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The mantle flow below the Alps from isolated mantle anisotropy based on differential Ps – XKS Splitting

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Seismic anisotropy – a proxy for mantle deformation and flow

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Motivation for our study:

- Observation of mantle flow below the alps using XKS-splitting measurements
- ➢ Complex pattern due to collision?

Difficulties:

- Determination of depth of the anisotropic origin
- Influence of crustal anisotropy

Main goals:

- Separation of the crustal influence by analysing Ps-phases using Receiver Functions
- Measuring and interpreting XKS-measurements using the known crustal contribution

Combining XKS- and Ps-Splitting analysis – A sequential approach

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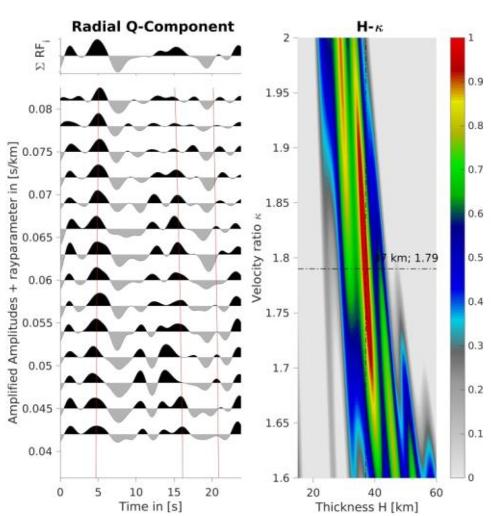
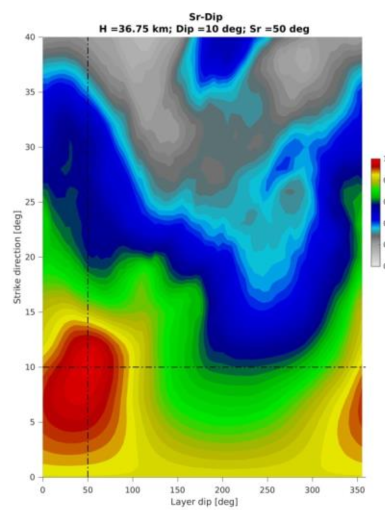
The crustal anisotropy from Ps-splitting

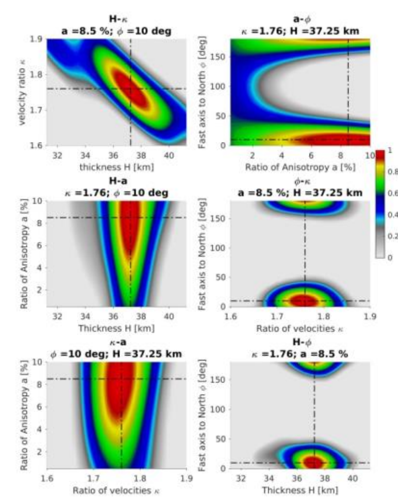
Isotropic analysis



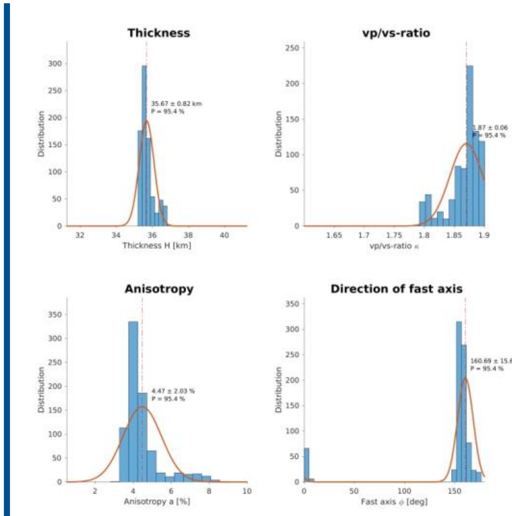
Search for layer dip



Anisotropic analysis



Bootstrapping statistics



Crustal anisotropy isolated

- Considering layer dip of the Moho-discontinuity

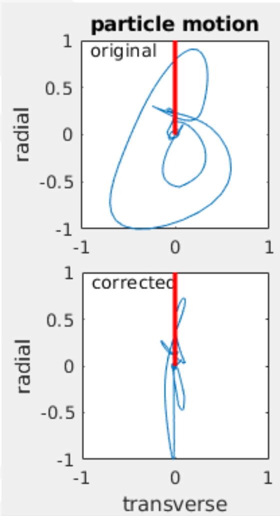
➢ Considerable strength (4% ≈ 0.5 seconds splitting time)

