# SPP Kickoff Meeting - May 17, 2017

Mountain-Building Processes in 4-Dimensions (4D-MB)

SPP 2017

# Meeting Program

Morning: 10-12:30

Introductory remarks
News
SPP and AlpArray structures & administration

Lunch: 12:30-13:30

Afternoon: 13:30-16:00

Reports
- DSEBRA, LOBSTER, SWATH (Friederich, Kopp-Lange, Weber)
- Geological & Modelling projects (Handy, Kaus)

SPP:
- Data handling (Elger)
- Advertisement of SPP positions
- Schedule of geophysical and geological/geodynamic activities
- Next meetings

# Detailed meeting program

Morning: 10-12:30

**Introductory remarks**

**News**

- Feedback from the DFG panel, projects funded
- AlpArray –current activities, report from EGU 2017

**SPP structure**

- Research themes and activity fields
- Connection to AlpArray working groups and science committee members
- International advisory board

Lunch, 12:30-13:30

Afternoon: 13:30-16:00

**Reports**

- DSEBRA (Friederich, Rümpker)
- LOBSTER (Kopp, Lange)
- SWATH (Weber)
- Overviews of Geodynamic & Thermomechanical Modelling projects (Handy, Kaus)

**Other**

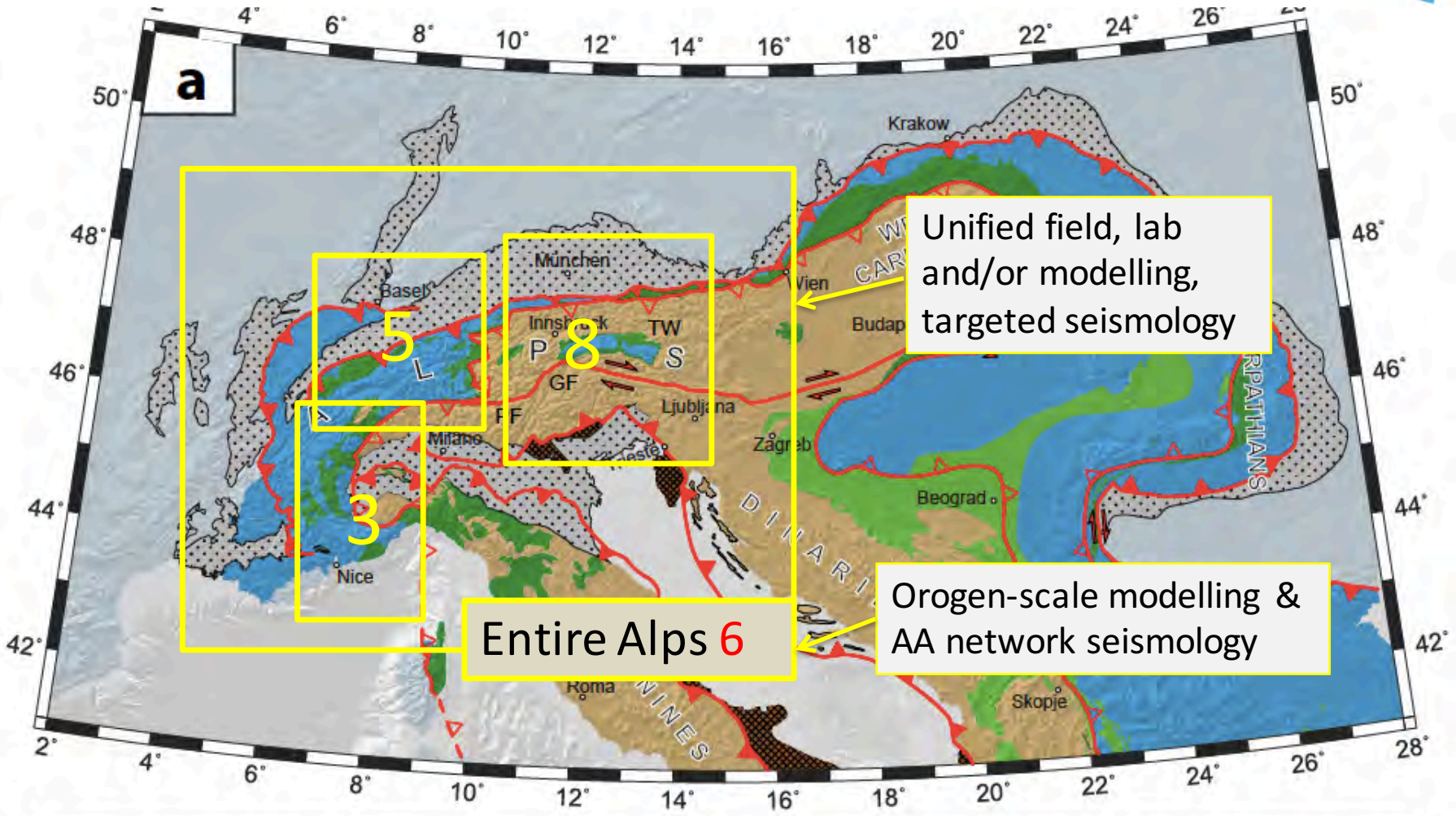
- Data handling
- Advertisement of SPP positions
- Schedule of geophysical and geological/geodynamic activities
- Next meetings

# Projects funded

| NR | Pis | Title |
|---|---|---|
| | | **CORE SPP ACTIVITIES (SEISMOLOGY, COORDINATION)** |
| 1 | Friederich-Korn-Meier-Rümpker-Tilmann-Thomas-Wassermann | Activity Field A - UNIBRA / DSEBRA: the German seismological contribution to AlpArray |
| 2 | Kopp-Lange-Grevemeyer | Activity Field B - LOBSTER: Ligurian Ocean Bottom Seismology and Tectonics Research |
| 4 | Weber-Tilmann-Haberland | Activity Field D – SWATH D: Providing seismological data for the SPP 4D-MB, |
| 5 | Handy | Coordination of SPP |
| | | |
| | | **ALL OTHER PROPOSALS** |
| 6 | Friederich-Meier-Kaus | Imaging structure and geometry of Alpine slabs by full waveform inversion of teleseismic body waves |
| 7 | Froitzheim-Keppler | Slab factory – ocean formation and subduction in the Western Alps |
| 8 | Glotzbach-Kley | Constraining the near-surface response to lithospheric reorientation - Structural thermochronology along AlpArray geophysical transects |
| 9 | Gruetzner*-Reicherter-von Blankenburg | Earth surface response to Quaternary faulting and shallow crustal structure in the eastern Adria-Alpine collision zone and the Friulian plain |
| 10 | Handy-Haberland-Le Breton | Linking surface kinematics to deep structure of the Adriatic indenter near a potential subduction-polarity switch – the Giudicarie Belt (Southern Alps) |
| 11 | Kaus-Friederich-Meier | Constraining the dynamics of the present-day Alps with 3D geodynamic inverse models |
| 12 | Keppler-Stipp-Froitzheim | Alpine subduction revisited – new structural and elastic wave velocity models for improved geophysical imaging towards greater depths |
| 13 | Kind | Seismic imaging of the newly discovered Sub-Lithospheric Discontinuity (SLD) in the larger Alpine region |
| 14 | Kummerow-Cesca-Wassermann-Plenefisch | From Top to Bottom- Seismicity, motion patterns & stress distribution in the Alpine Crust |
| 15 | Lange-Thorwart-Grevemeyer | Generation, destruction and of lithosphere of the Ligurian Sea |
| 16 | Luijendijk-von Hagke | Quantifying crustal fluid flow and its role in the thermal structure of the Alps |
| 17 | Meier-Friederich-Ebbing | Surface Wavefield Tomography of the Alpine Region to Constrain Slab Geometries, Lithospheric Deformation and Asthenospheric Flow in the Alpine Region |
| 18 | Mulch-Ehlers-Methner-Mutz | Neogene Paleoelevation and Paleoclimate of the Central Alps – Linking Earth surface processes to lithospheric dynamics |
| 19 | Petrunin* | Inverse and forward multiscale numerical modeling of the Alpine orogeny (IFMMALPO) |
| 20 | Pleuger-John-Tilmann-Yuan-Kaus-Handy-Mechie | Understanding subduction by linking surface exposures of subducted and exhumed crut to geophysical images of slabs |
| 21 | Reicherter-Ritter | Stress transfer and Quaternary faulting in the northern Alpine foreland |
| 22 | Rümpker-Schmeling | Mantle deformation beneath the Alps and the physics of the subduction polarity switch - Constraints from thermomechanical modelling, seismic anisotropy |
| 23 | Scheck-Wenderoth - Ebbing-Sippel-Götze | Integrated 3D structural, thermal, gravity and rheological modeling of |
| 24 | von Hagke-Luijendijk-Hindle-Kley | FB-4D - Foreland basin evolution records the effects of plate reorganization, surface evolution and crustal deformation on mountain building |

- 75% of proposals funded (usually ≤ 50%); high rate attributed to relatively few applicants relative to large amount of money granted (see next slide)
- Swath C not funded (not well connected to other proposals)
- Major cuts to DSEBRA - postdoc position in Frankfurt not funded
- Major cuts to Coordination proposal -only 36 month postdoc proposal was funded; 24 month postdoc position was treated as a PhD request (?) and rejected

# Location of funded projects (22)



# Feedback from DFG panel on proposals

Reviewers' impression of the proposals:

- Exemplary interdisciplinarity and cogency of themes; major challenge will be to bring disciplines together for the duration of the project
- Quality of proposals rather low given the ambitious pre-proposal (*Frau Sonntag – this is unfortunately usual for SPPs*); reviewers expected more competition among proposals with similar aims (*Based on past SPP experience, we tried to avoid uncoordinated proposals*)
- Weak aspects: inefficient management of seismic stations among the depts. involved (too much personel); overall weaknesses in thermochronology and geodesy

For the future:

- 2nd round of the SPP may receive less funding due large amount appropriated and relatively small number of proposals in the 1st round
- Quality of proposals submitted for 2nd round must be improved
- Build multidisciplinary data base with access by all members
- Involve geodesy

