Coda Attenuation Imaging of the North Anatolian Fault Zone, northern Turkey

Panayiota Sketsiou[1], Luca De Siena[1,2] and David G. Cornwell[1]

[1]University of Aberdeen, [2]Johannes Gutenberg University Mainz

UNIVERSITY OF ABERDEEN

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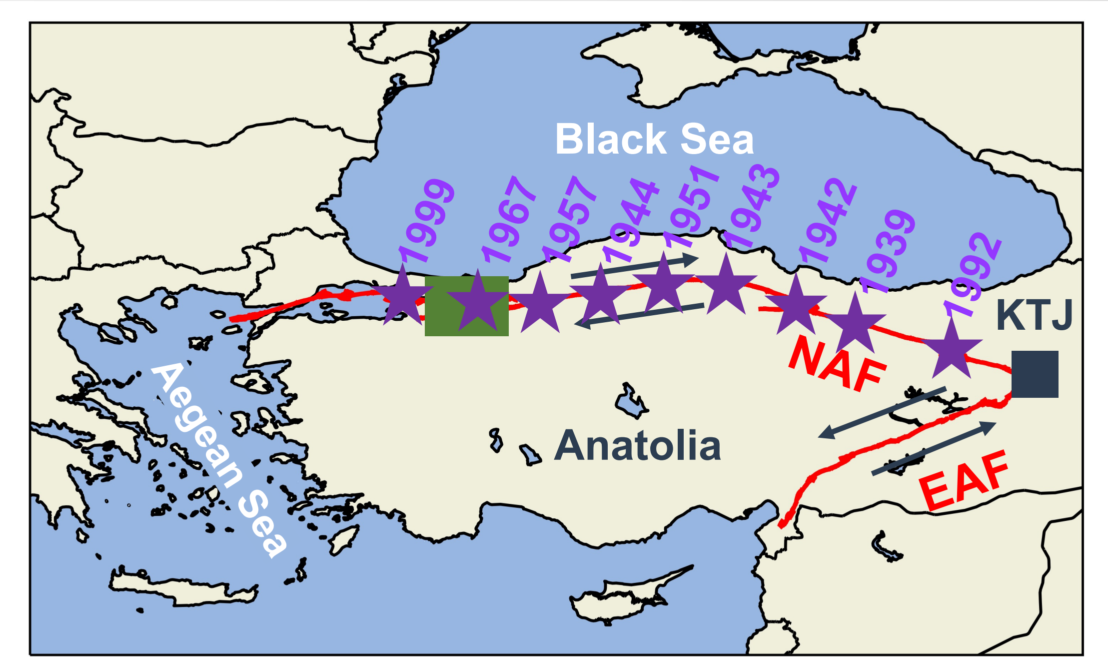
North Anatolian Fault (NAF)

- Active right-later strike-slip fault, 1200 – 1500 km long
- Transform boundary between Eurasian and Anatolian plates
- Nucleates at Karliova Triple Junction (KTJ) and stretches westward to the Aegean Sea
- Series of high-magnitude EQs, migrating from east to west

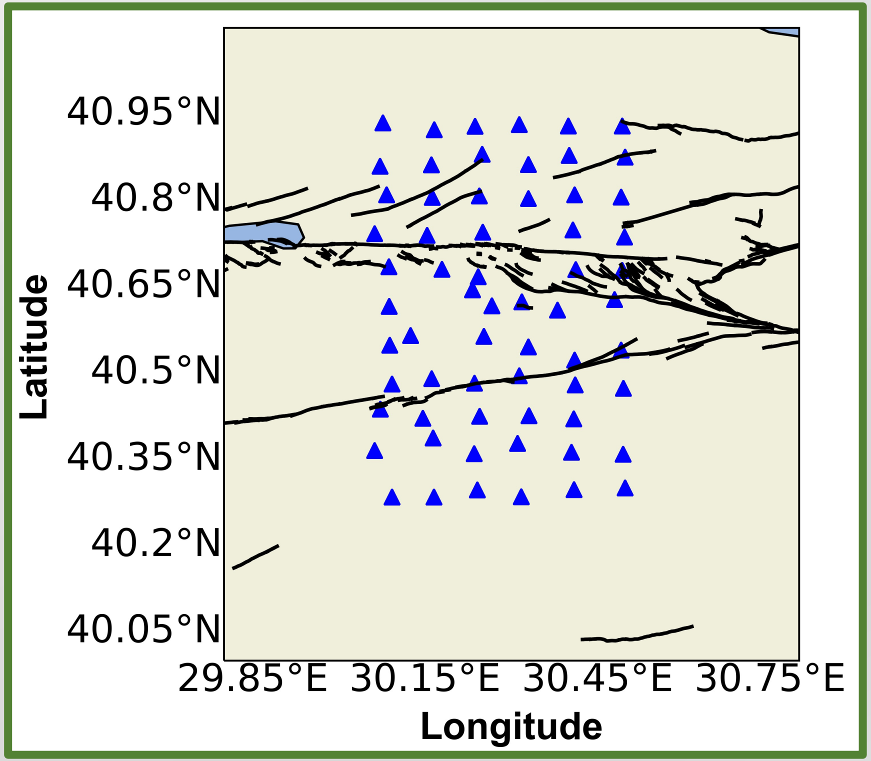


Area of interest

Approximate locations of previous high magnitude events

Area of interest – western NAF

- NAF splays in two major strands: a northern and a southern strand
- Most seismically active part of the fault now
- DANA (**D**ense **A**rray for **N**orth **A**natolia) deployed in 2012 to study this area
- 73 stations with ~7 km nominal spacing
- 18 months of data



