



universität  
wien

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

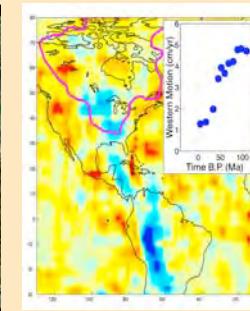
- PEDR, France 2004-2008, 2008-2012
- Fellow, Geological Society of America 2000
- Heisenberg-Stipendium 1998

## 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

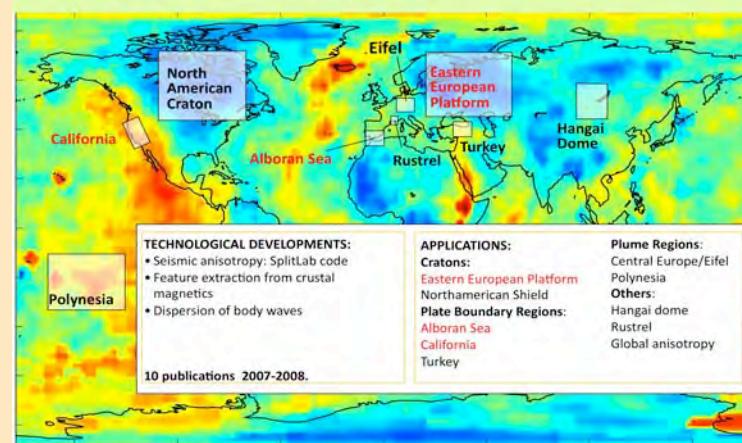


Motion of  
North  
America  
>> The motion will  
come to a halt

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

### Université Montpellier 2003-2010

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





universität  
wien

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

Geoelectrics: Geolog 2000?, AGI Sting/Swift 100

Borehole geophysics: Geonics EM39

Magnetics: several Scintrex

Aerogeophysics (...)

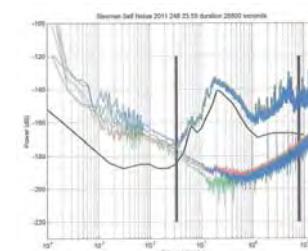
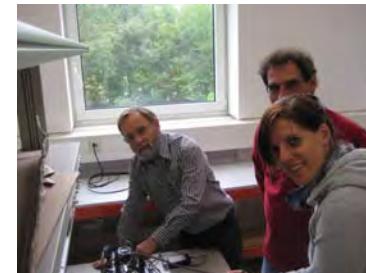
Portable seismometers: Short-period >37 Sensors

29 BB-Recorders, 31 Texan SP-Recorders

Seismic: Seistronix RAS 24

## University of Vienna:

15+ portable broadband seismometer stations

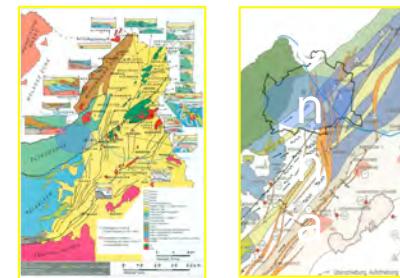


# Scientific context in the Vienna area

# SEISMIC HAZARD



# RESOURCES



# **University of Vienna Geophysics**

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





## INTERNATIONAL ORGANIZATIONS (and national)

### Comprehensive Test Ban Treaty Organization CTBTO

United Nations Vienna



Global network  
(seismic etc)



Seismologists and Diplomats



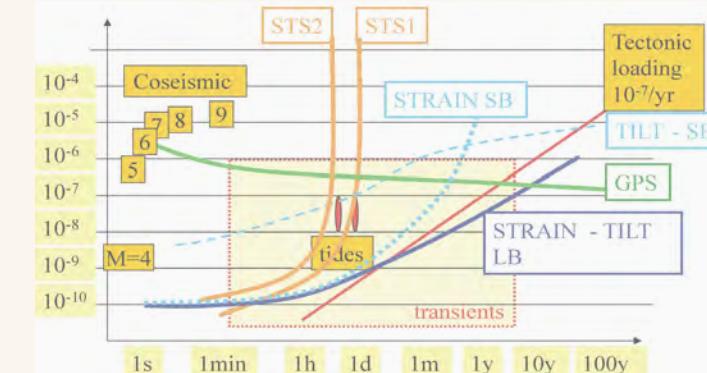
#### Questions:

- 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?