# Original budget & positions

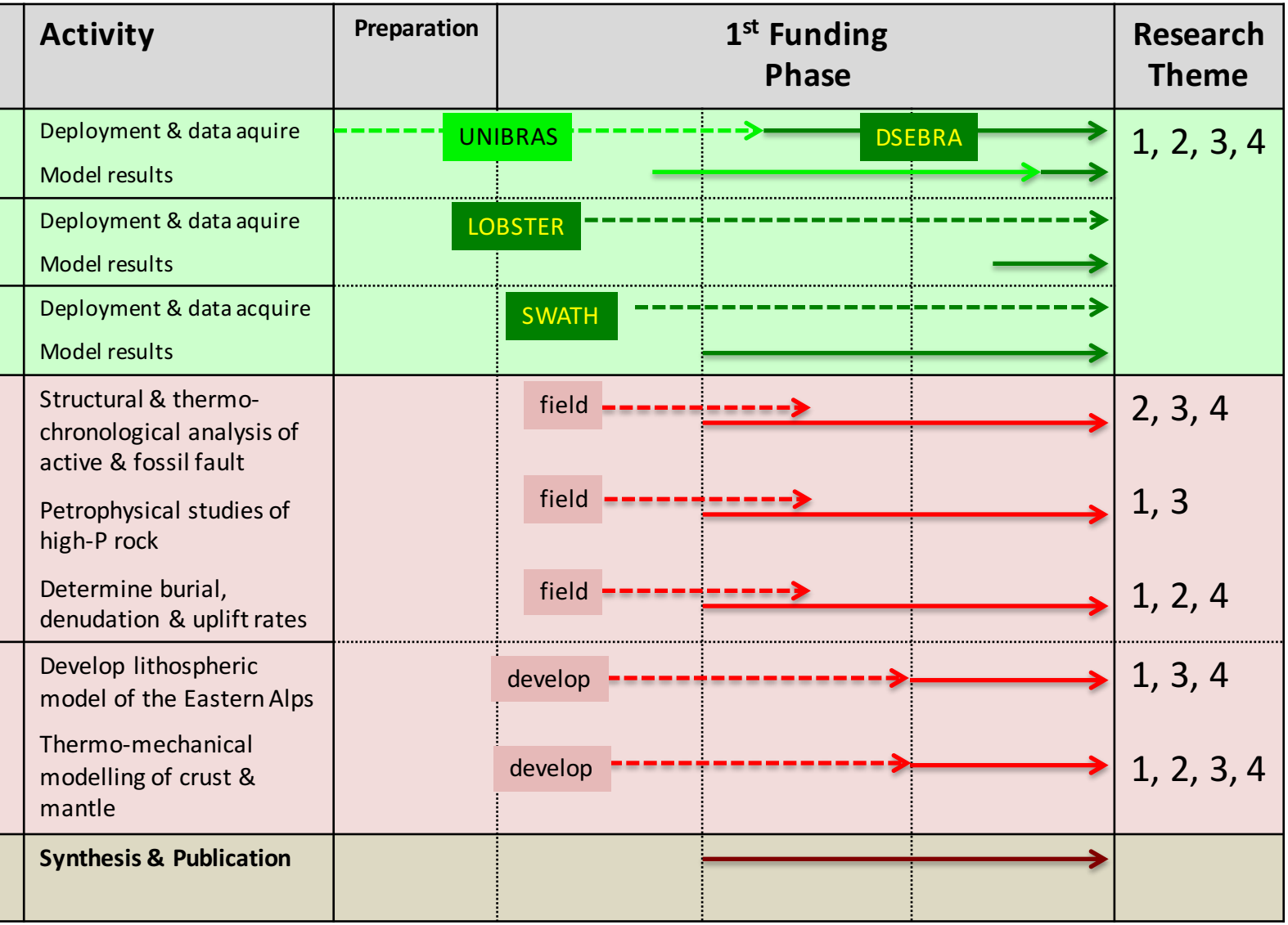
| | Activity | Acronym | Principle Investigator | (PostDocs) | Costs € | |
|---|---|---|---|---|---|---|
| RESEARCH | **Res. Projects** | | All PIs , all disciplines | | **6.100.000 €** | **52%** |
| | | | 31 PhDs + 4 PostDocs (2 PostDoc own-pos, 1 PostDoc 1 yr) | | | |
| COORDINATION | Scientific data synthesis, coordination, support | | Handy /FU Berlin | (1 PostDoc 3 yrs) | 600.000 € | **6%** |
| | Central seismological Data management | | Handy/FU-Berlin (Weber/GFZ) | (1 PostDoc 2 yrs) | 100.000 € | |
| | **Sum** | | incl. 2 PostDocs | (1 PostDoc 2 yrs) | **700.000 €** | |
| SEISM. EXPERIM. | Seismological experiments | DSEBRA | Friederich/Bochum + 6 others | (2 PostDocs 3 yrs) | 900.000 € | **17%** |
| | | LOBSTER | Kopp / GEOMAR | (1 PostDoc 3 yrs) | 400.000 € | |
| | | SWATH C | Parolai/GFZ + Rackwitz/TU Berlin | (1 PostDoc 2 yrs) | 300.000 € | |
| | | SWATH D | Weber, Tilmann, Haberland / GFZ | (1 PostDoc 2 yrs) | 400.000 € | |
| | **Sum** | | incl. 5 PostDocs (2 PostDoc 2 yrs) | | **2.000.000 €** | |
| INFRA-STRUCT. | 100 stations | DSEBRA | Friederich / Bochum + 6 others | | **3.000.000 €** | **25%** |
| | **Total** | | | | **11.800.000 €** | |

**Details in SPP-Application 2015, Appendix V, VI, VII; NOTE: values above only approximate; see DFG sheets for more accurate values**

# Incomplete! - funded budget & positions

| | Activity | Acronym | Principle Investigator | (PostDocs) | Costs € | |
|---|---|---|---|---|---|---|
| RESEARCH | **Res. Projects** | | All PIs , all disciplines | | **x.xxx.000 €** | **xx%** |
| | | | 31 PhDs + 4 PostDocs (2 PostDoc own-pos, 1 PostDoc 1 yr) | | | |
| COORDINATION | Scientific data synthesis, coordination, support | | Handy /FU Berlin | (1 PostDoc 3 yrs) | xxx.000 € | **x%** |
| | Central seismological Data management | | | | | |
| | **Sum** | | incl. 1 PostDoc | | xxx**.000 €** | |
| SEISM. EXPERIM. | Seismological experiments | DSEBRA | Friederich/Bochum + 6 others | (1 PostDoc 3 yrs) | xxx.000 € | **x%** |
| | | LOBSTER | Kopp / GEOMAR | (1 PostDoc 3 yrs) | xxx.000 € | |
| | | SWATH D | Weber, Tilmann, Haberland / GFZ | (1 PostDoc 2 yrs) | xxx.000 € | |
| | **Sum** | | incl. 3 PostDocs (2 PostDoc 2 yrs) | | **x.xxx.000 €** | |
| INFRA-STRUCT. | 100 stations | DSEBRA | Friederich / Bochum + 6 others | | **3.000.000 €** | **xx%** |
| | **Total** | | | | **xx.000.000 €** | |

# Schedule for *4D-MB* - 1st Phase



# AlpArray developments

Report on stations

- Land-based network is almost complete and operational
- Almost 1 yr transpired since end of station evaluation period; only a few stations are delivering poor-quality data
- Permanent stations not as consistent as the mobile stations
- Station deployment will end in 2nd half of 2018, but will be extended for some countries (await summary of György Hetenyi)
- OBS will be deployed in June 2017, collected in Spring 2018 (see below)

Related projects

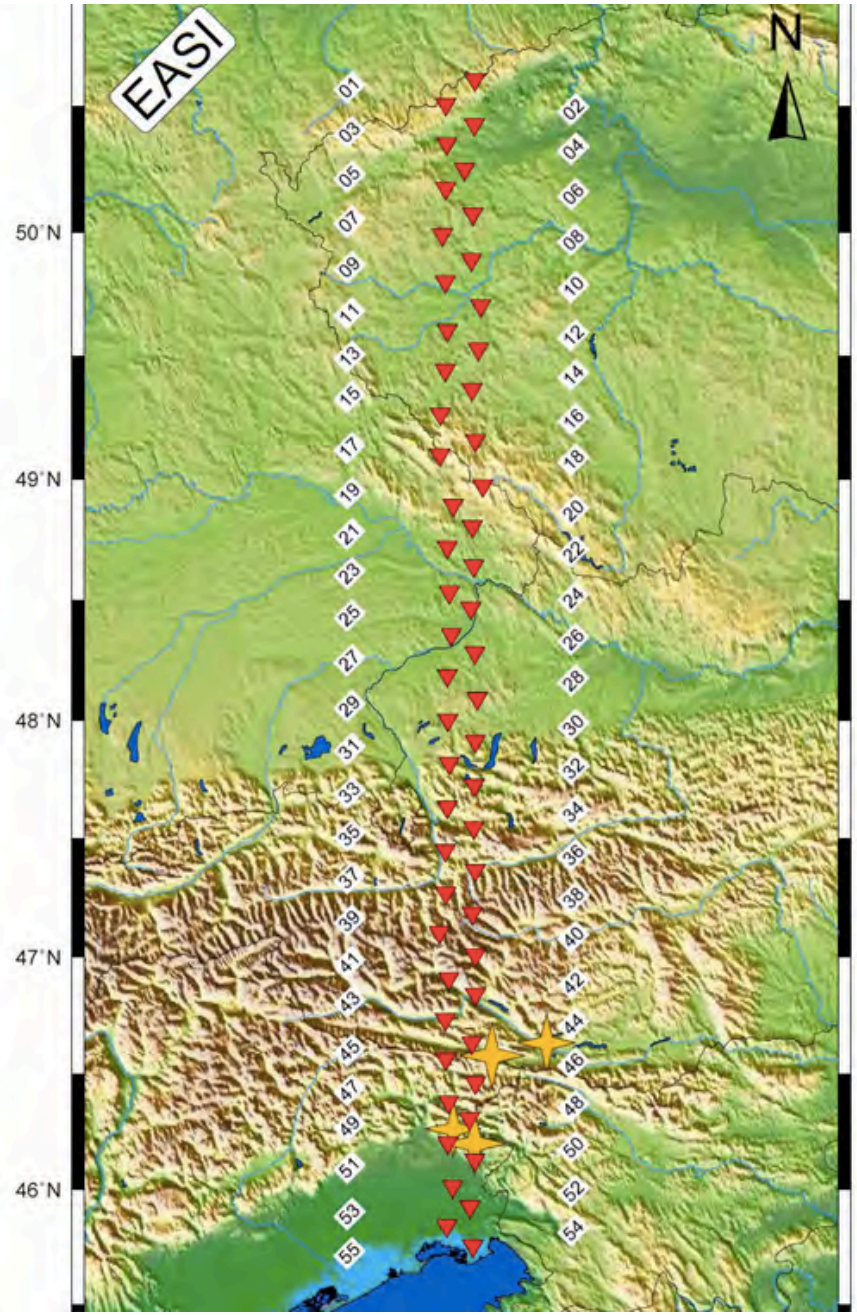
- EASI (Eastern Alps Seismic Investigation – Prag-Vienna-Zürich)
- CASE (Central Adriatic Seismic Experiment) meeting in Zagreb on June 13-14, 2017 (M. Handy will attend)

Upcoming

- Working Groups need to be activated; these help to avoid unnecessary overlap, encourage networking of young researchers

