Signatures of the Subduction/Obduction Processes in the Lithosphere and Asthenosphere beneath the Semail Ophiolites in Oman Revealed by Seismic Anisotropy

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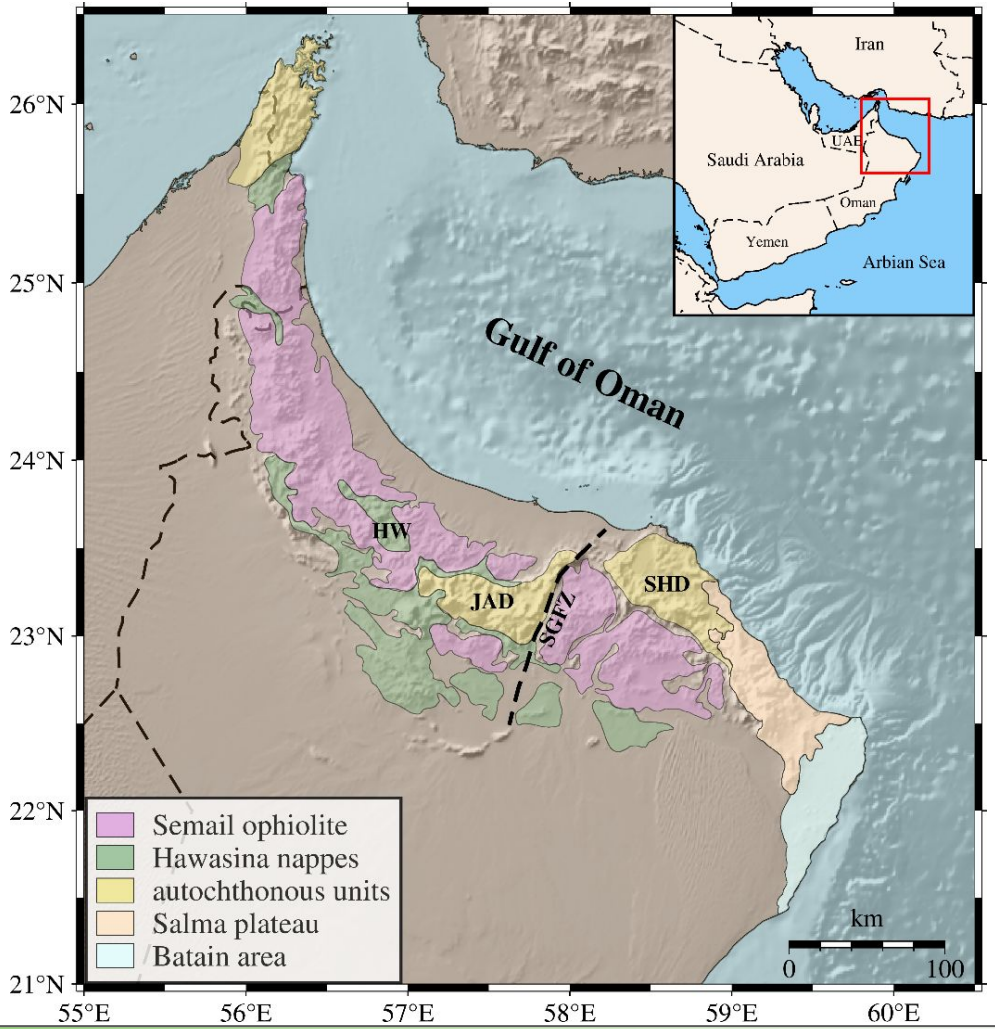
Study area & Motivation

- Typical example of the **subduction-obduction** tectonic regime
- **Semail ophiolites** and Oman mountains
- Contribution of the **inherited structures** to the obduction of ophiolites.
- More insights by performing **seismic anisotropy**

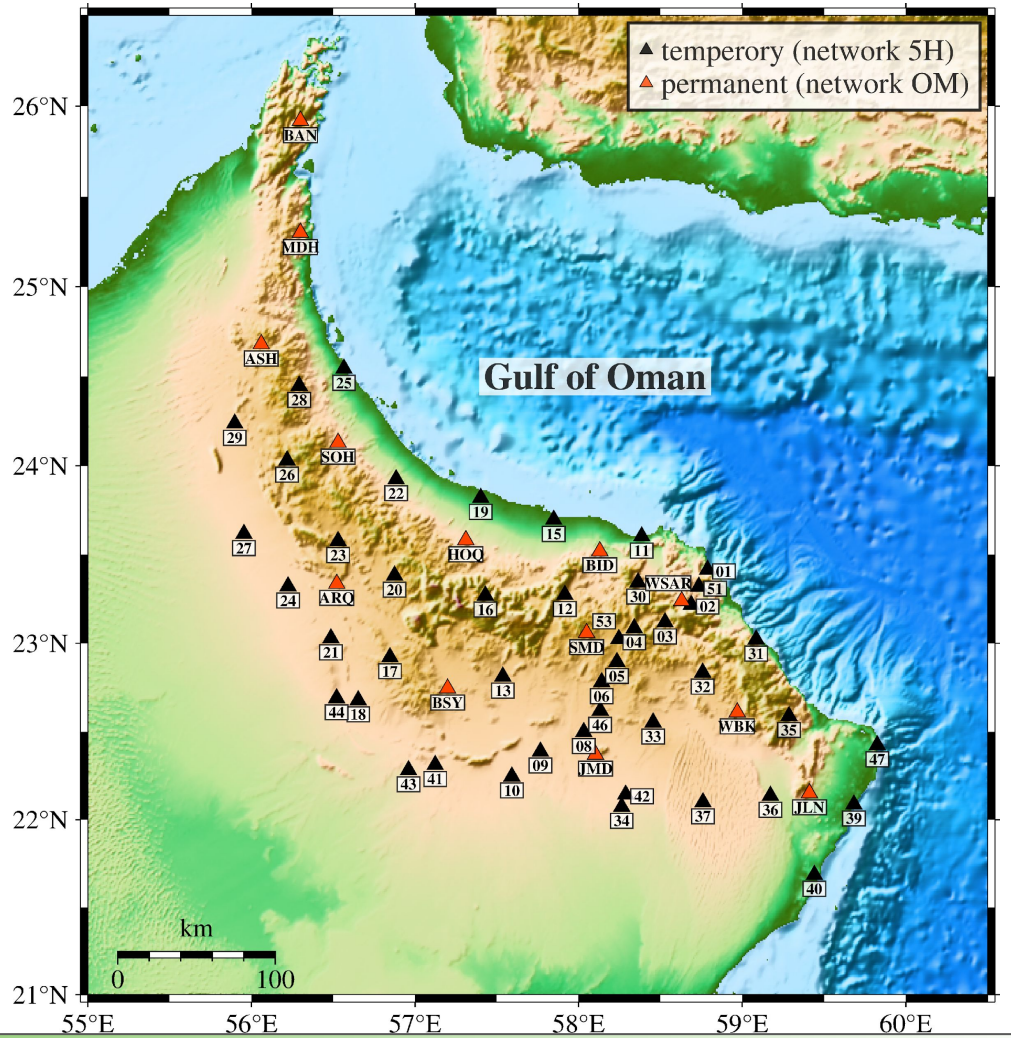


Data

- **13** stations, **Permanent** OM network (2014-2016)
- **45** stations, 5H **temporary** deployment [COOL project, Weidle et al., 2013] (2013-2016)