#### Questions:

- Better understand seismicity in Austria region
- Understand regional deformation



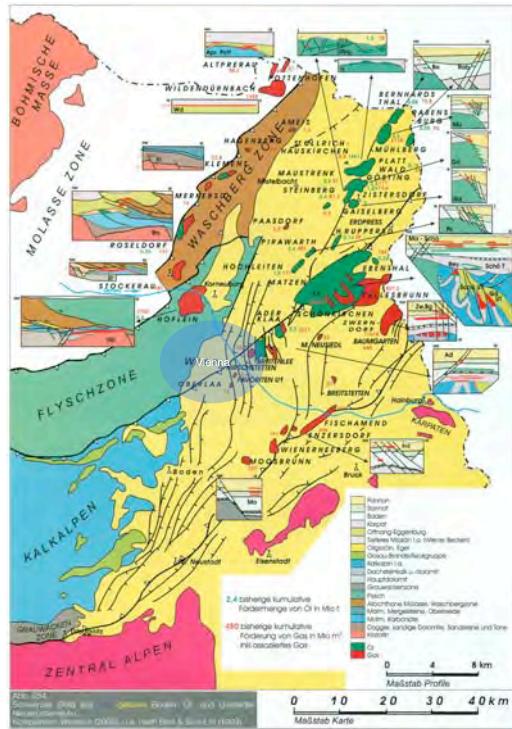
Boudin (2008)