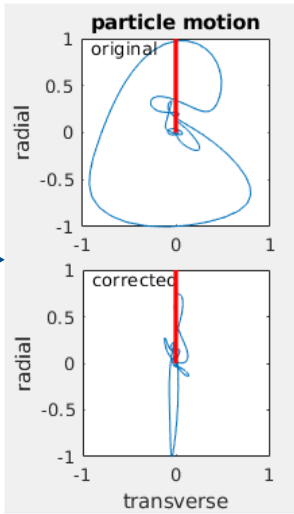
Combining XKS- and Ps-Splitting analysis – A sequential approach

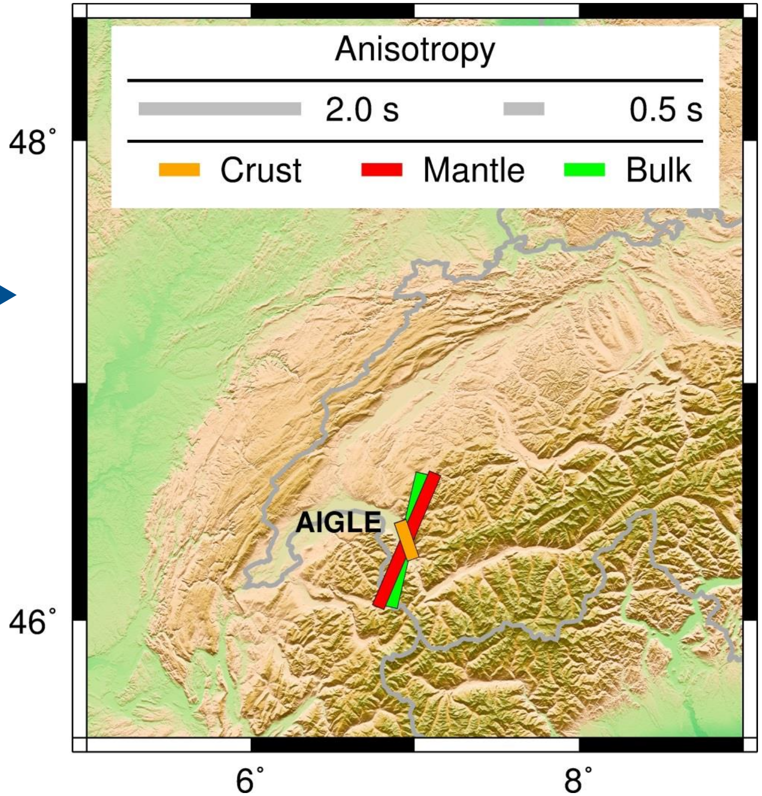
Mantle anisotropy from corrected XKS-waveforms