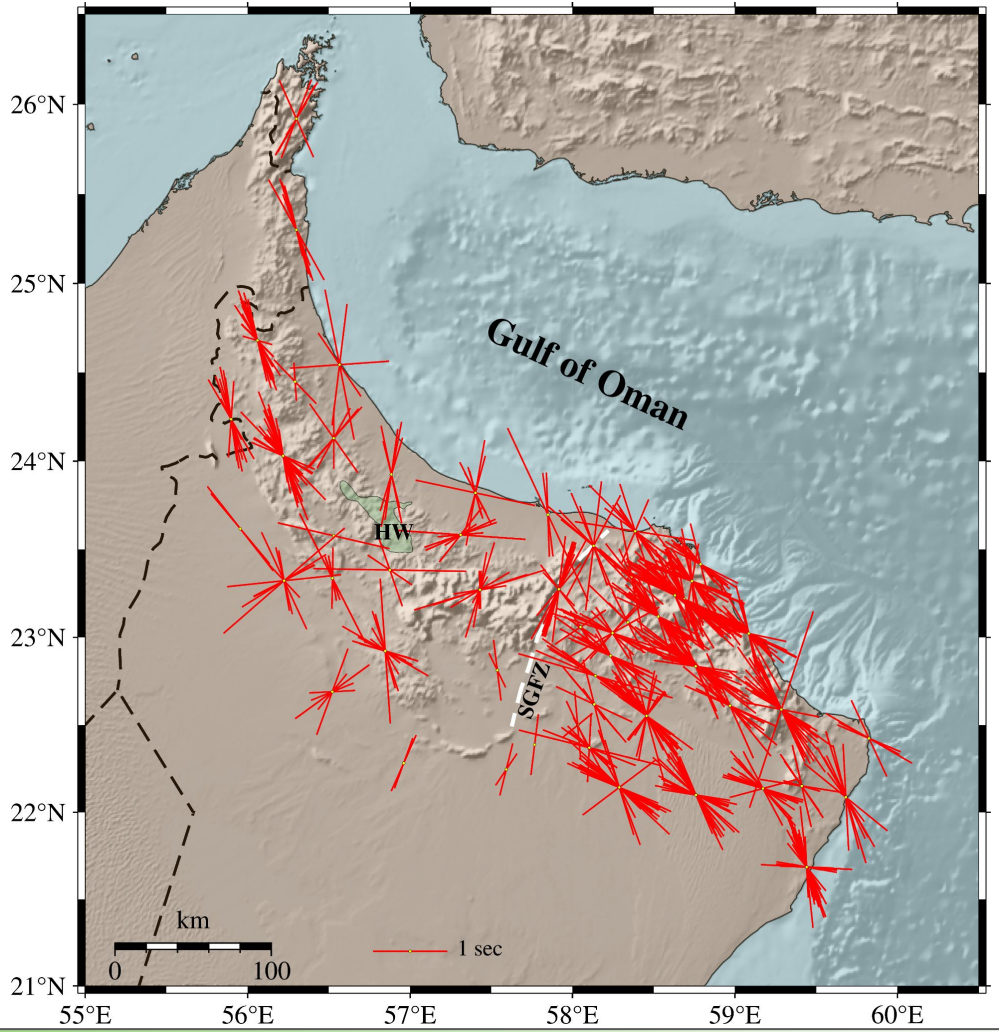
Methods

- Shear wave splitting joint inversion
- Software used: SplitRacer (Reiss and Rümpker, 2017)
- Ps-splitting (Rümpker et al., 2014)