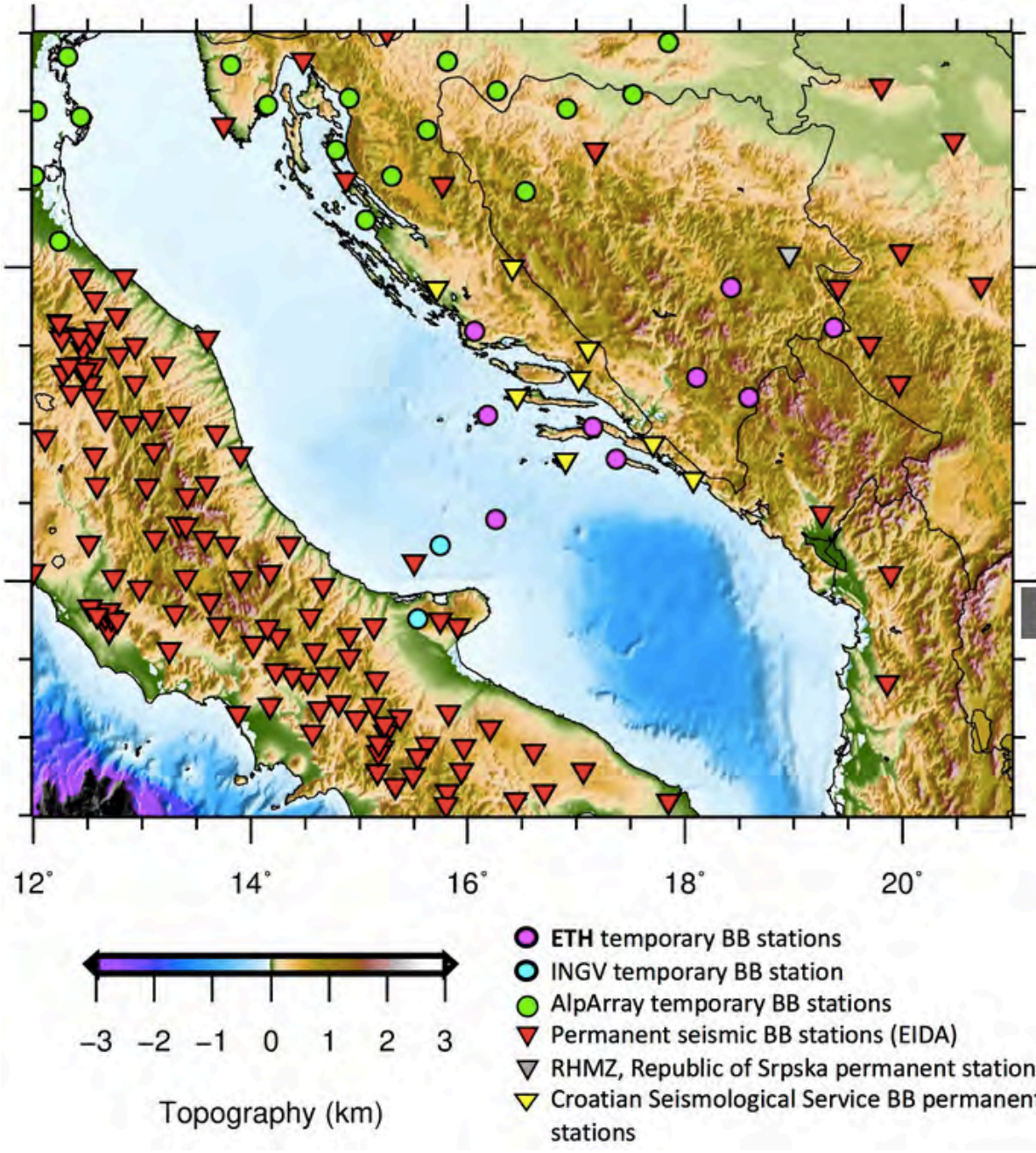
# Eastern Alps Seismic Investigation (EASI)

Prag-Vienna-Zürich, 55 BB Stations
August 2014-August 2015



# Central Adriatic Seismic Experiment (CASE)

Zürich-Zagreb-Bosnia-INGV



# SPP Structure

## Coordinators

**M. Handy, M. Weber**

## Steering Committee

| | | |
|---|---|---|
| W. Friederich | Bochum | Seismology |
| M. Handy | Berlin | Tectonics |
| T. John | Berlin | Petrology |
| B. Kaus | Mainz | Modelling |
| H. Kopp | Kiel/GEOMAR | Marine Geophys |
| K. Reicherter | Aachen | Neotectonics |
| L. Scheck-W. | Aachen/GFZ | Basin dynamics |
| T. Ehlers | Tübingen | Surface, Thermochron |
| M. Weber | GFZ-Potsdam | Seismology |

## Research Themes

1 Reorgan. of lithosphere
**M. Handy**

2 Surface response
**T. Ehlers**

3 Deform. of crust & mantle
**L. Scheck-Wenderoth**

4 Motion patterns & seismicity
**K. Reicherter**

## Activity Fields

Geological activities
**T. John**

DSEBRA
**W. Friederich, G. Rümpker**

LOBSTER
**H. Kopp**

Thermomechanical modeling
**B. Kaus**

Swath
**M. Weber**

# Relation SPP to AlpArray

## AlpArray Steering Committe

**German members**

- M. Handy
- M. Weber

## AlpArray Science Council

**SPP SC + additional members**

| | |
|---|---|
| T. Ehlers | - surface, thermochr |
| M. Korn | - seismology |
| T. Meier | - seismology |
| G. Rümpker | - seismology |
| J. Wassermann | - seismology |

## SPP Steering Committee

| | | |
|---|---|---|
| W. Friederich | Bochum | Seismology |
| M. Handy | Berlin | Tectonics |
| T. John | Berlin | Petrology |
| B. Kaus | Mainz | Modelling |
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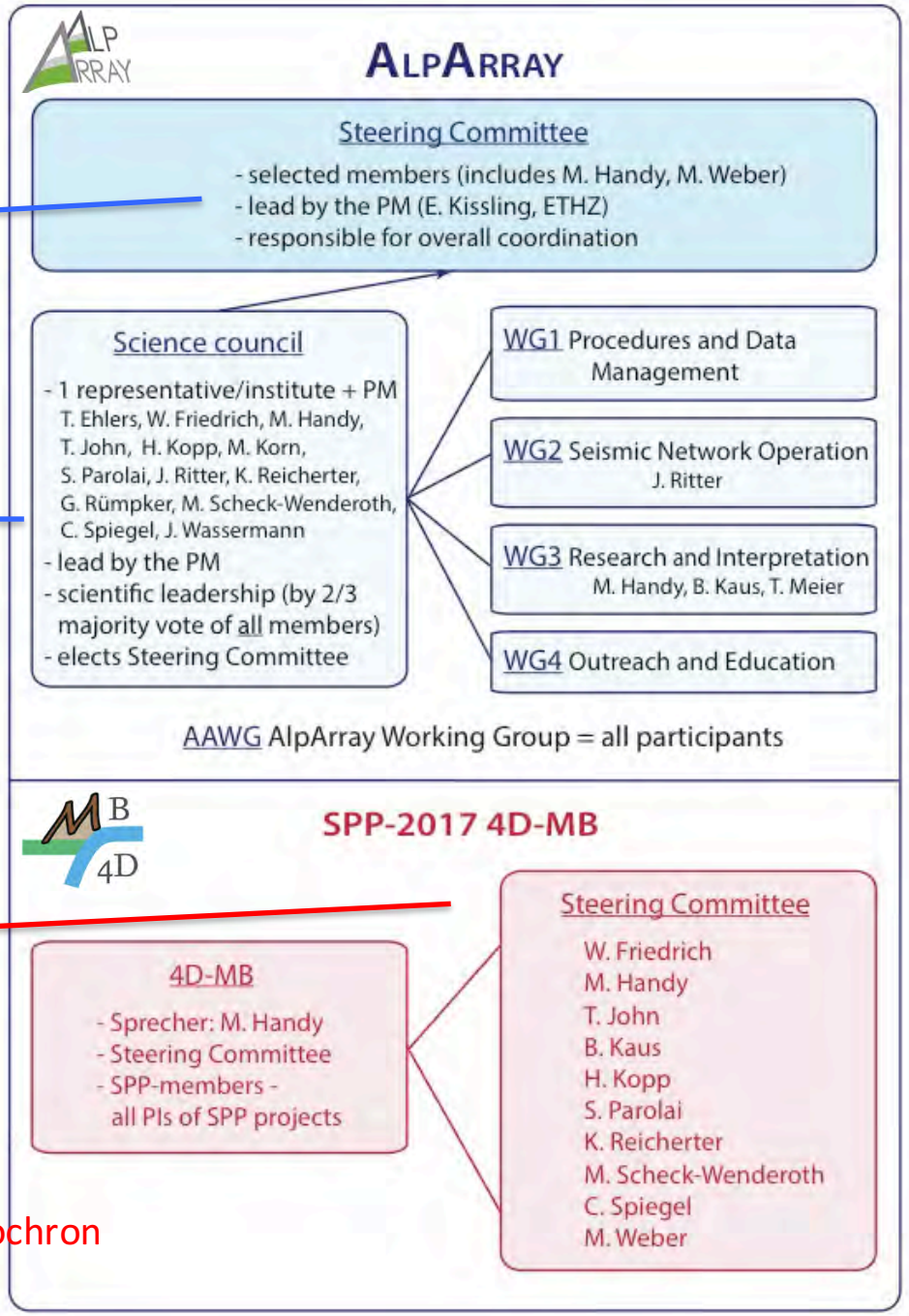
| K. Reicherter | Aachen | Neotectonics |
| L. Scheck-W. | Aachen/GFZ | Basin dynamics |
| T. Ehlers | Tübingen | Surface, Thermochron |
| M. Weber | Potsdam/GFZ | Seismology |



# International SPP Advisory Board

The creation of an international advisory board was suggested by the DFG Panel.

