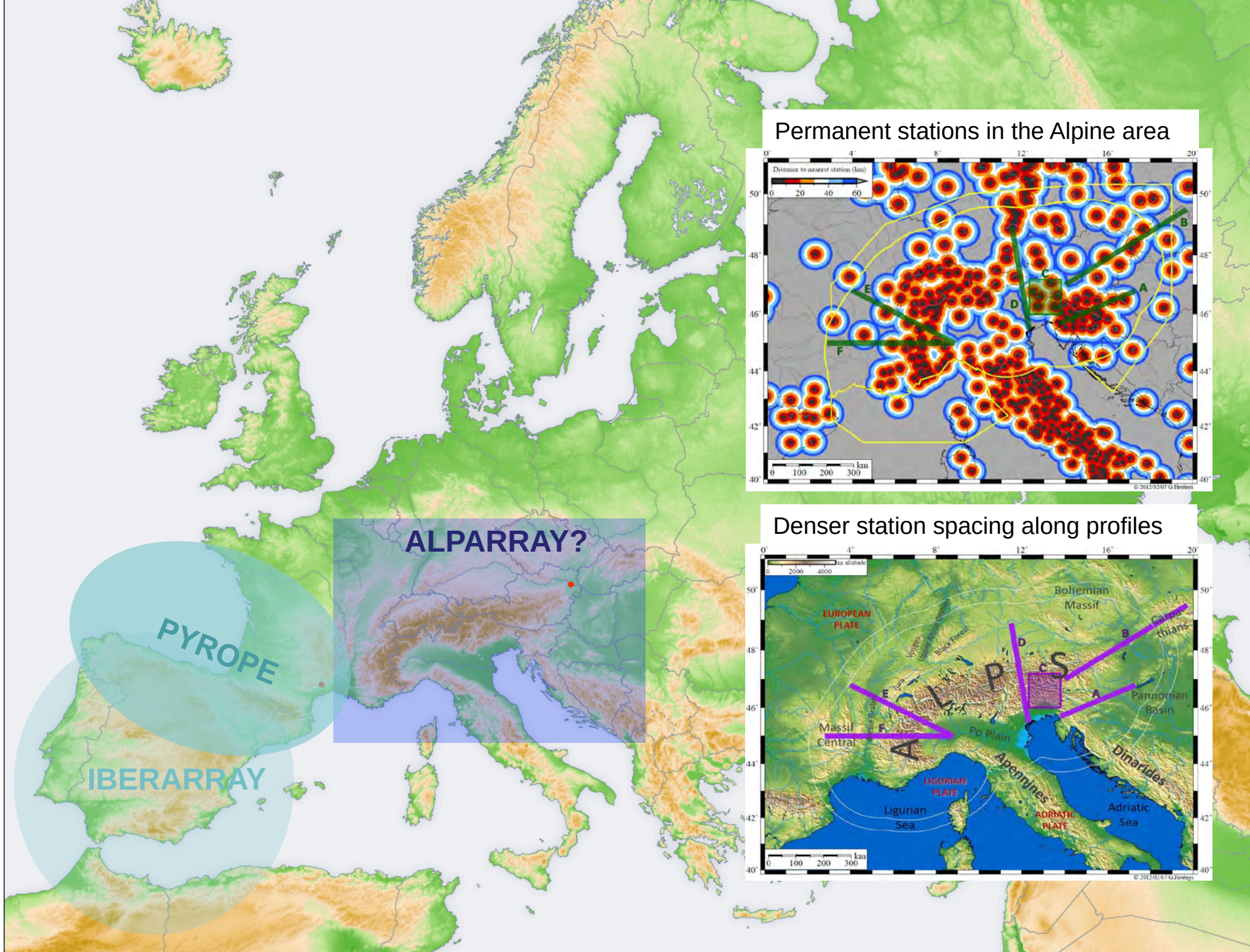
- ▲ Installed
- ▲ Permitted
- ▲ Planned

STATION NETWORK as of 2/2012

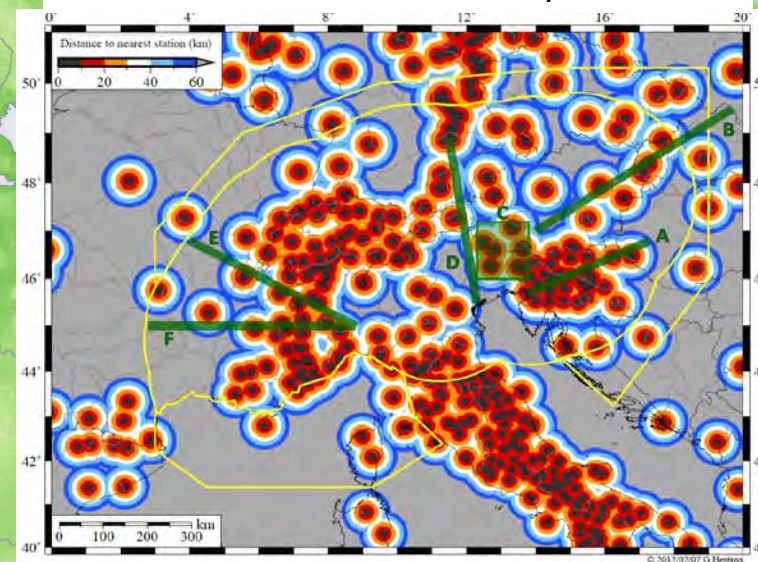
Active: Network 2012-02-29

- ▲ AZ (UC San Diego) (2/2)
- ▲ CI (CalTech) (40/40)
- ▲ TU GSN (9/9)
- ▲ LCSN (1/1)
- ▲ POLARIS (22/24)
- ▲ TA (USArray) (449/454)
- ▲ US ANSS (48/49)
- No data return (8)

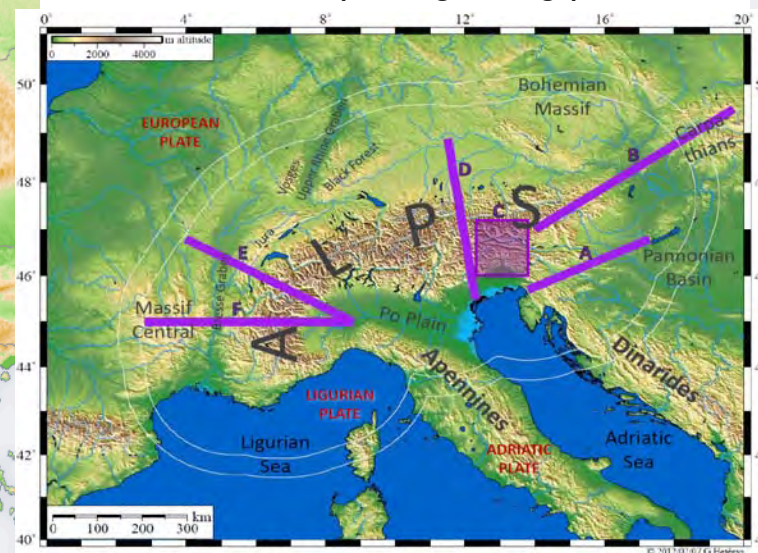
km
0 500



Permanent stations in the Alpine area



Denser station spacing along profiles



Geophysics Teaching in Vienna:

- Früher: **Diplomstudiengang Meteorologie und Geophysik (U.Wien)**
- Bis 2011: **Master Geodäsie und Geophysik (TU Wien)**
- **Pläne für Master Geophysik** (gemäß Leistungsvereinbarung U.Wien – BMWF)
 - Klassischer Geophysikmaster (mit TU Wien, Bratislava?)
 - International Master mit anderen U. in Europa?

Outlook:

- Focus on Vienna Basin: Seismic hazard, natural resources, ..
- Alpes, Pannonian basin, Carpathians, ..
- Potential collaboration: D-A-CH, EU