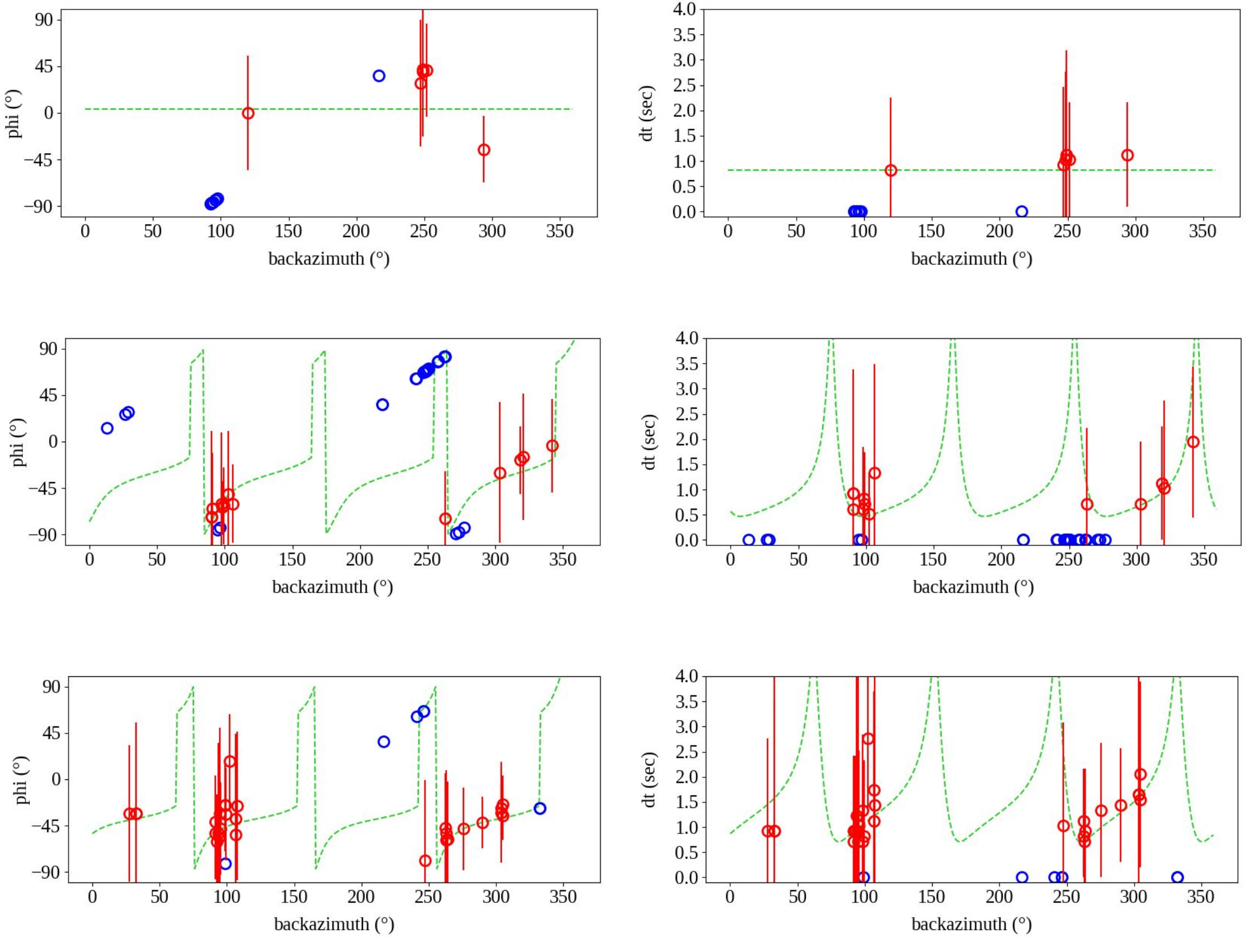


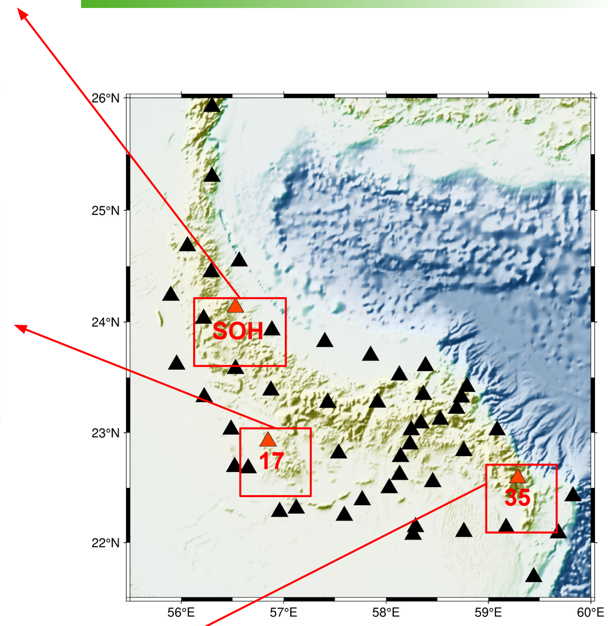
Single shear wave splitting measurements

- First indication of complexity of the anisotropic structure beneath some stations.
- More single measurements and variations in fast axes at eastern parts.
- For some stations only a few reliable measurements.



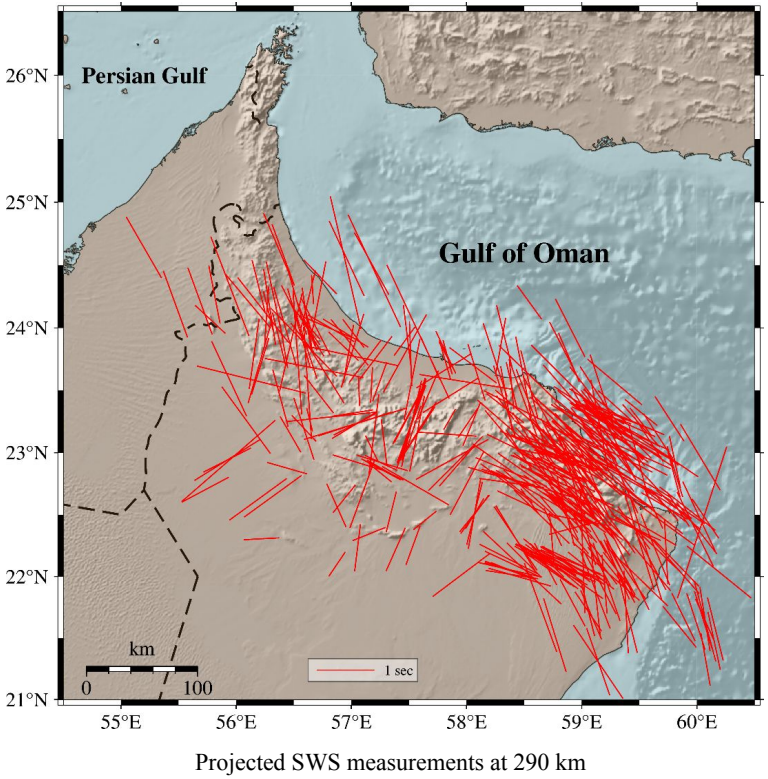
Back azimuthal variations



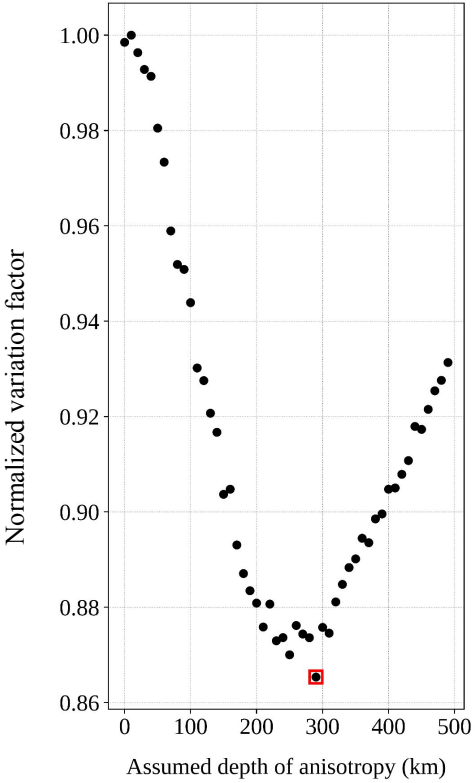


Depth projection of the individual splitting measurements

- **Spatial coherency** approach (Liu and Gao, 2011)
- **Projection** of the individual splitting measurements to the **ray piercing points** at different depths
- Determining the **depth** with a **maximum** level of **spatial coherency** by assumption of **one anisotropic layer**