Advantages:

- Possibly gives the SPP a high visibility, at least formally

Disadvantages:

- Unwieldy administrative work to keep members informed, regular invitations, etc.
- Members may exert undue influence on the SPP

Alternative: Ask colleagues external to the SPP to hold keynote talks at SPP meetings; these colleagues can then be consulted during the preparatory stages of the 2nd phase

Advantages:

- More flexible, less burocratic

# Lunch - 12:30-13:30

# SPP activity fields

Geological activities
**T. John**

DSEBRA
**W. Friederich, G. Rümpker**

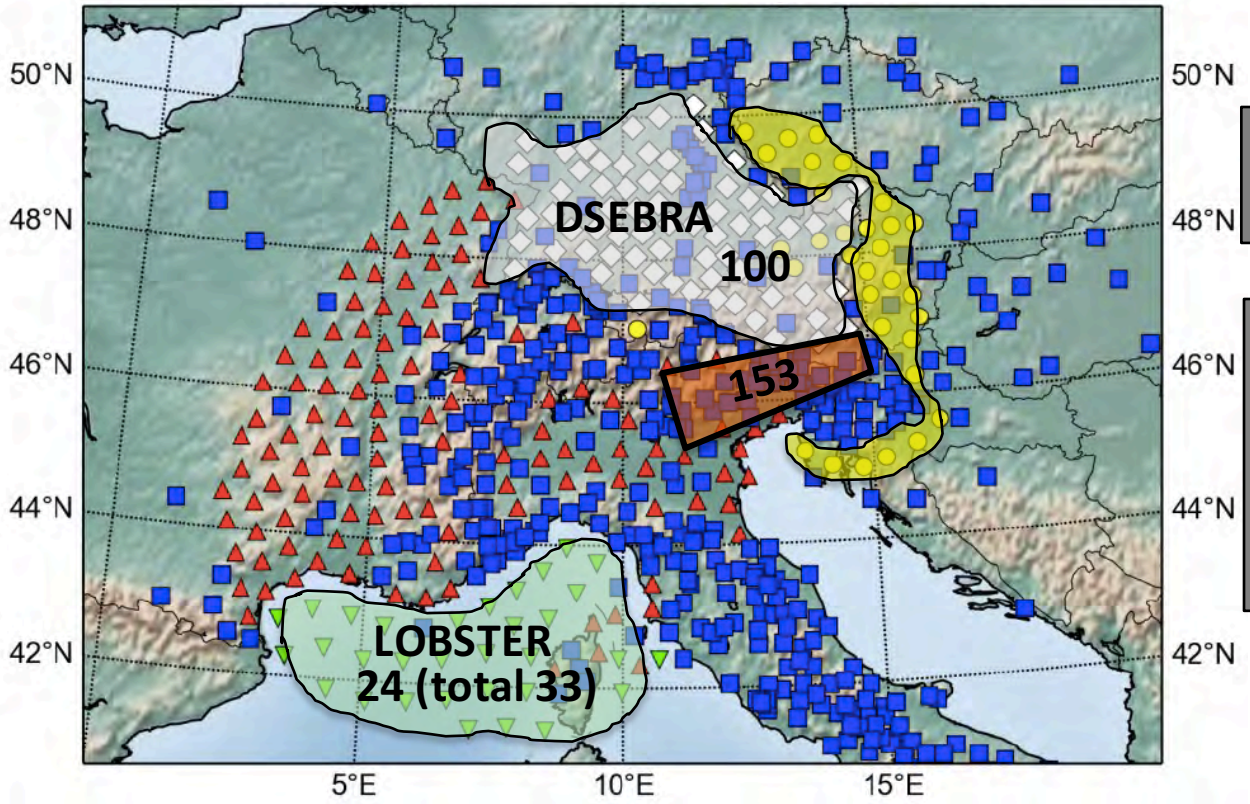
LOBSTER
**H. Kopp**

Thermomechanical modeling
**B. Kaus**

Swath
**M. Weber**

# Seismological Activities – DSEBRA, LOBSTER, SWATH

Envisaged AlpArray network configuration in 2018




**Permanent stations 2015**
**Temp stations F, I, CH, SL, etc.**

**German contributions**
UNIBRAS/DSEBRA sta 2015-18
DSEBRA additional sta 2018
**LOBSTER OBS 2017-18**
Swath D 2017-19

SPP contributions to the AA network:

Deployment & operation of 100 land stations (**DSEBRA**) & 23 of 32 ocean-bottom stations (**LOBSTER**)

SPP targeted study:

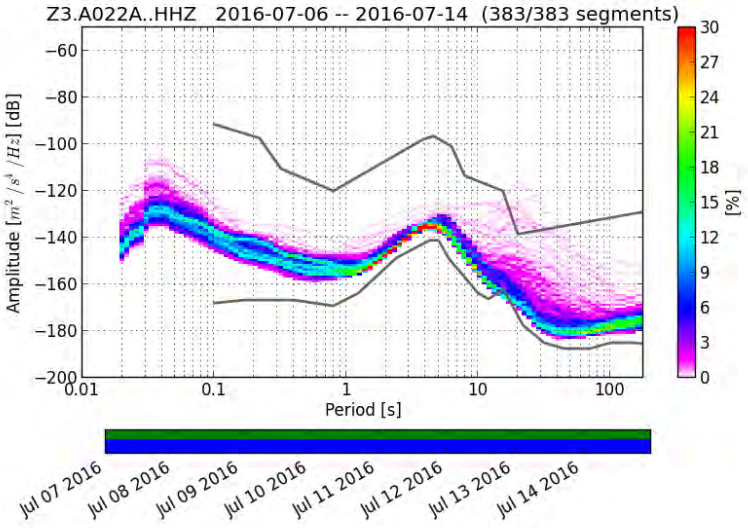
Densified station **swath (153 stations)** deployment, operation, data acquisition & research projects

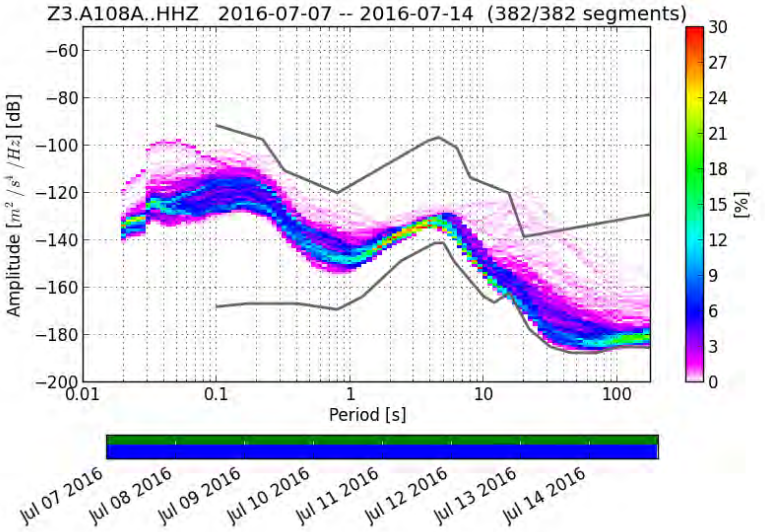
# Report – UNIBRAS & DSEBRA (W. Friederich)

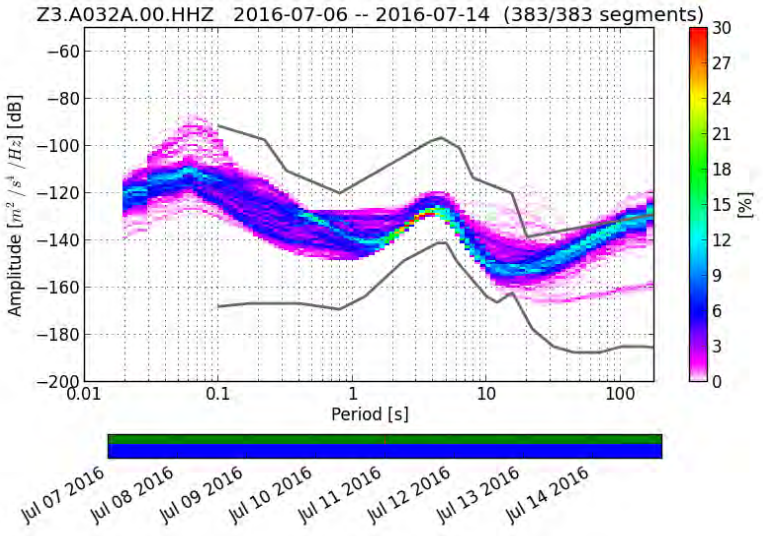
| Task | Action | Who | Until When |
|---|---|---|---|
| Ordering of instruments | Technical description of seismometers and data loggers | WF, JW, TM, GR, CT | May 25 |
| | Teilnahmewettbewerb for seismometers and data loggers | DFG | |
| | 3 offers for less expensive items below 209.000 Euro net | WF, JW, TM, GR, CT | June 16 |
| Hiring of personnel | Job advertisement for 1 scientist and 1 technician | JW | Done |
| | Selection and contract | JW | July, 31 |
| Aquisition of instruments | Ordering of seismometers, ordering of data loggers | DFG | |
| | Ordering of other parts | DFG | |
| | Delivery of seismometers | Manufacturer | 12/17-03/18 |
| | Delivery of loggers | Manufacturer | 10/17-01/18 |
| Installation of DSEBRA | Preparation and assembly of stations, Testing | Personnel+PIs | 09/17 - |
| | Deployment of stations | Personnel+Pis | 01/18 - |

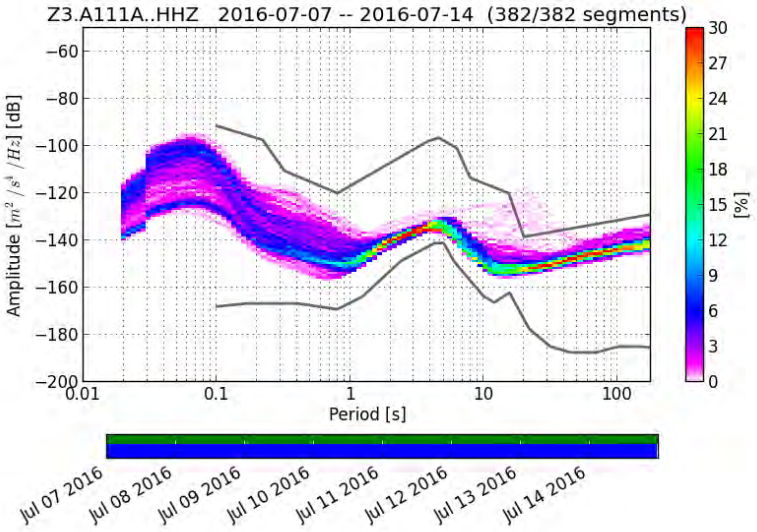
# Report – UNIBRAS & DSEBRA (W. Friederich)

## Data quality – PPSD Spectra



# Report – UNIBRAS & DSEBRA (W. Friederich)

**Funding reality**:

- Funds for personnel cut by 50% (proposal GR)
- Travel funds for maintenance cut by 50% (by accident?)
- Funds for operation (power, data transfer, Seiscomp support) cut by 50% (by accident?)
- Total loss of about 60.000 Euros!!