1. XKS-splitting performed with automated SplitRacer

2. Correction of the XKS-waveform using the known crustal layer (inverse splitting)







3. New XKS-splitting for corrected waveform

➢ Resulting splitting from the anisotropy in the mantle

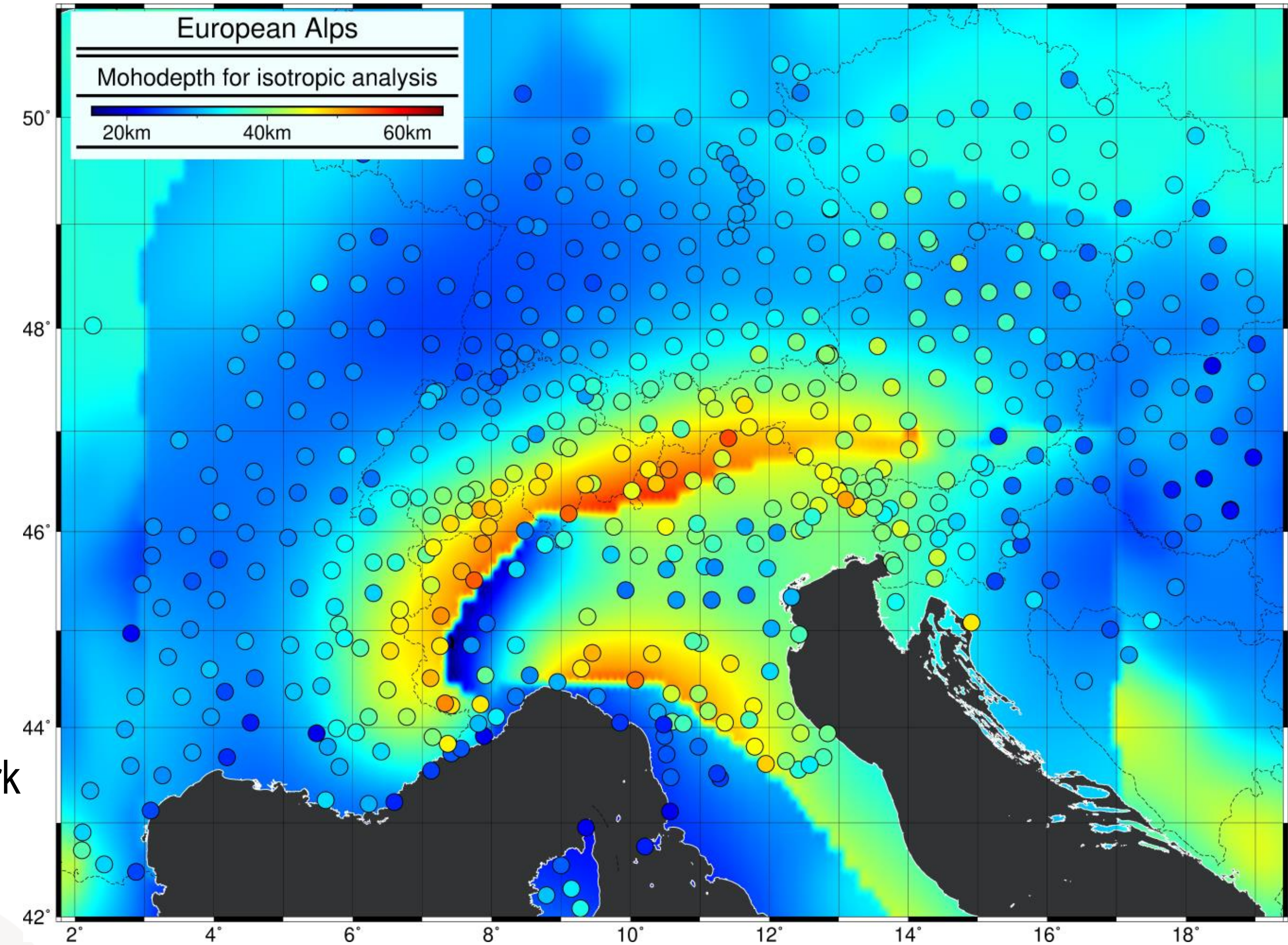
Application on the AlpArray network – Preliminary results

Moho depth from isotropic analysis

- Similar patterns for crustal thickness as former studies
  (Spada et al. 2013;
  Tesauro et al. 2008)

- deviations at
  – Po-basin
  – the transition of the Eastern Alps to the Carpathians and the Bohemian Massif