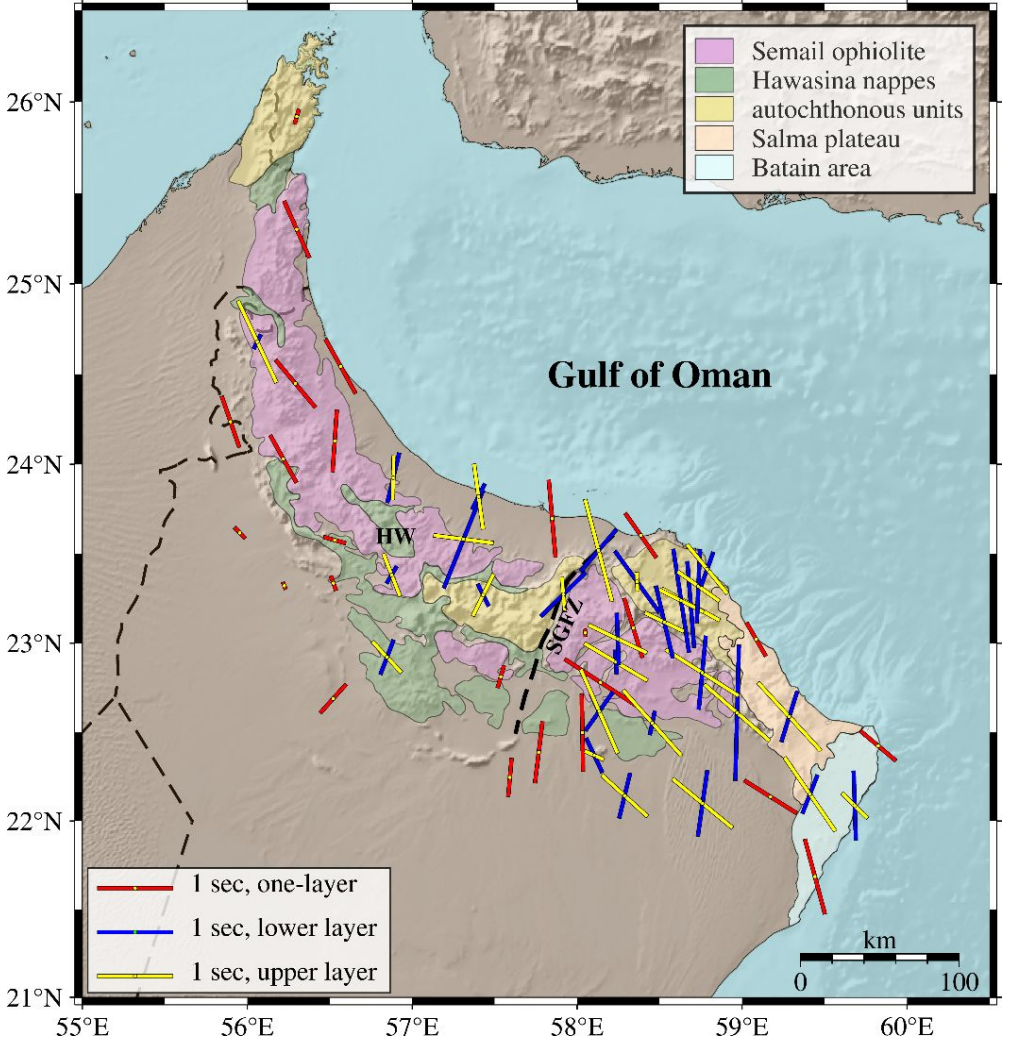


Projected SWS measurements at 290 km

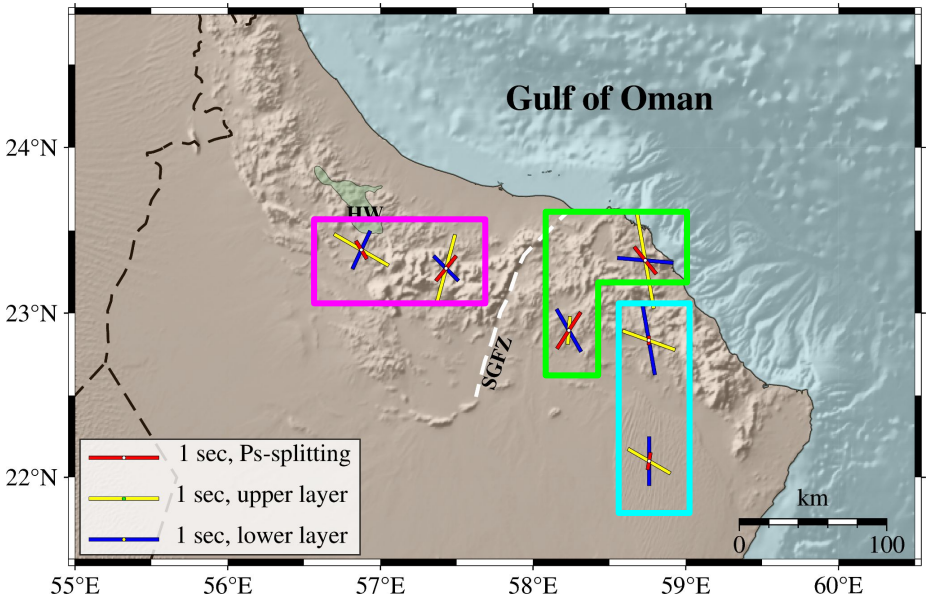


Joint splitting analysis for 1 and 2 layers

- Clear **distinction** between the **western** and **central/eastern parts** of the study region
- **Central part** shows relatively **weak anisotropy**
- **Two perpendicular anisotropic layers** at **SW part** of the study area?