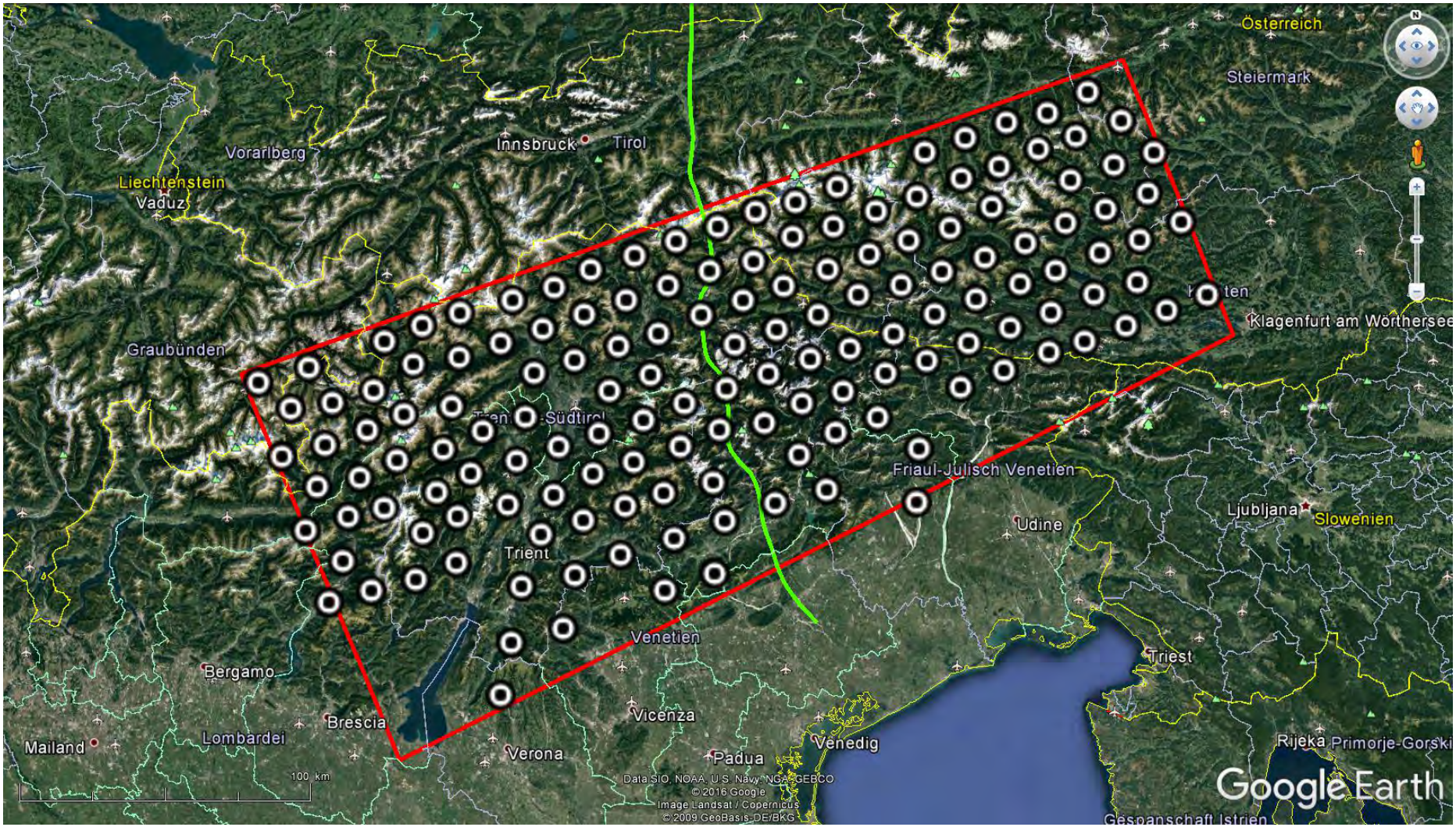
**Potential workarounds:**

- Personnel support by other DSEBRA PIs (PhD students, HiWis)
- Continuation of funding of operation by DSEBRA PIs until granted money is spent to save central operation funds.
- Reduce SeisComp support and/or shift to investments (?)
- Reduce costs for data transfer
- Stretch maintenance intervals
- Use Programmpauschale funds for operation
- De-install earlier than planned

# Report – SWATH (M. Weber)

M. Weber, Ch. Haberland, F. Tilmann, B. Heit

153 station locations
(pre-scouted, spacing c. 700 m)