➢ High resolution due to dense AlpArray-network



Application on the AlpArray network – Preliminary results

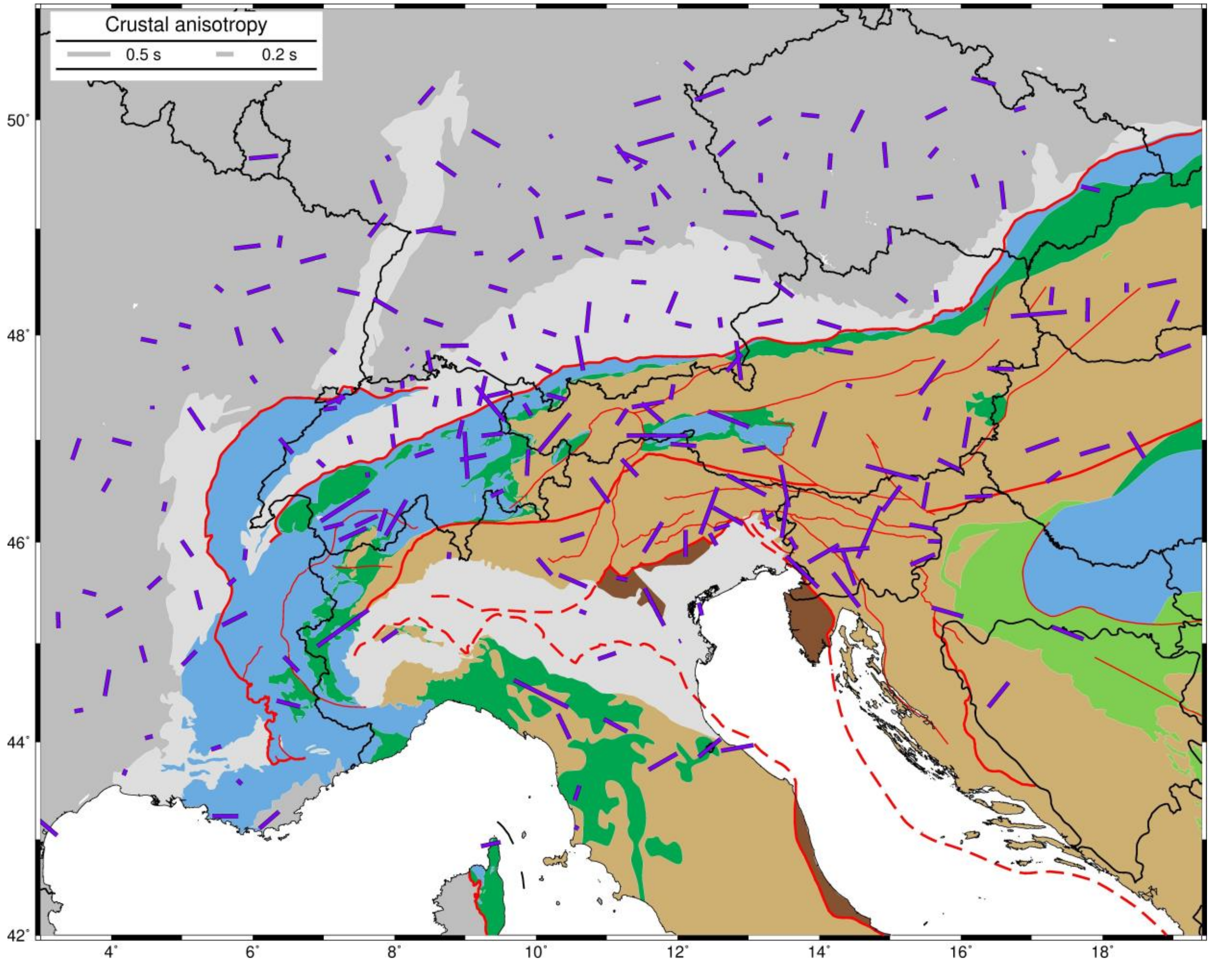
Crustal anisotropy

- Symmetry axis varies strongly even in short distances
- Mostly below 0.2 s
- Increasing splitting time up to 0.7 s to collision zones