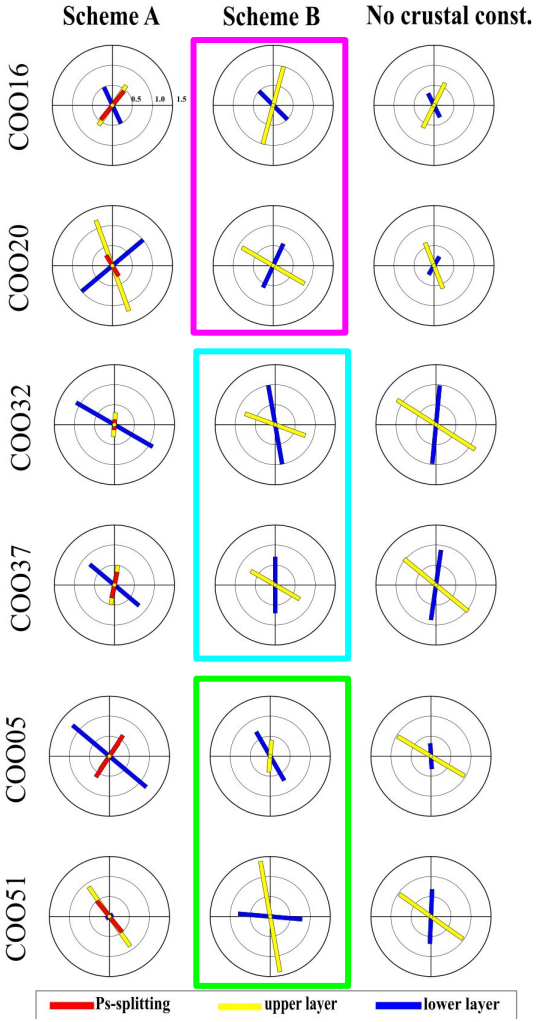


Crustal constraints from Ps-splitting



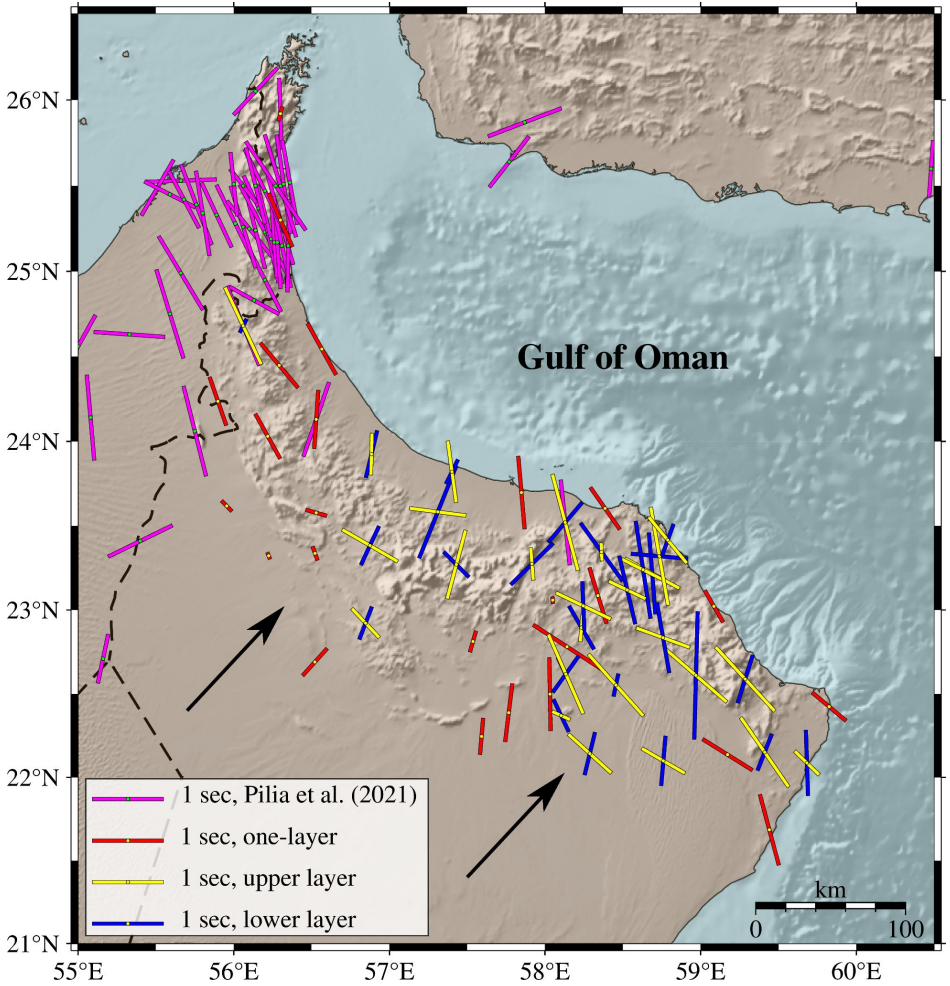
Scheme A: fixed upper layer fast axis

Scheme B: corrected XKS waveforms for the crustal layer

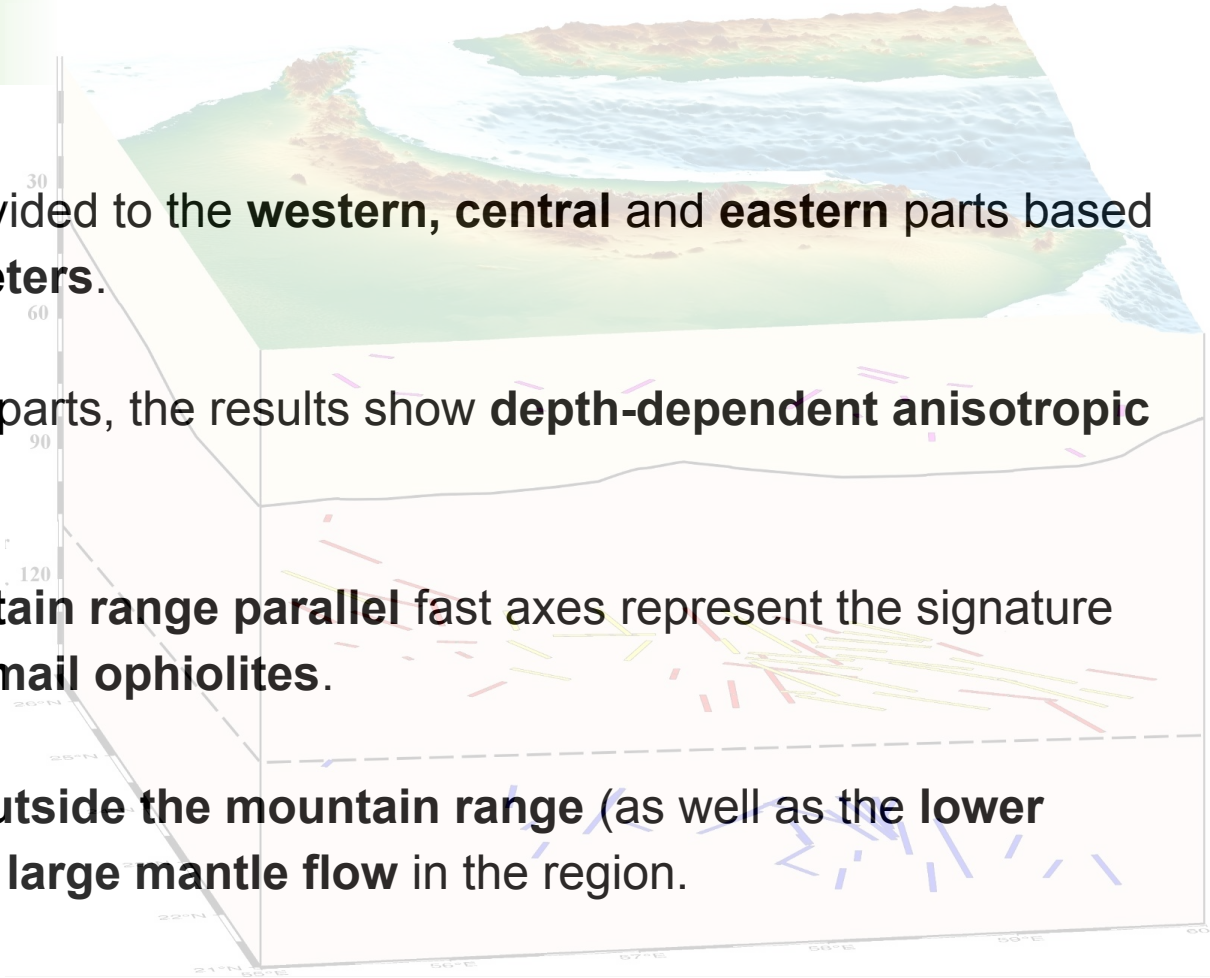


Comparison to the previous study and interpretation

- **Orogen-parallel** fast axes (mainly red and yellow bars) indicate the **ophiolite emplacement**
- **NNE-SSW** fast axes (mainly blue bars) represent **regional mantle flow/APM**



Conclusions



- The study area is subdivided to the **western, central** and **eastern** parts based on the **splitting parameters**.
- At **central** and **eastern** parts, the results show **depth-dependent anisotropic fabrics**.
- **Upper layer** and **mountain range parallel** fast axes represent the signature of **obduction of the semail ophiolites**.
- Fast axes orientation **Outside the mountain range** (as well as the **lower layer**) is consistent with **large mantle flow** in the region.