Methodology

- **Scattering imaging:** peak delay analysis

$$\Delta \log t_{pd}(f) = \log t_{pd}^{obs}(f) - A(f) + B(f) \log R$$

  - **Peak-delay:** the time-lag between the direct wave arrival and its maximum amplitude – measure of forward scattering
  - t_{pd}^{obs}**:** observed peak-delay time of each waveform
  - ***A(f)*, B(f):** frequency-dependent regression coefficients
  - ***R***: epicentral distance

For details please see: Takahashi, T., Sato, H., Nishimura, T., & Obara, K. (2007). Strong inhomogeneity beneath Quaternary volcanoes revealed from the peak delay analysis of S-wave seismograms of microearthquakes in northeastern Japan. *Geophysical Journal International*, *168*(1), 90-99.

Methodology

- **Absorption imaging:** coda attenuation factor (Q_c^{-1}) inversion using sensitivity kernels

  - **Q_c^{-1}:** coda attenuation factors measured from seismogram enveloped between each source-receiver pair
  - **Sensitivity kernels:** space-weighting functions describing the physical model of each attenuation regime and can be used as a forward model in a tomographic inversion. In our case we used multiple-scattering sensitivity kernels (Del Pezzo et al. 2018)

For details please see:

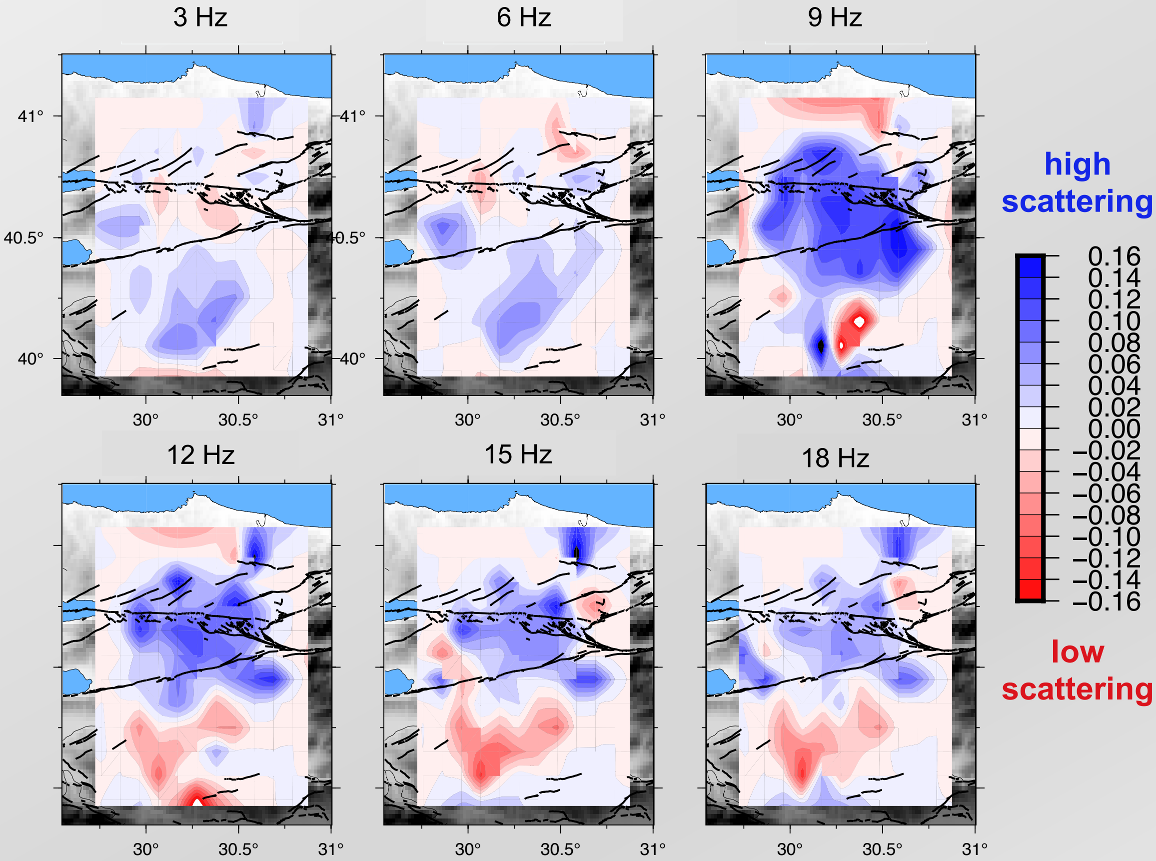
Sketsiou, P., Napolitano, F., Zenonos, A., & De Siena, L. (2020). New insights into seismic absorption imaging. *Physics of the Earth and Planetary Interiors*, *298*, 106337.