# Scientific context in the Vienna area

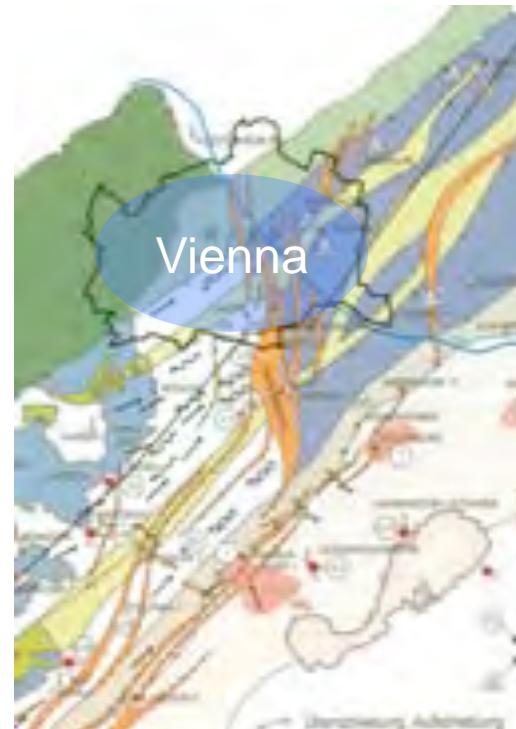
## RESOURCES

# RESOURCES

Oil and gas



## Water and geothermal energy



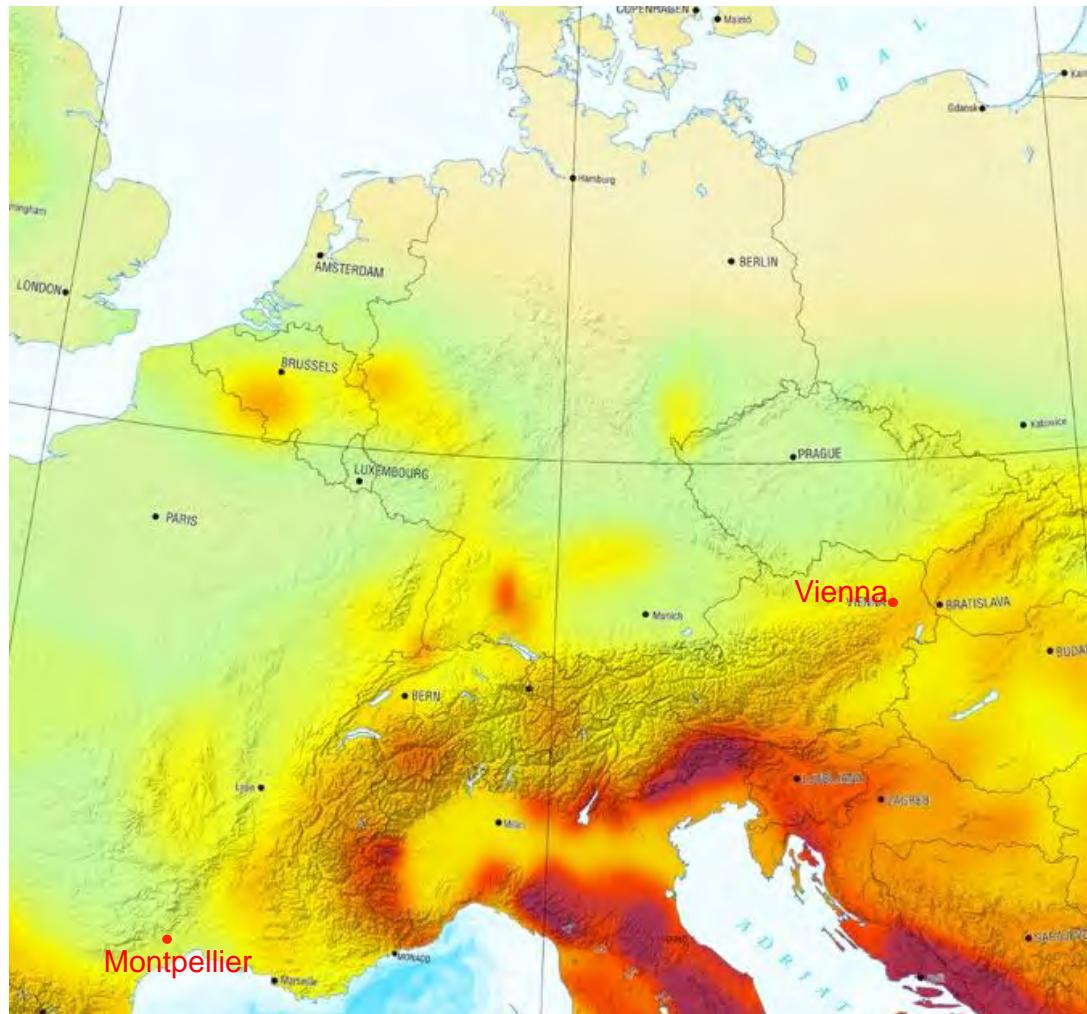
## Questions:

- 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.

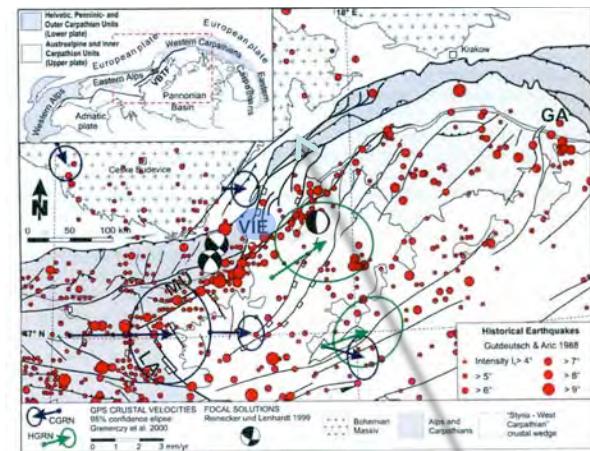


## Seismic Hazard in Vienna area

Vienna after the 1590 earthquake



Instrumental seismicity  
after Hirsch und Decker (2007)