Thanks for your attention

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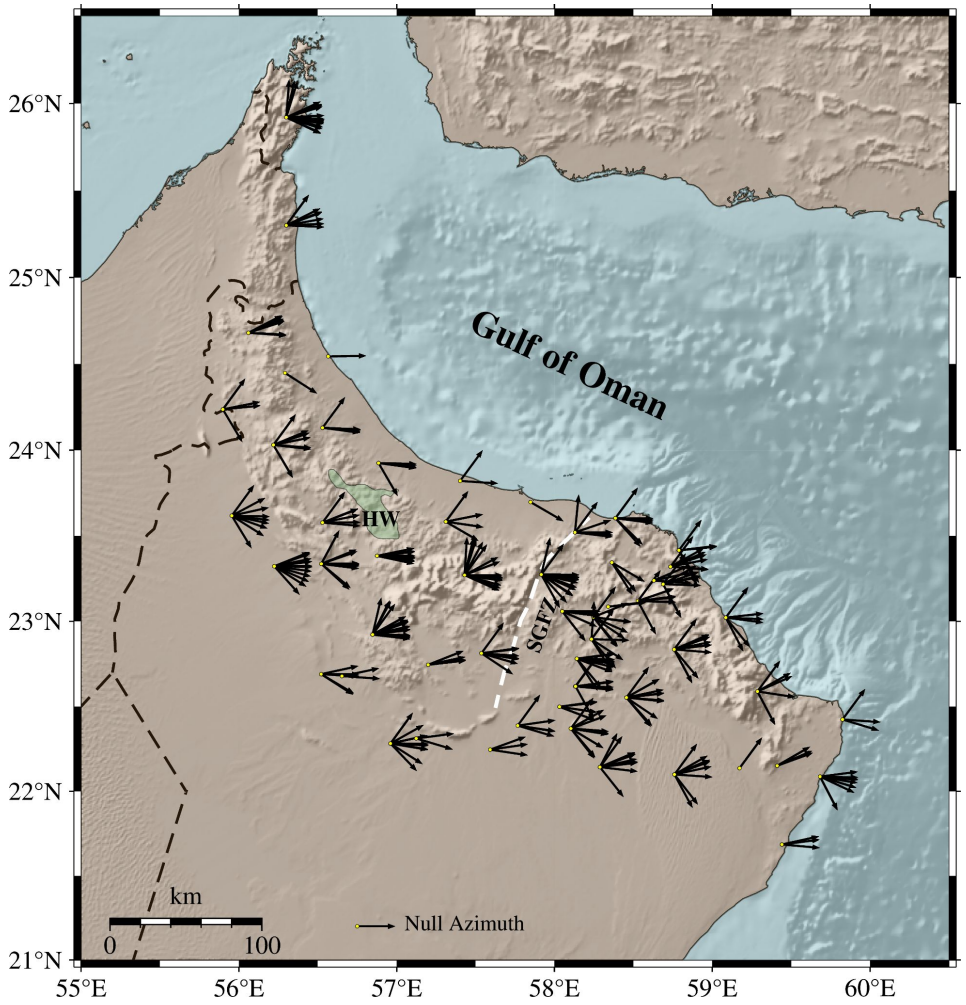