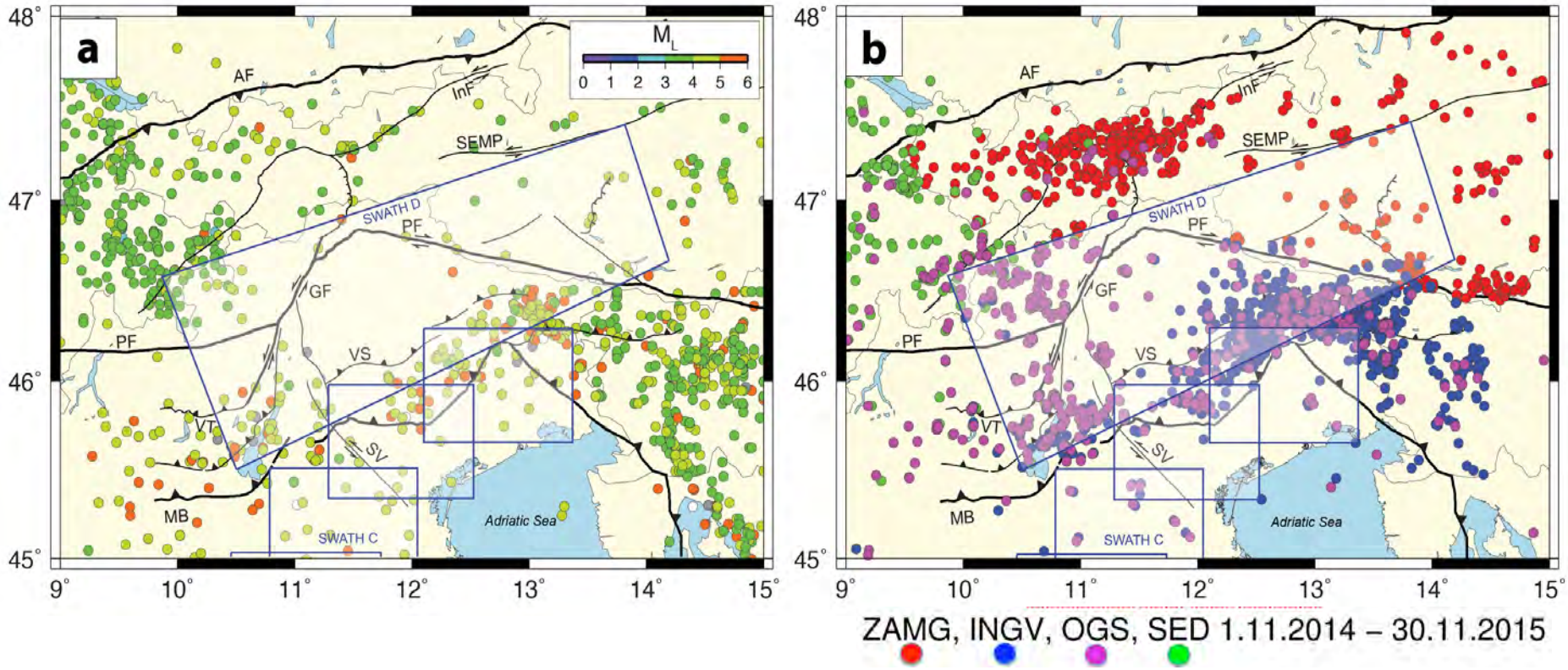


# Report – SWATH (M. Weber)

Seismicity within the Swath

SHARE catalog 1000 – 2006, $M_L > 3$

Local networks, 13 months, $M_L$ 0-4



# Report – SWATH (M. Weber)

Schedule of activities

2017

- Site assessment May/June/July
- Deployment June/July/August/September

2018

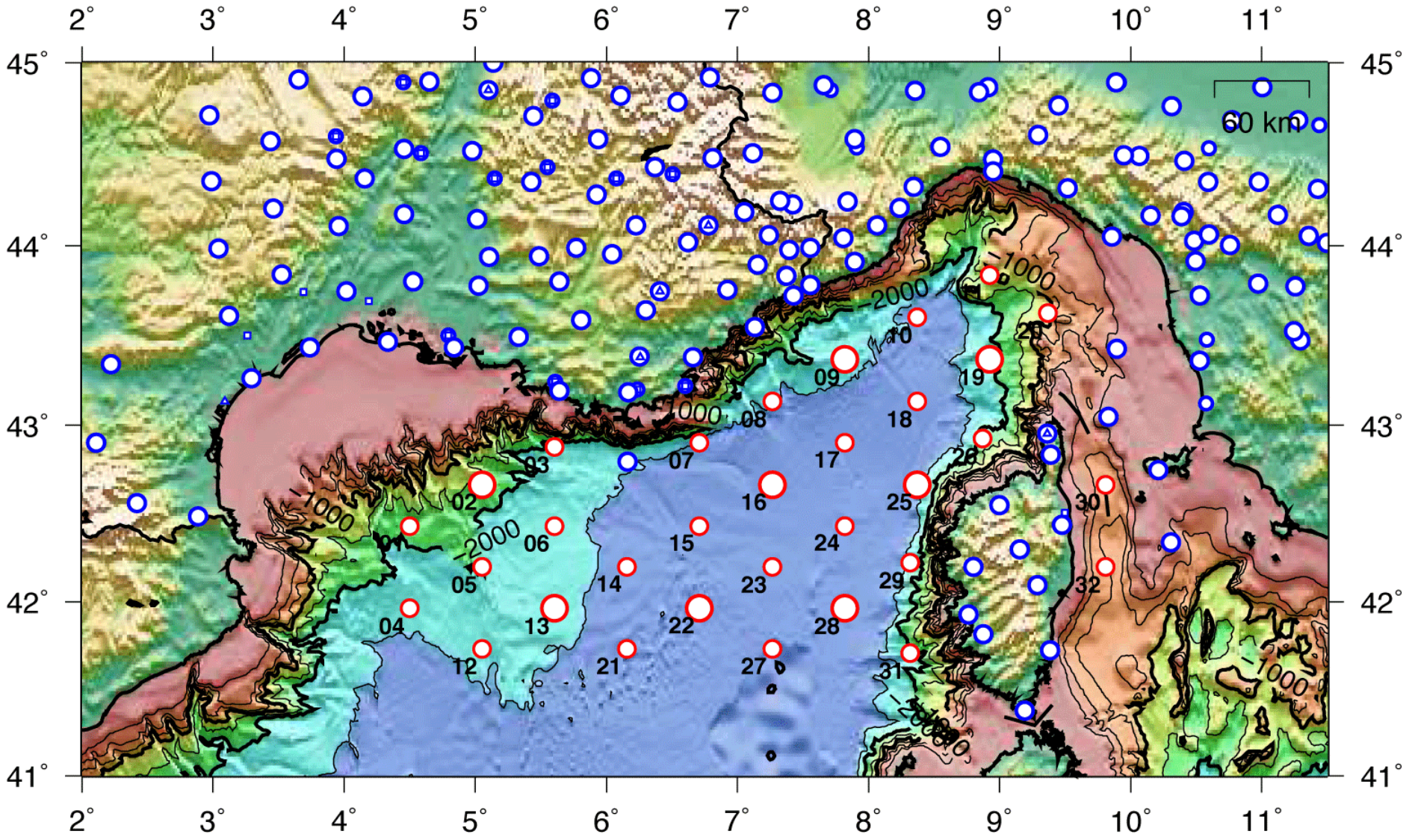
- Maintenance
- Maintenance

2019

- 1. De-installment Summer

# Report – LOBSTER (H. Kopp)

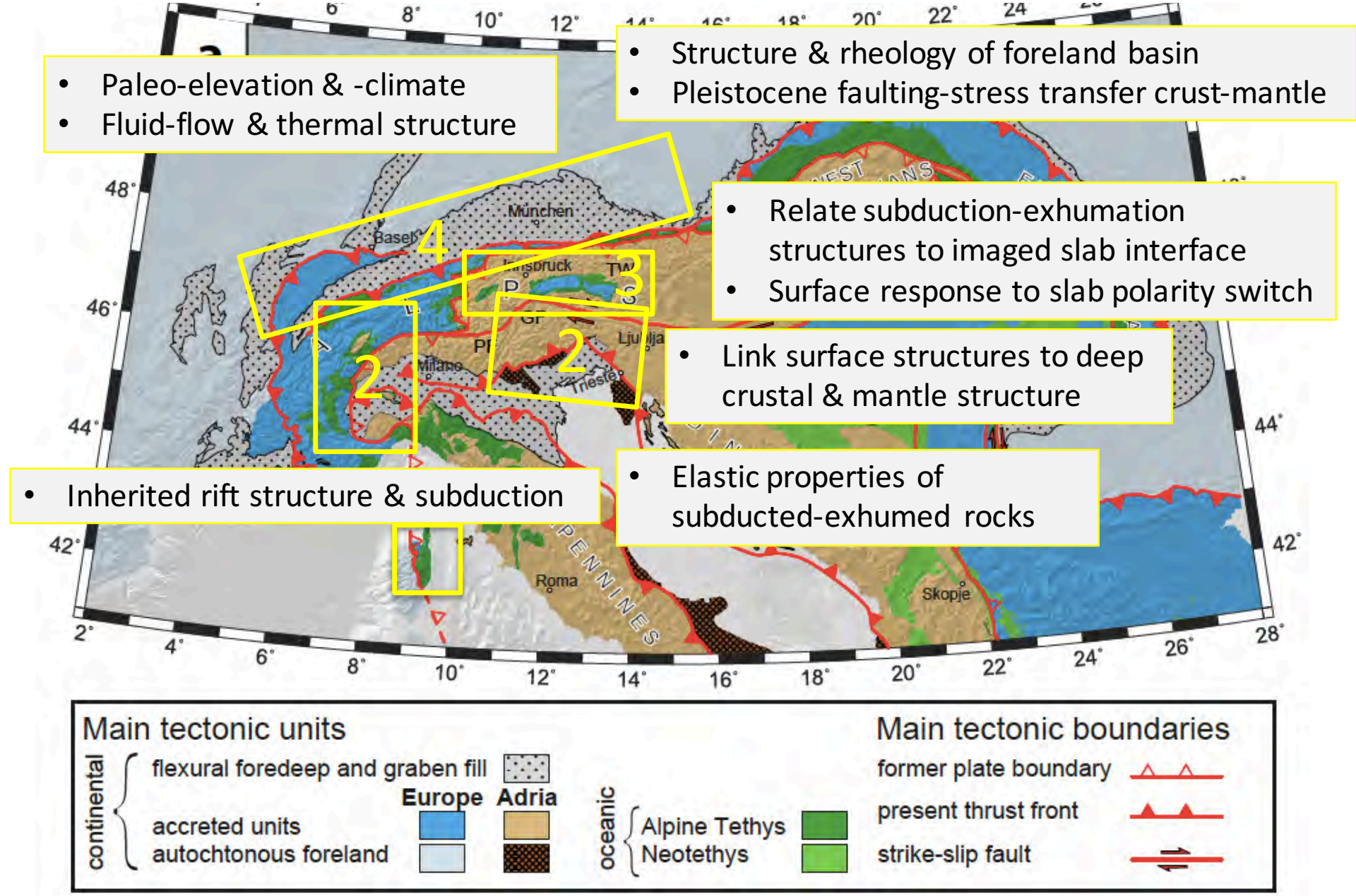
23 German & 7 French OBS stations, Deployment: 14-28.6.2017, Gathering: spring 2018



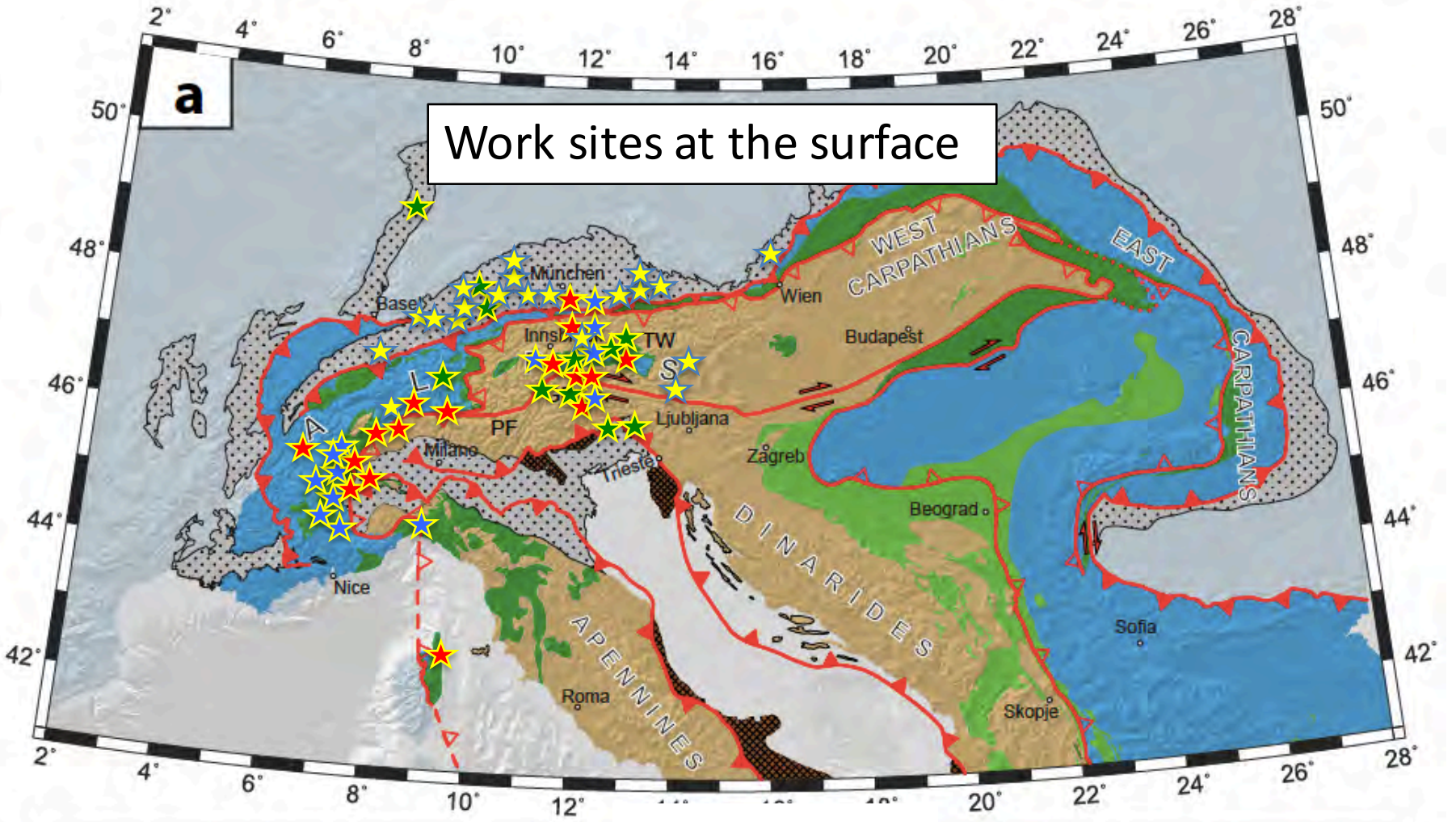

Additional - active seismics during the cruises

# Report - funded geodynamic projects (M. Handy)

## 7 geodynamic & 4 geodyn-seismology or -modelling



# Report - funded geodynamic projects (M. Handy)




Main tectonic units

continental
- flexural foredeep and graben fill
- accreted units
- autochtonous foreland

Europe Adria

- 1 - Reorg. of the lithosphere
- 2 - Surface response to deep processes
- 3 - Deform. of crust & mantle
- 4 - Motion patterns & seismicity