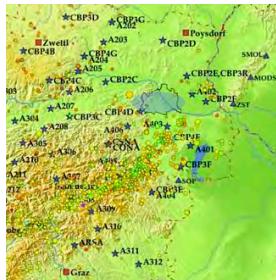


Markgrafneusiedler Fault

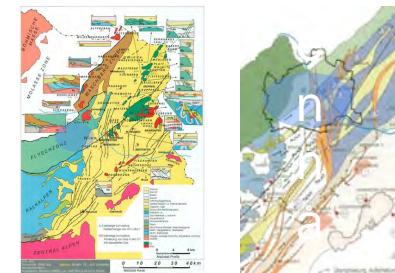


# Vienna basin

# SEISMIC HAZARD



# RESOURCES

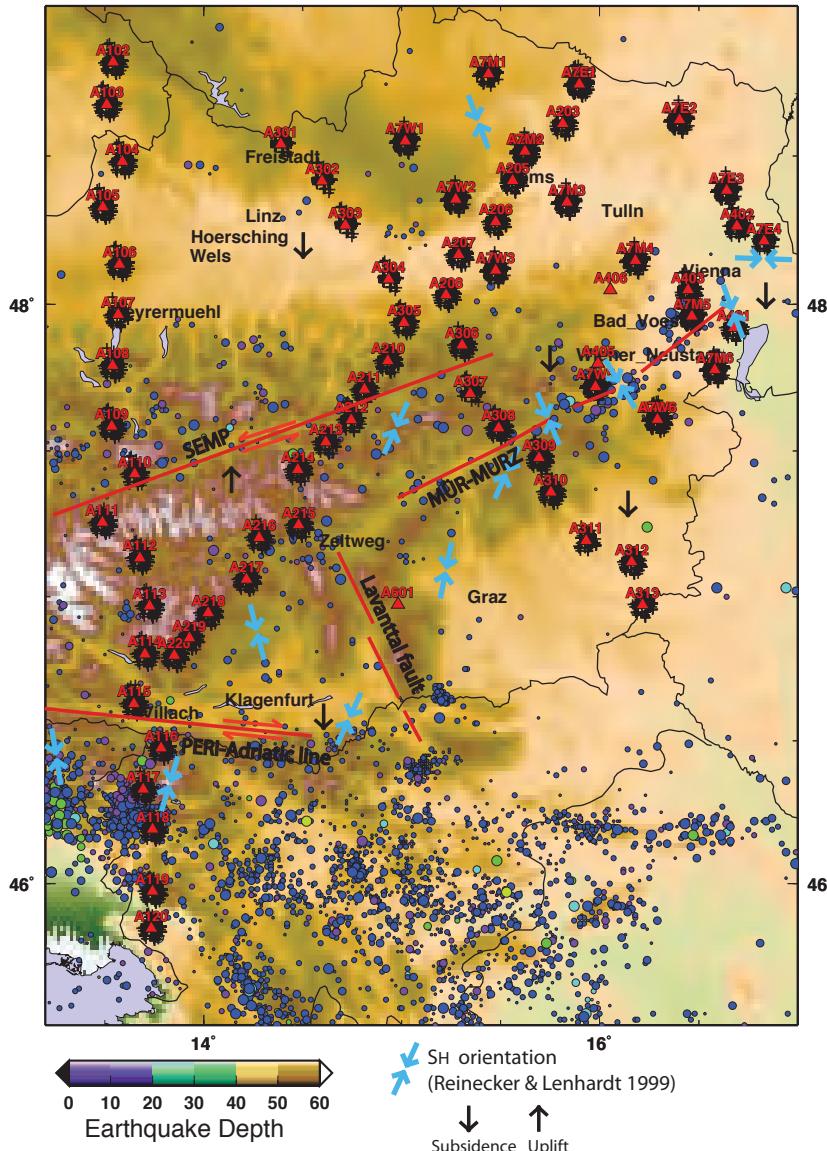


## Our Current work:

- 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



# Seismological data sets in Eastern Austria

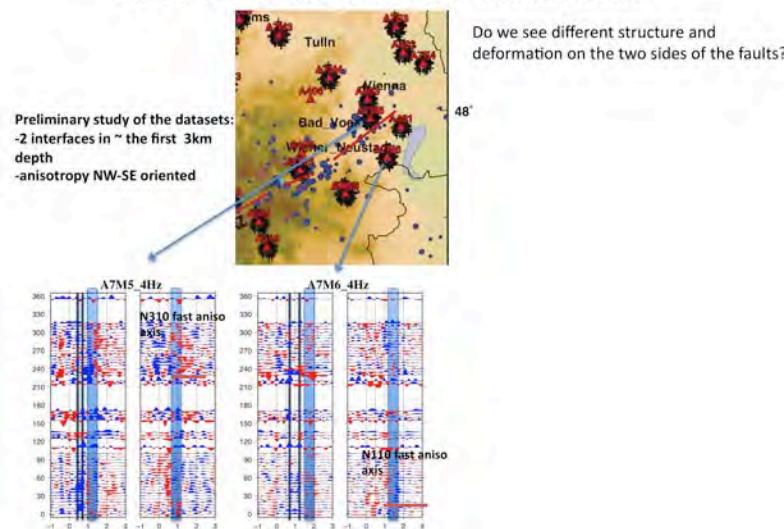


- ▲ Seismic stations (permanent and temporary)
- Piercing points at 20 km depth for teleseisms
- Seismicity



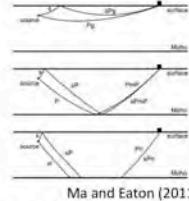
Earthquakes since 1973 from NEIC catalogue