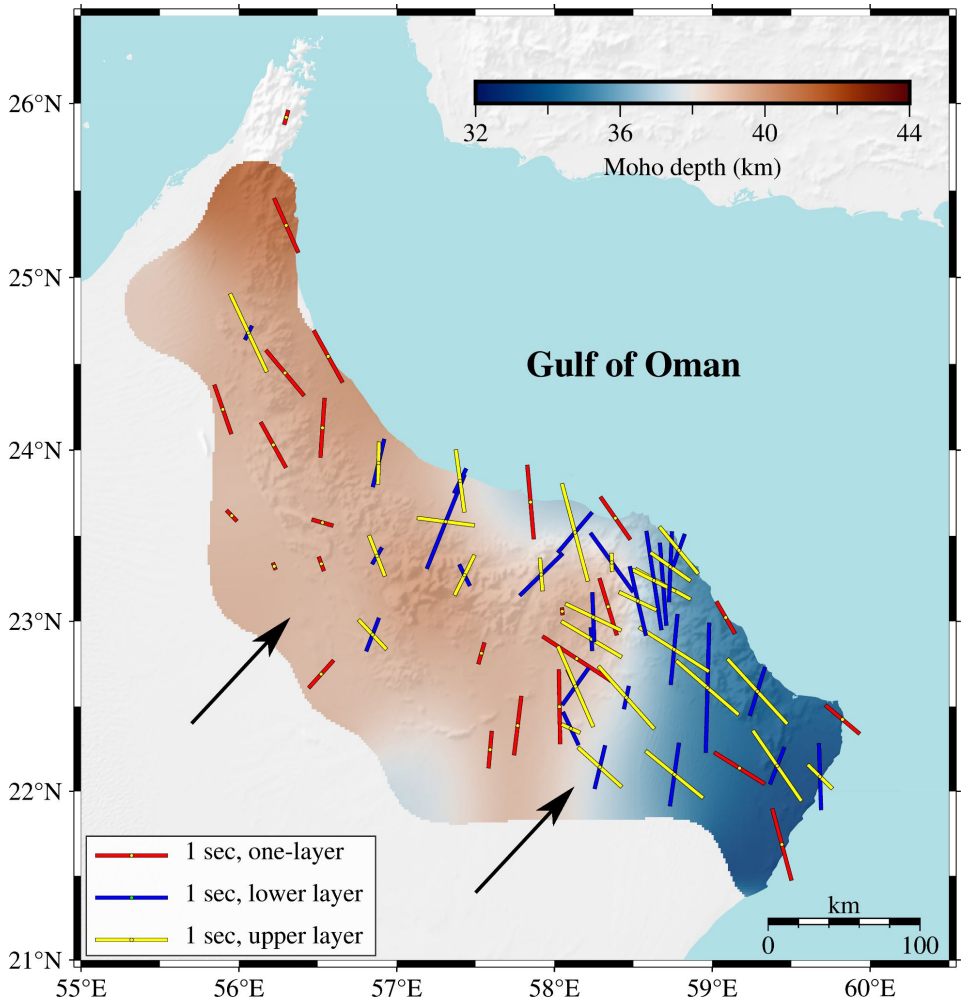
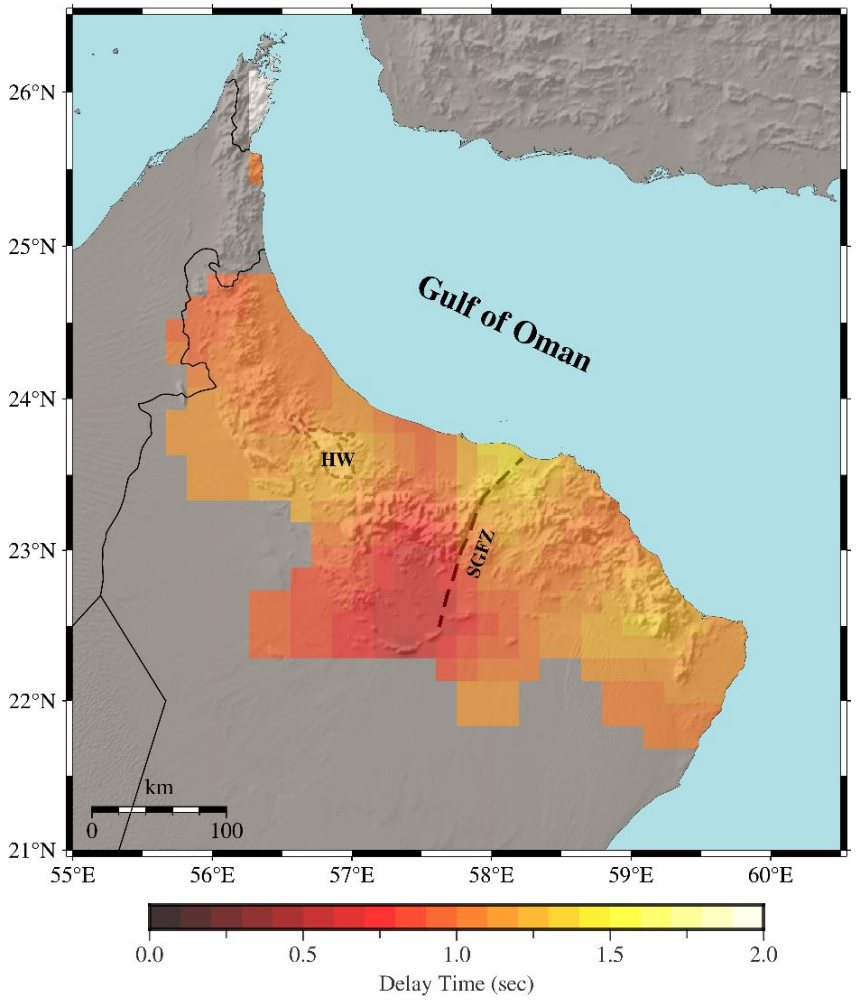
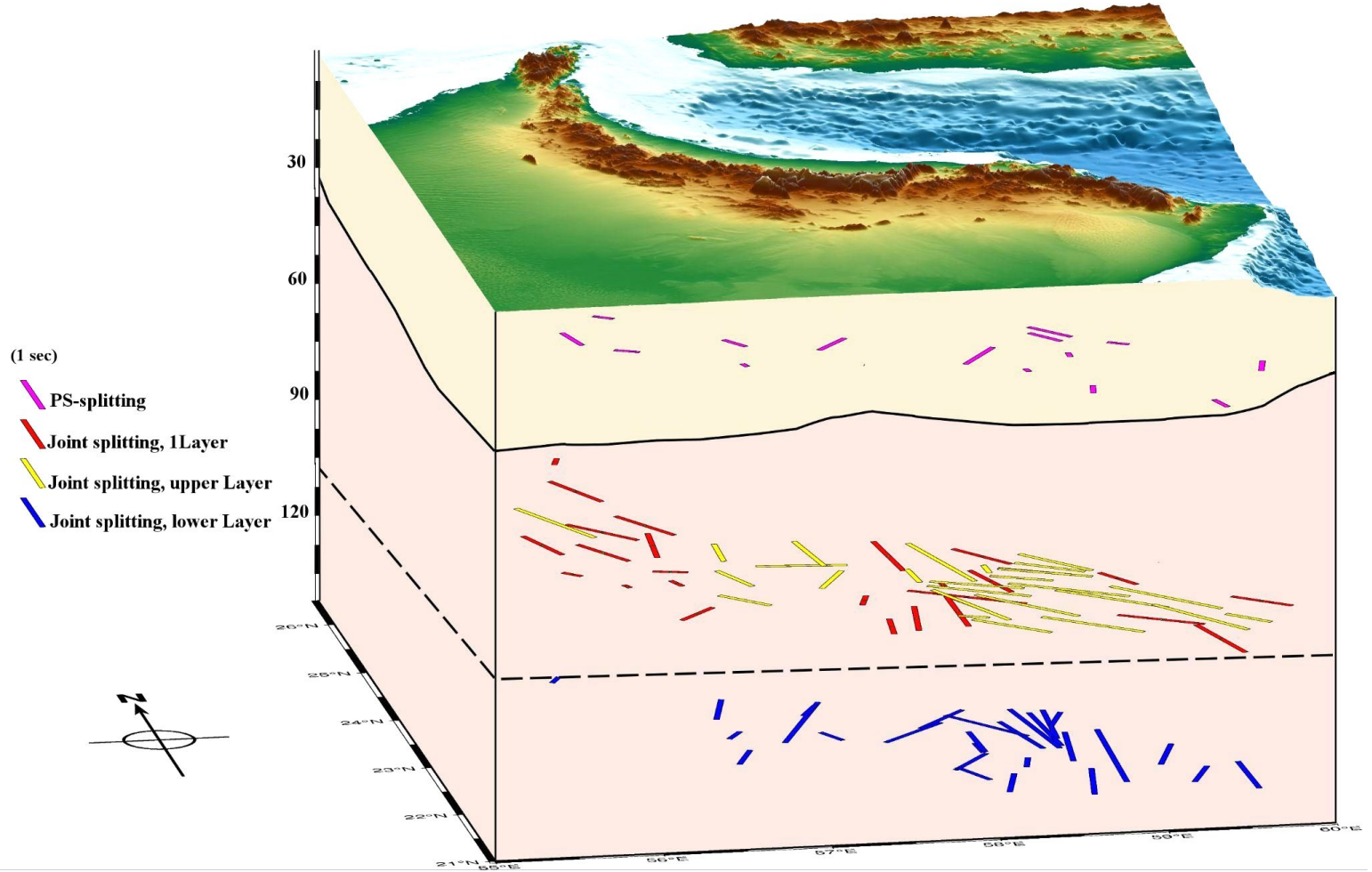
Null-measurements