Del Pezzo, E., De La Torre, A., Bianco, F., Ibanez, J., Gabrielli, S., & De Siena, L. (2018). Numerically calculated 3D space-weighting functions to image crustal volcanic structures using diffuse coda waves. *Geosciences*, *8*(5), 175.

Preliminary results - Scattering

Main observations:

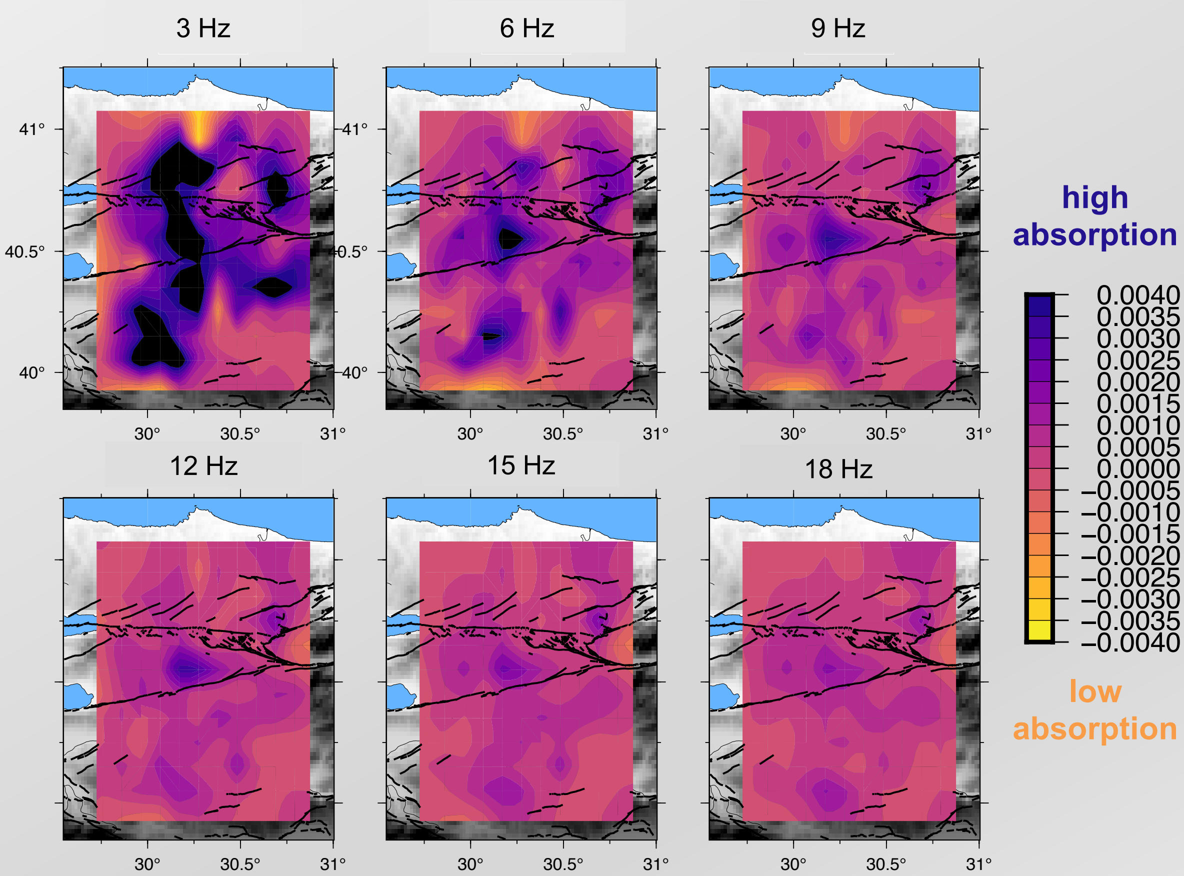
- Scattering increasing from North to South at low frequencies (3-6 Hz)
- Scattering increasing from South to North at higher frequencies (9-18 Hz)
- Clear distinction in scattering properties between Istanbul zone (north part) and Sakarya zone (south part)
- High scattering anomaly between the two strands of the fault



Preliminary results - Absorption

Main observations:

- Overall decrease in absorption values with increasing frequency
- High absorption anomaly between they two fault strands – more prominent at 9-12 Hz
- High absorption anomaly coincides spatially with a high gravity anomaly – they most likely represent a solid rock body in the area, possibly metamorphosed accretionary rocks



Thank you for your time!

Feel free to email me at Panayiota.Sketsiou@abdn.ac.uk or Panayiotasketsiou@gmail.com for any comments/questions you may have.