## Receiver Functions and the Vienna Basin



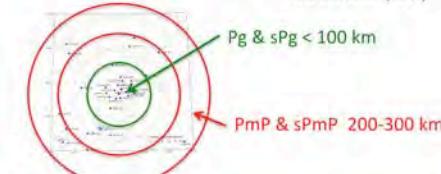
## Earthquake depths from regional depth phases

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



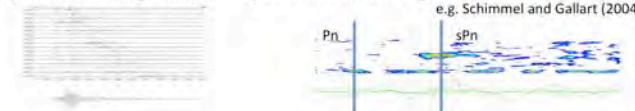
Only 1 pair of depth phases needed  
 Phases are well-developed at regional distances

Ma and Eaton (2011)

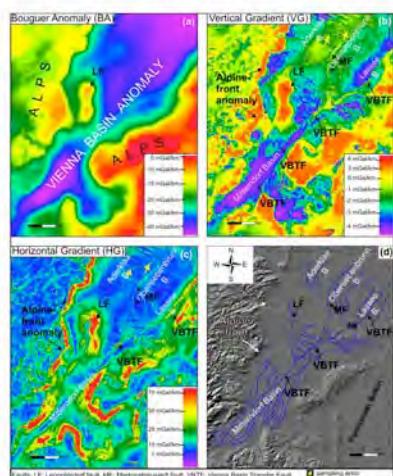


→ Depth phase enhancement with

- a) Trace stacking and/or b) Polarization filtering

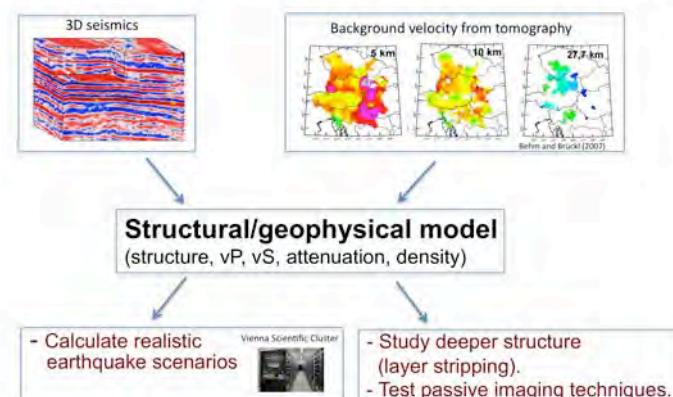


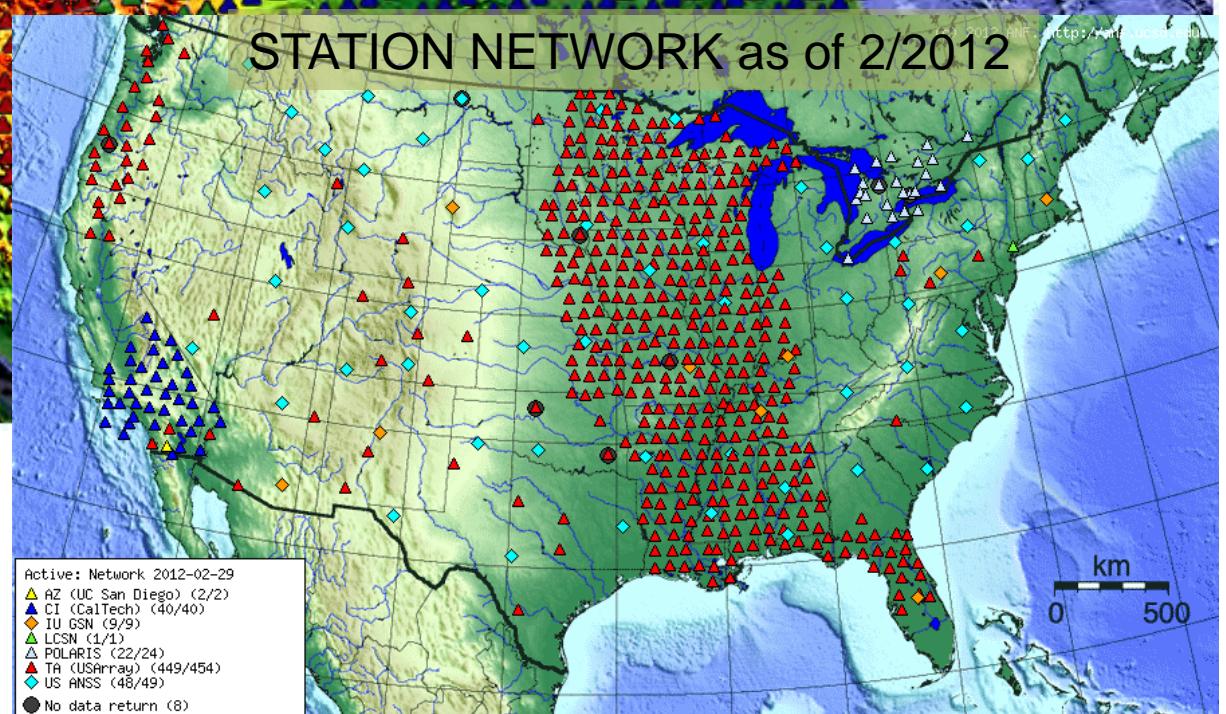
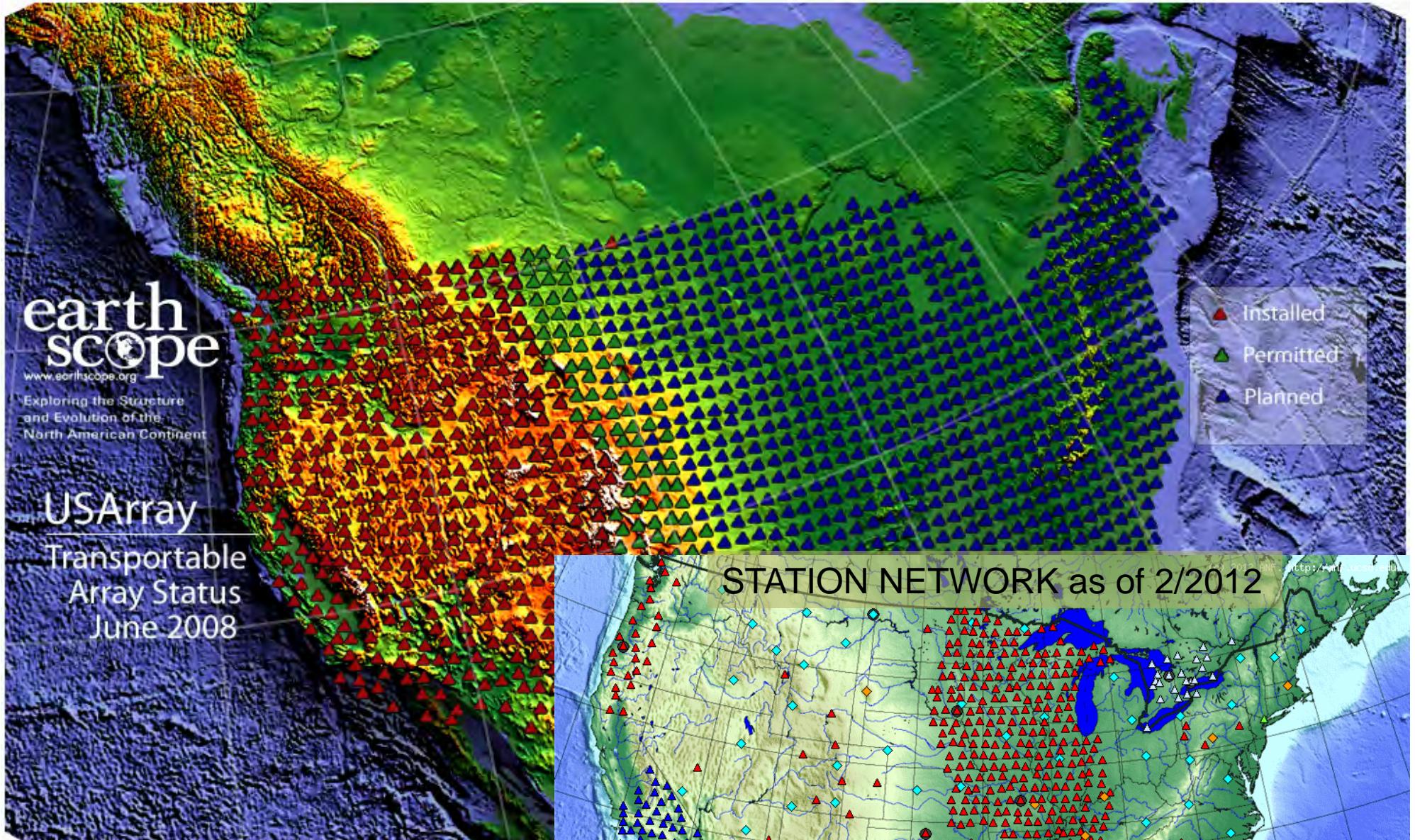
## Gravity Derivatives in the Vienna Basin