Research Themes

# Report – Thermomechanical Modelling (B. Kaus)

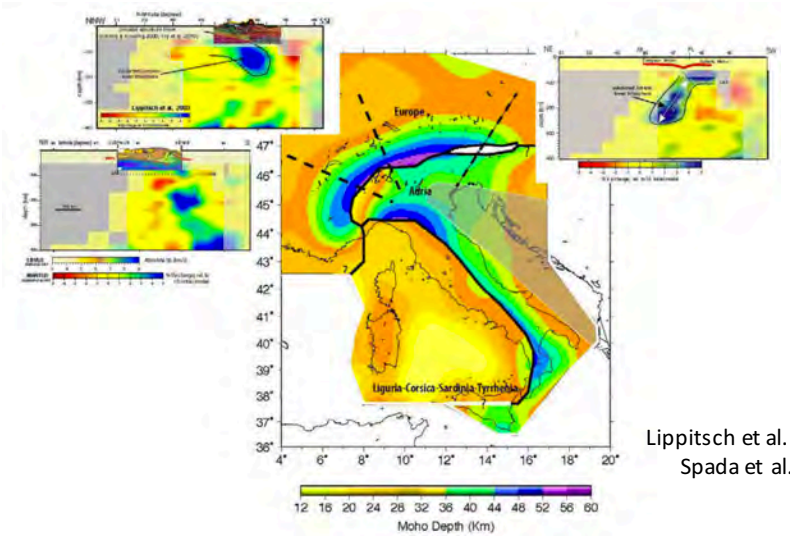
Overall goal of modelling

## Link **observations** (geological/geophysical)

## with

## Mechanics of mountain-building **processes** in **4D**

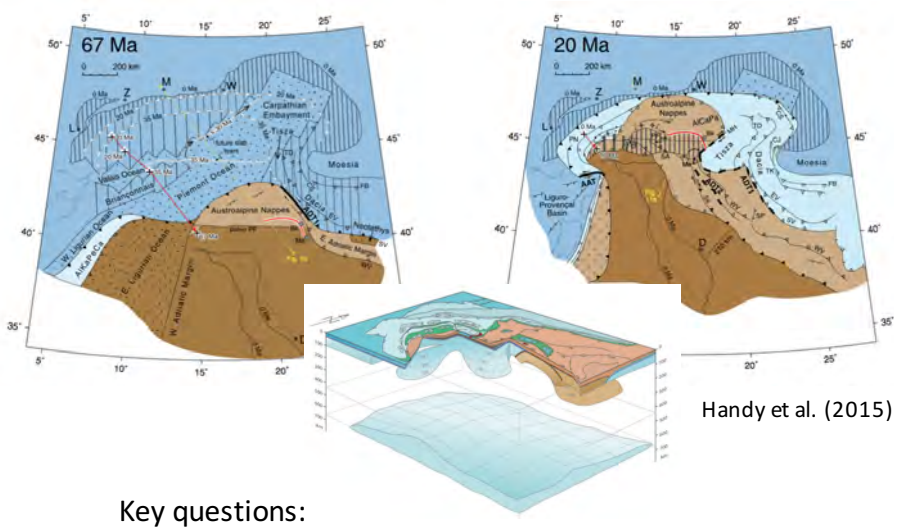
### Geophysical data




Lippitsch et al. (2003), Spada et al. (2013)

- Structure/geometry of the lithosphere?
- Rheology of the crust and lithosphere?
- Which dynamic/mechanical models are consistent with various geophysical data (GPS, gravity, seismic tomography, seismic anisotropy, EQ focal mechanisms)?

### Geodynamic data




Handy et al. (2015)

Key questions:

- How does lithospheric collision work?
- How do specific processes work (subduction polarity switch, nappe folding)
- What is the interaction between large-scale mantle flow and regional scale plate collision processes?

# Report – Thermomechanical Modelling (B. Kaus)

Funded modelling projects

## *Present-day Alps*

- Constraining the dynamics of the present-day Alps with 3D geodynamic inverse models. *Kaus/Friederich/Meier*
- INTEGRATE: Integrated 3D structural, thermal, gravity and rheological modeling of the Alps and their forelands. *Scheck-Wenderoth/Ebbing/Götze/Sippel*

## *4D Evolution*

- Mantle deformation beneath the Alps and the physics of the subduction polarity switch - Constraints from thermomechanical modelling, seismic anisotropy and waveform modelling. *Rümpker/Schmeling*
- IFMMALPO: Inverse and forward multiscale numerical modeling of the Alpine orogeny. *Petrunin.*

# Report – Thermomechanical Modelling (B. Kaus)

Funded projects with a modelling component

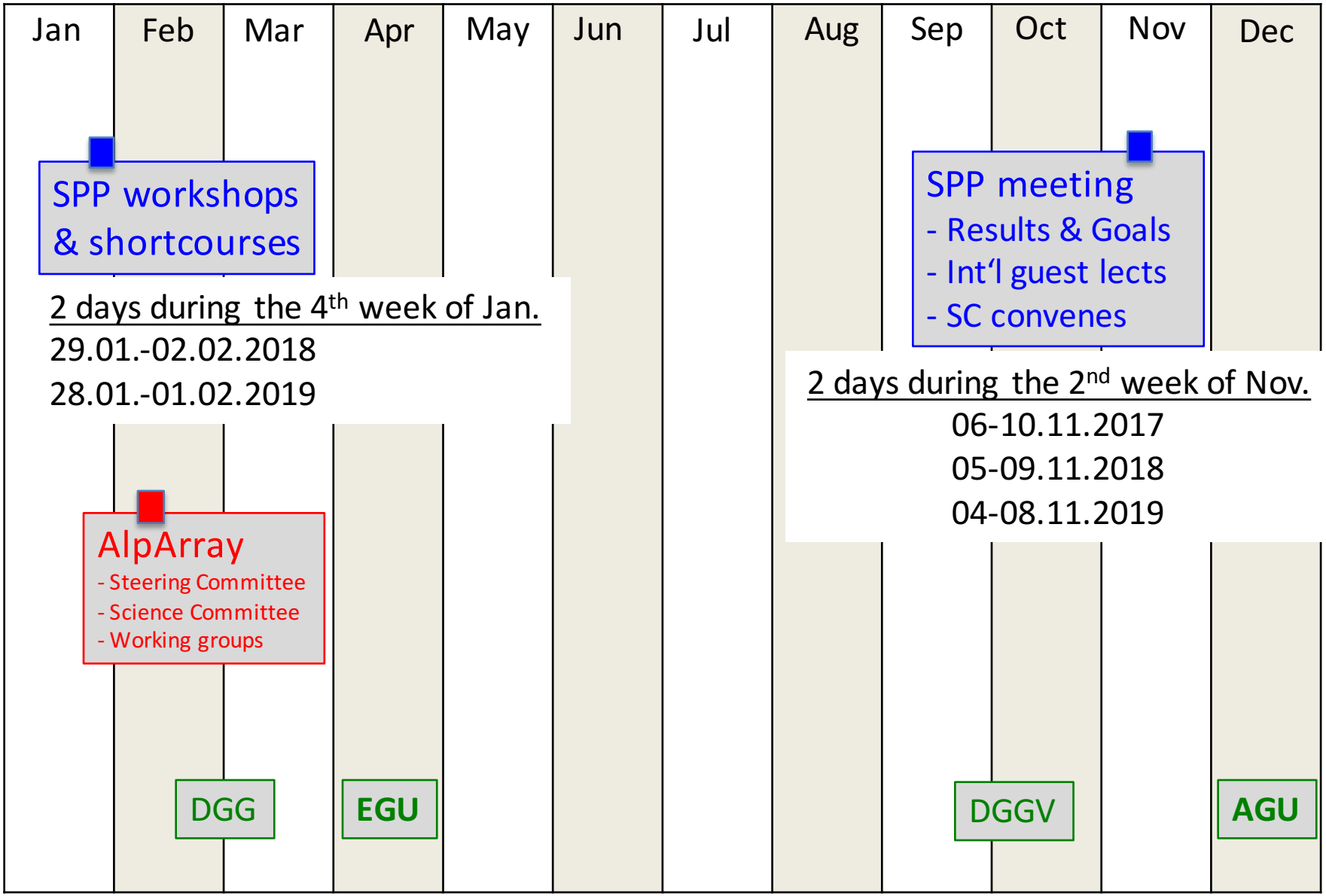
## *Present-day Alps*

- Imaging structure and geometry of Alpine slabs by full waveform inversion of teleseismic body waves (comparison with 3D geodynamic models). *Friederich/Meier/Kaus*
- Surface Wavefield Tomography of the Alpine Region to Constrain Slab Geometries, Lithospheric Deformation and Asthenospheric Flow in the Alpine Region (comparison with 3D geodynamic models). *Meier/Friederich/Ebbing*

## *4D Evolution*

- Constraining the near-surface response to lithospheric reorientation - Structural thermochronology along AlpArray geophysical transects (thermokinematic cooling-age modelling). *Glotzbach/Kley*
- Neogene paleoelevation and paleoclimate of the Central Alps – Linking Earth surface processes to lithospheric dynamics (thermokinematic cooling age modelling). *Mulch/Ehlers/Methner-Mutz.*
- Understanding subduction by linking surface exposures of subducted and exhumed crust to geophysical images of slabs (geodynamic models of folding in the subduction channel ). *Pleuger/John/Tilmann/Handy/Kaus/Yuan/Mechie*

# SPP – proposed annual schedule



# SPP - Data management (Kirsten Elger, GFZ)

Some thoughts for the SPP

Requirement: DFG requires SPP to make metadata from project available during or after publication of papers

Challenge: no SPP data manager was funded

What we seek:

- To collect data and make it available to SPP members
- To render the collected data citeable in publications
- To make published data accessible to broader geoscience community after publication

# SPP - Data management (Kirsten Elger, GFZ)

Some thoughts for the SPP

## Data possible to be collected:

- Seismological - waveforms stored in GEOFON which provides standardised, archived DOIs for seismic networks
- Geological - structural measurements, thermochronological data, geomorphological data, etc.

## Data products:

- Seismological data products => e.g., tomographic slices
- Geological data products => data plotted on 3-4 standardized maps of the Alps, possibly also cross sections, data tables

# SPP - Data management (Kirsten Elger, GFZ)

Some thoughts for the SPP

- Tools like the GFZ Metadata Editor (ME) can facilitate metadata generation and distribution (for Discovery)
- Metadata standards, machine executable, interoperable
- ME can easily be adapted to include additional metadata fields relevant for SPP / AlpArray (example: EPOS)
- We can build the database for a SPP / AlpArray Discovery Portal, provided that researchers submit metadata for their data
- ME can be used to register DOIs
- Data publication via data repositories guarantees the availability of data beyond the SPP funding period

Conclusion: SPP Steering Committe will find 4 colleagues from different disciplines to develop a concept for data management along the lines presented above by the next SPP meeting in November 2017

# Advertisement of SPP positions

Suggestion: One overall advertisement (example: SPP-Earthworks) that lists all PhD project names and universities (one line per project, each with a link to the full advertisement on the corresponding webpage of the project group). Advertisement sent to *Earthworks* and *EOS*.

Advantages:

- High visibility of 4D-MB in the community
- High attractivity for PhDs and Postdocs
- Does not qualify as an official advertisement under German law

Disadvantages:

- If notification appears before the official advertisment is published, the website must tell the prospective applicant when applications can be accepted.

# AlpArray Working Groups

http://www.alparray.ethz.ch/home/

- Surface Waves => 1st meeting in Bologna, 17/18.11.2016
- Gravity
- Local Earthquake Tomography
- Earthquake catalogue

=> Further groups can/should be founded!

# AlpArray Collaborative Projects

http://www.alparray.ethz.ch/home/

Topics

- Structure, fabric and flow of lithosphere-mantle system beneath the Alpine region
- Geodynamics of Alpine Orogeny
- Seismicity, Seismotectonics and Seismic Hazard
- New Methods and Opportunities in Seismic Imaging

Regional Themes:

- Western Alpine arc and Northern Apennines: resolving slab interaction
- Eastern Alps, Dinarides and Bohemian Massif
- Alpine forelands - establishing structure, composition and deformation history

=> Need SPP members to take the initiative on these projects!

See you all at the SPP meeting in November!