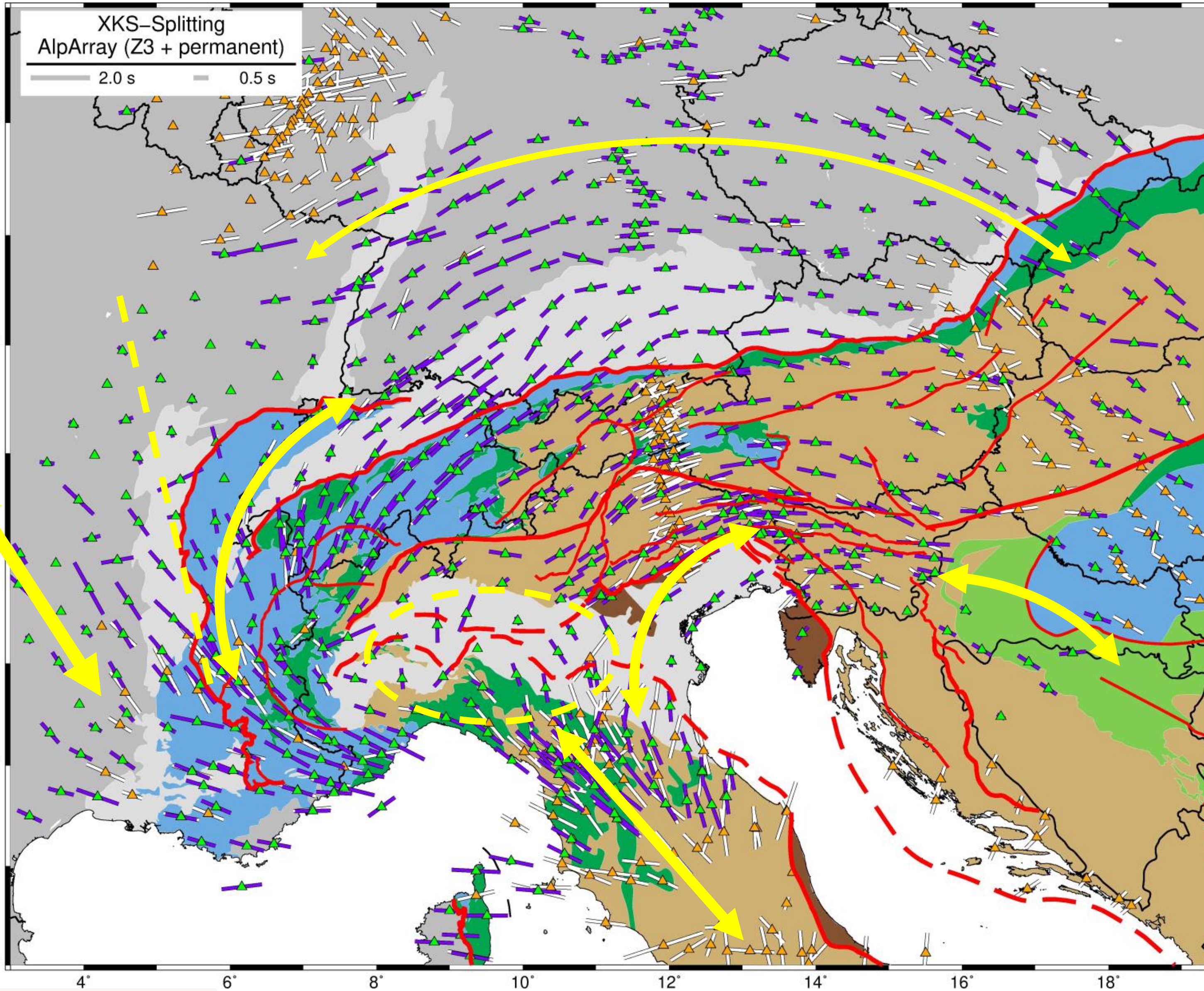
➢ Originated by isolated crystalline blocks?

➢ **Minor impact on XKS-splitting**

Generalized tectonic map of the Alps (Handy, Bousquet, Schmid, Ustaszewski) simplified from maps of Schmid et al. 2004, 2008



Application on the AlpArray network – Preliminary results (Joint analysis)



Generalized tectonic map of the Alps (Handy, Bousquet, Schmid, Ustaszewski) simplified from maps of Schmid et al. 2004, 2008