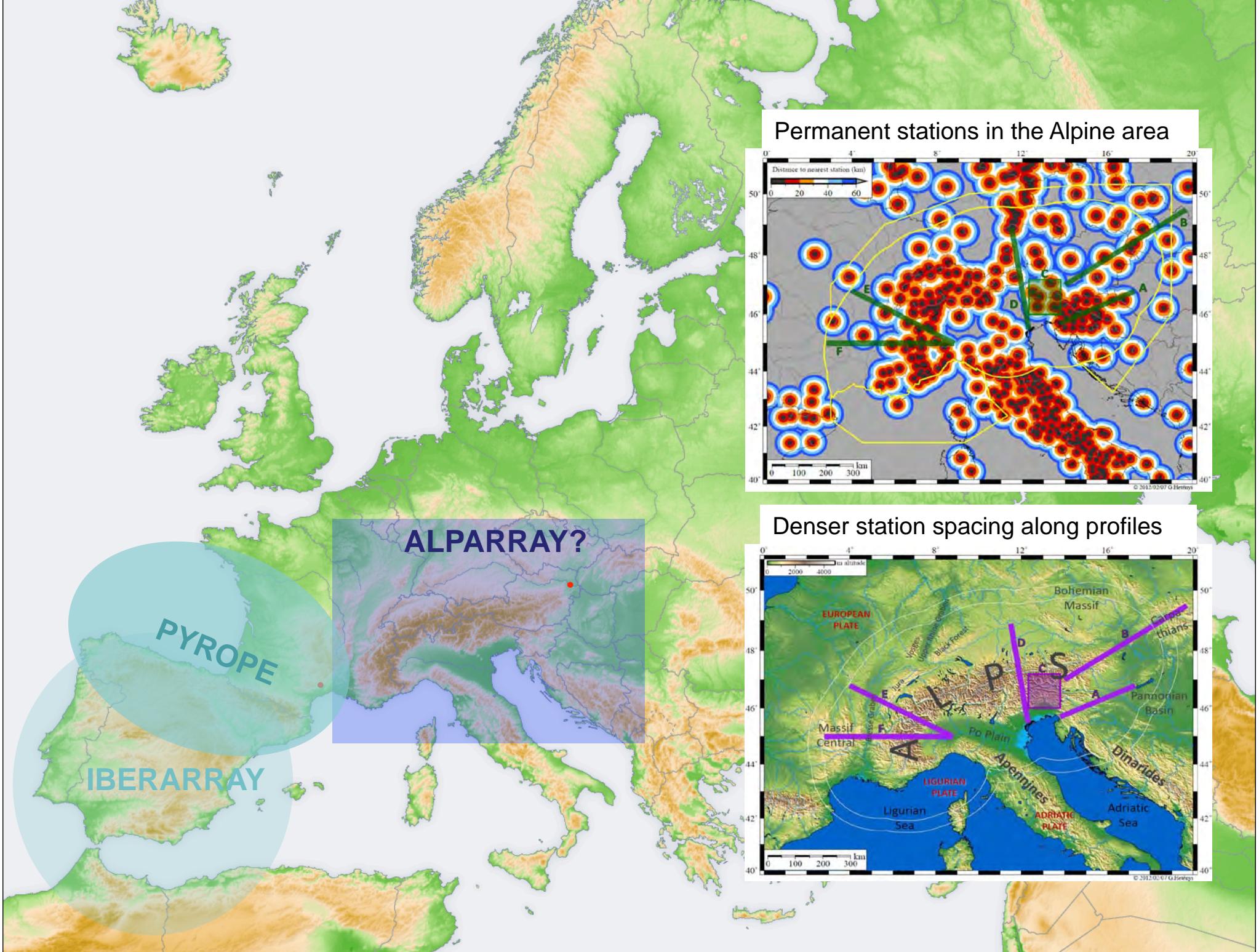


Bruno Meurers

## The Vienna basin: Structural/geophysical model







## 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 ressources, ..
- Alpes, Pannonian basin, Carpathians, ..
  
- Potential collaboration: D-A-CH, EU