# Extra slides


Helmholtz-Zentrum Potsdam - Deutsches GeoForschungsZentrum GFZ
Alfred-Wegener-Institut für Polar- und Meeresforschung (AWI)
Potsdam-Institut für Klimafolgenforschung (PIK)
Leibniz-Institut für Astrophysik Potsdam (AIP)
Deutscher Wetterdienst (DWD)
Nutzergemeinschaft des Wissenschaftsparks
Wissenschaftspark Albert Einstein
Telegrafenberg Potsdam
Weg zum Haus H
Waldhaus
Paläomagnetisches Labor
A58
A56
Klimareferenz-station (DWD)
"Wetterküche"
A64
A63
A62
Süring-Haus
A61
Dienerhaus
Haus B
Haus C
Haus D
Haus E
Haus F
Haus G
Haus H
A53
A51
S3
Optischer Telegraf (Nachbau)
A32
Freundlichweg
A26
A28
Einsteinturm
A22
Großer Refraktor
A27
Schülerlabor GeoLab
Vogelweg
A23
K20
A31
Michelson-Haus
A33
Gäste-wohnungen
Hörsaal Kantine
Adolf-Schmidt-Weg
Schwarzschildweg
Sport-platz
A20
A19
A13
A11
A10
A9
A8
A7
Helmert-Turm
A5
A6
A3
Café Freundlich
A34
Helmertweg
A35
Wirtschafts-hof
A36
A37
A38
A39
A54
A40
A41
A43
A69
A70
C4
A17
LIS (Bibliothek)
Helmert-Haus
A18
A16
A15
A14
A45
AWI - Neubau
A2
K2
A1
Eingang
Albert-Einstein-Straße
0
50
100 m
N

# Summary of Funded Projects - 1

**Friederich, Korn, Meier, Rümpker, Tilmann, Thomas, Wassermann**
Goals: Determine elastic properties of deep Alpine lithosphere
Challenge:
Methods: application of FWI to teleseismic body waves (P & S)
Targets: all
Personel: 2 PhDs
Theme(s): 1 (3)
Activity field(s): A, F

**Friederich, Meier, Kaus**
Goals: Obtain data for high resolution images of Alpine crust and mantle
Challenge: DSEBRA - Deploy and operate land-based BB seismometers
Methods: Deployment & operation of BB seismometers
Targets: northern and eastern parts of Alps
Personel: 2 Postdocs
Theme(s): relevant for all
Activity field(s): A

# Summary of Funded Projects - 2

**Froitzheim & Keppler**
Goals: Relate inherited rift and spreading structure of Alpine margins to current slab geometry
Challenge: Reconstruct kinematics and timing of opening of ocean basins
Methods: structural geology, U-Pb and Lu-Hf dating
Targets: W Alps (Versoyen, Monte Rosa, Cogne, Canvese, Dora Maira)
Personel: 1 PhD
Theme(s): 3 (1)
Activity field(s): E (B)

**Glotzbach & Kley**
Goals: Surface response to slab breakoff and polarity switch
Challenge:
Methods: AHe, ZrHe; cross-section balancing
Targets: Sampling; Subalpine Molasse, S of SEMP along EASI transect; Balancing (NFP20E, TRANSALP, EASI)
Personel: 1 PhD
Theme(s): 2, 3
Activity field(s): F

**Gruetzer, Reicherter, von Blankenburg**
Goals: Surface response to Pliocene faulting
Challenge: Determine age and kinematics of active faults at surface, connect these with deep crustal images (swath C)
Methods: tectonophysical map of the Alps,
Targets: entire Alps
Personel: 1 Postdoc (own position), 1 PhD
Theme(s): 4, 3
Activity field(s): E (C, D)

# Summary of Funded Projects - 3

**Handy, Le Breton, Haberland**
Goals: Link faults at surface with deep crustal
Challenge: Trace active faults from surface to depth, reconstruct Giudiacrie Belt back in time
Methods: cross section construction and balancing, processing and interpretation of seismological data (swaths D, C)
Targets: transition C and E Alps
Personel: 2 PhDs
Theme(s): 1, 3
Activity field(s): D, E (C)

**Kaus, Friederich, Meier**
Goals: Understand which crust/mantle, thermal states and rheologies are consistent with geophysical properties of the Alps
Challenge: Compare model results with geophysical data
Methods: geodynamic inverse modelling
Targets: Alpine upper mantle
Personel: 1 PhD
Theme(s): 1
Activity field(s): F

**Keppler, Stipp, Froitzhiem**
Goals: Determine elastic wave anisotropies of subducted rocks
Challenge: Provide a data base for interpretation of seismic images
Methods: measure CPO (Neutron Diffraction); measure Vp, Vs of samples at hi P
Targets: W & C Alps (Dora Maira, Gran Paradiso, Monte Rosa, Monviso, etc.)
Personel: 1 PhD
Theme(s): 1
Activity field(s): E

# Summary of Funded Projects - 4

**Kind**
Goals: 3D-seismic imaging of sub-lithospheric discontinuities
Challenge: Distinguish mantle discontinuities in vicinity of slabs
Methods: application of S-receiver function technique
Targets: Alpine mantle between Moho and 410 km discontinuitiy
Personel: none
Theme(s): 1
Activity field(s): A

**Kopp, Lange, Grevemeyer**
Goals: Obtain data for high resolution images of Alpine crust and mantle
Challenge: LOBSTER - Deploy and operate land-based BB seismometers
Methods: Deploy and operate land-based BB seismometers
Targets: Ligurian Sea
Personel: 1 Postdoc
Theme(s): relevant for all
Activity field(s): B

**Kummerow, Cesca, Wassermann, Plenefisch**
Goals: Quantify stress and deformation in the E Alps
Challenge: Analyse link between shallow crust and deep mantle structures, map active faults, map stress field
Methods: Apply novel moment tensor inversion technique to microseismicity
Targets: Eastern Alps lithosphere
Personel: 2 PhDs
Theme(s): 3
Activity field(s): D

# Summary of Funded Projects - 5

**Lange, Thorwart, Grevemeyer**
Goals: Resolve structure of Ligurian Sea with new OBS data and adjacent land stations
Challenge: Detection nad location of local seismiicity
Methods: Ambient noise cross correlation techniques, Rayleigh wave analysis
Targets: Ligurian lithosphere, slab geometry at transition Alps-Dinarides
Personel: 1 PhD
Theme(s): 1
Activity field(s): B

**Luijendijk & von Hagke**
Goals: Quantify crustal fluid flow and its role in the thermal structure of the Alps
Challenge: Determine contribution of fluid flow to thermal regime of Alpine crust
Methods: compile thermal data, numerical modelling of coupled, density-driven fluid flow and heat flow
Targets: Thermal springs in the Molasse Basin near end of Jura chain (their Fig. 2)
Personel: none
Theme(s): 4 (2)
Activity field(s): E

**Meier, Friederich, Ebbing**
Goals: Surface-wave tomography of the Alpine region
Challenge: Constrain slab geometry, lithospheric deformation and asthenospheric flow
Methods: analysis of surface waves (R & L), seismic anisotropy
Targets: all
Personel: 1 Postdoc, 1 PhD
Theme(s): 1
Activity field(s): A

# Summary of Funded Projects - 6

**Mulch, Ehler, Metner, Mutz**
Goals: Neogene Paleoelevation and Paleoclimate of Central Alps
Challenge: Establish long-term elevation history of Central Alps (location, timing of elevation changes) and relate this to changes in slab dynamics
Methods: stable isotope altimetry, clumped isotope studies, paleoclimate modelling of 7 time slices (Present back to Pliocene, 2 Middle Miocene from lit)
Targets: Swiss Molasse Basin, high Alps (Simplon Fault)
Personel: 2 PhDs
Theme(s): 2
Activity field(s): E

**Petrunin**
Goals: Cenozoic evolution of the Alps
Challenge: Not mentioned
Methods: Inverse and forward multiscale modelling
Targets: Alps
Personel: 1 Postdoc (own position)
Theme(s): 1
Activity field(s): F

**Pleuger, John, Tilmann, Handy, Kaus, Yuan, Mechie**
Goals: Linking images of subducted continental crust with geophysical slab images
Challenge: Develop 4D view of subduction and exhumation by comparing fossil subduction zones with current slab images
Methods: multiscale structural & kinematic analysis of subducted & exhumed crust, petrophysical measurements of CPO (Vp, Vs) and receiver function analysis, synthetic seismograms, forward numerical modelling
Targets: E Alps slab, hI-P rocks & structures (Tauern, Adula, Dora Maira, Tenda)
Personel: 3 PhDs
Theme(s): 1, 3
Activity field(s): D, E, F

# Summary of Funded Projects - 7

**Reicherter & Ritter**
Goals: Understand stress transfer & Quaternary faulting in Alpine foreland
Challenge: Correlating seismicity with shallow crustal faulting, fault reactivation and stress state
Methods: paleostress analysis, 3D imaging of crust with receiver functions
Targets: Molasse Basin (Albstadt, German Molasse), Upper Rhine Graben
Personel: 1 PhD
Theme(s): 4
Activity field(s): A, E

**Rümpker & Schmeling**
Goals: Understand mantle deformation beneath the Alps and the physics of subduction polarity switch
Challenge: 4D modelling of surface response to subduction-polarity switch
Methods: thermomechanical modelling, seismic anisotropy and waveform modelling
Targets: Alps-Apennines & Alps- Dinarides transitions
Personel: 2 PhDs
Theme(s): 1
Activity fields: A, F

**Scheck-Wenderoth, Ebbing, Sippel, Götze**
Goals: 3D model of structure, thermal state and rheology of the Eastern Alps and their northern and southern foreland basins along TRANSALP
Challenge: Combine geothermal, seismological, gravity data to make an internally consistent model
Methods: 3D gravity and thermal modelling
Targets: Eastern Alps and Molasse & Veneto basins along TRANSALP
Personel: 1 Postdoc, 1 PhD
Theme(s): 3
Activity fields: E, F

# Summary of Funded Projects - 8

**van Hagke, Luijendijk, Hindle, Kley**
Goals: Link foreland basin evolution to deep crustal processes
Challenge: Mantle processes manifested differently in different parts of Molasse (W – slab breakoff, E – polarity reversal)
Methods: AFT, AHe, thermal modelling, balanced cross sections
Targets: 3 transects across Molasse (W of Moho gap to N of Tauern W, across Molasse between Zürich and Salzburg)
Personel: 1 PhD
Theme(s): 2, 3
Activity field(s): E

**Weber, Tilmann, Haberland**
Goals: Depict 3D geometry of lithosphere and upper mantle across slab gap, along E Alps slab and along Moho „hole“, provide better database for seismic hazard assessment
Challenge: Obtain sufficient high-resolution data to improve constraint on geometery of structures above
Methods: Deployment of closely spaced BB seismometers
Targets: Swath D
Personel: 1 Postdoc
Theme(s): relevant for all
Activity field(s): D