Application on the SWATH-D network – Preliminary results

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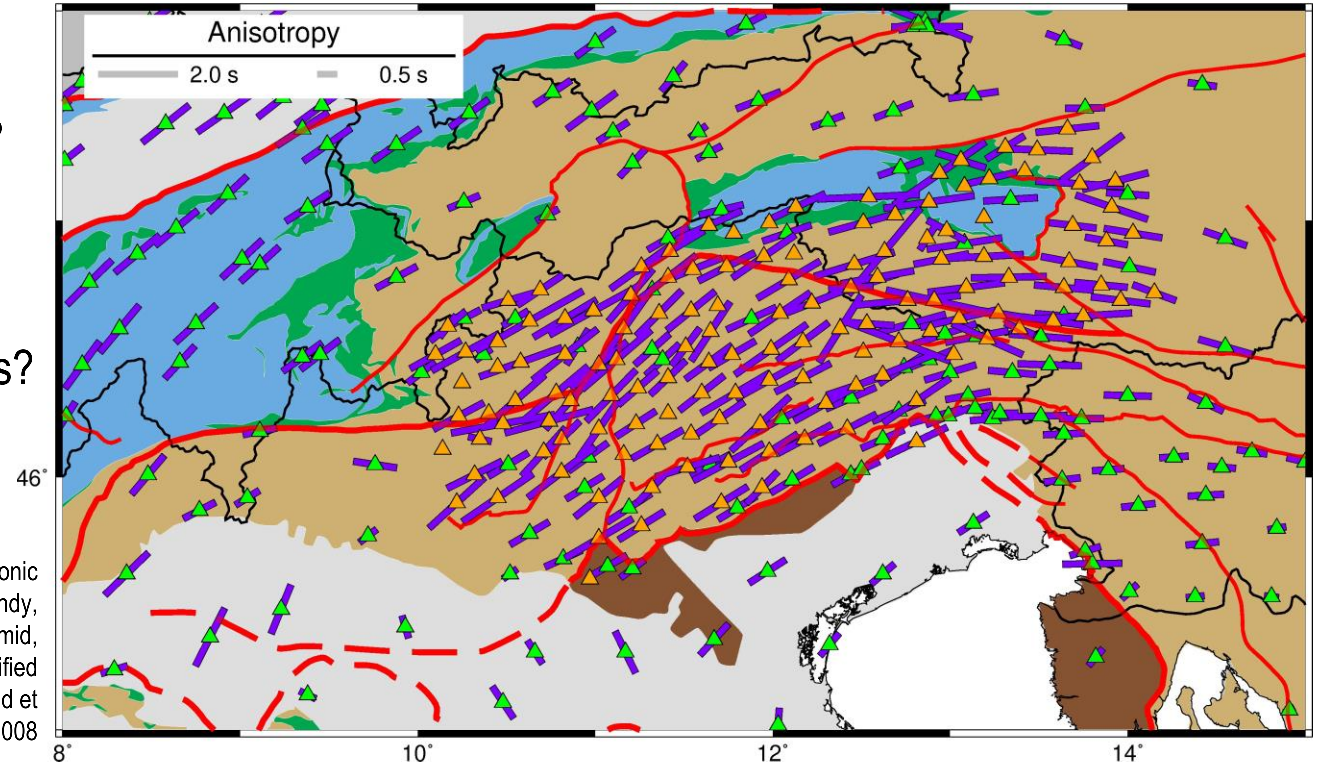
SWATH-D Joint Splitting

Objective:

- Signatures for subduction polarity switch in Anisotropy?

➢ Laterally small scale anomalous jump of fast axis polarizations?



Generalized tectonic map of the Alps (Handy, Bousquet, Schmid, Ustaszewski) simplified from maps of Schmid et al. 2004, 2008

Conclusion and outlook

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Receiver functions:

- Stable isolation of crustal anisotropy
- Maximum delay time 0.7 s (mostly below 0.2 s)
- ➢ Only minor effects on XKS-splitting
- Strong variation in short distances
- ➢ Local cristalline blocks with oriented intrinsic anisotropy

XKS-splitting

- Following plate boundaries
- Complex pattern below Po-Basin
- ➢ Mantle flow strongly affected by subducting slabs
- Evidence for a slab gap in transition to the dinarides

Further Tasks

- Update of receiver function data and XKS-Splitting
- Analyze complexities in the XKS-measurements

ALP ARRAY
MB 4D Mountain Building Processes in 4D
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