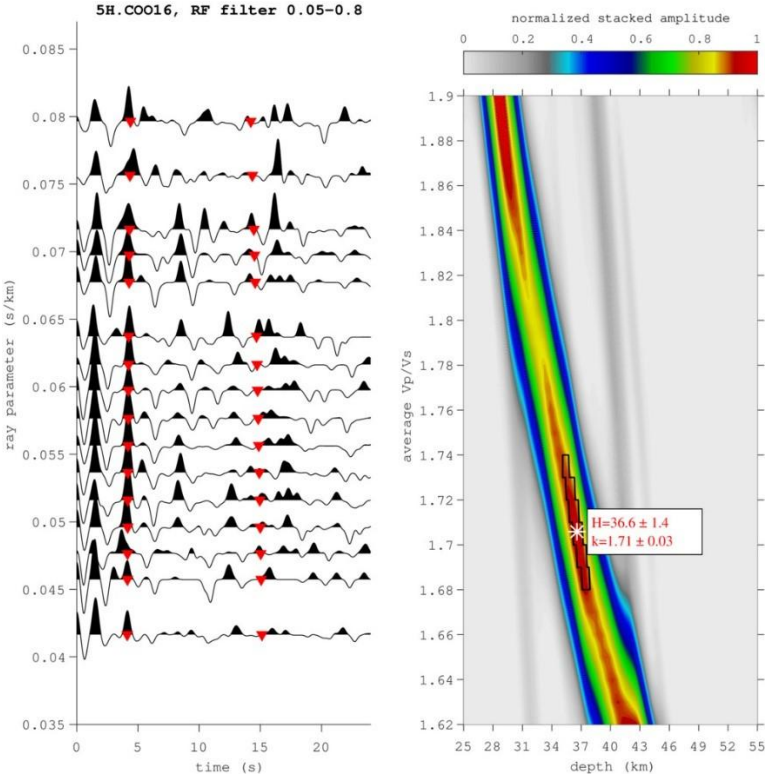


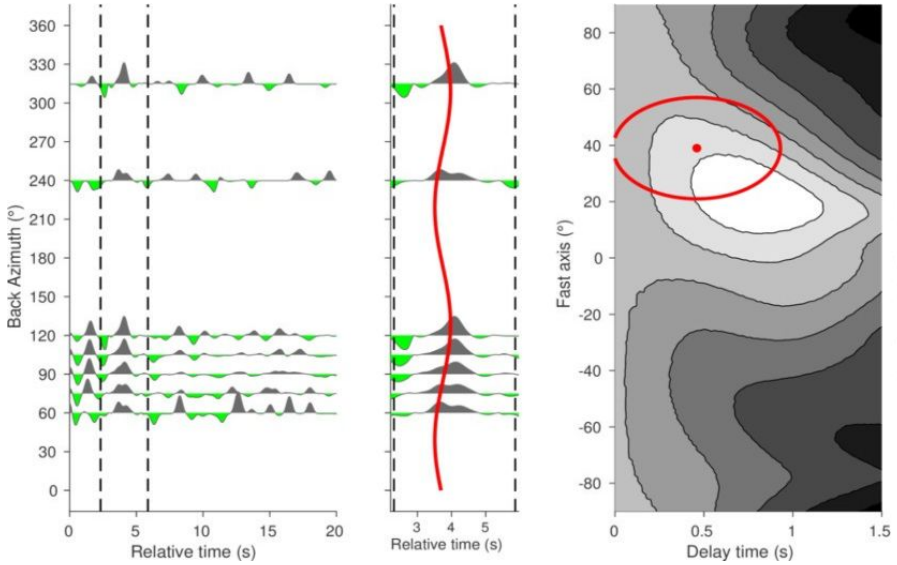

32
36
40
44
Moho depth (km)
Gulf of Oman
1 sec, one-layer
1 sec, lower layer
1 sec, upper layer
km
0
100
26°N
25°N
24°N
23°N
22°N
21°N
55°E
56°E
57°E
58°E
59°E
60°E


Gulf of Oman
HW
SGFZ
km
0
100
0.0
0.5
1.0
1.5
2.0
Delay Time (sec)
26°N
25°N
24°N
23°N
22°N
21°N
55°E
56°E
57°E
58°E
59°E
60°E

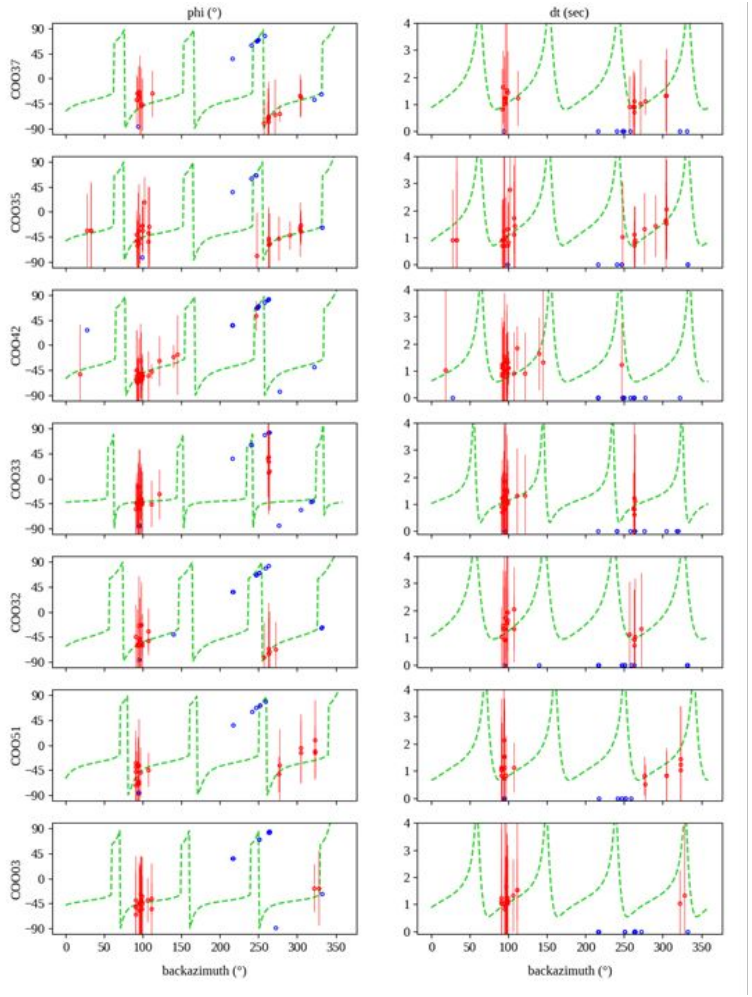

(1 sec)
PS-splitting
Joint splitting, 1Layer
Joint splitting, upper Layer
Joint splitting, lower Layer
30
60
90
120
26°N
25°N
24°N
23°N
22°N
21°N
55°E
56°E
57°E
58°E
59°E
60°E
N

Example of PS-splittings





Other examples of 2-layer modeling



Energy reductions