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İSTANBUL TEKNİK ÜNİVERSİTESİ 1773

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Coda-derived moment magnitudes in central Anatolia

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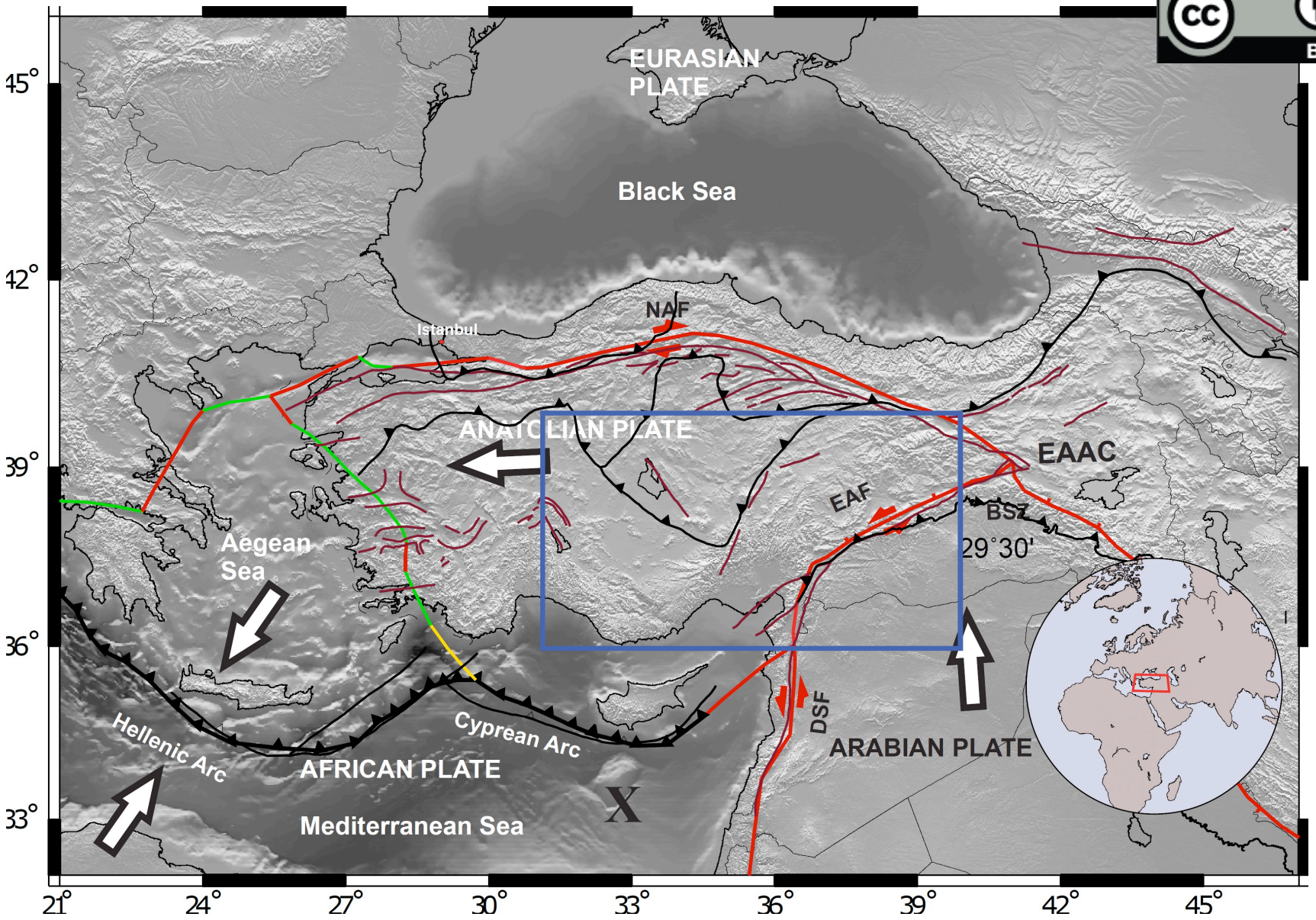
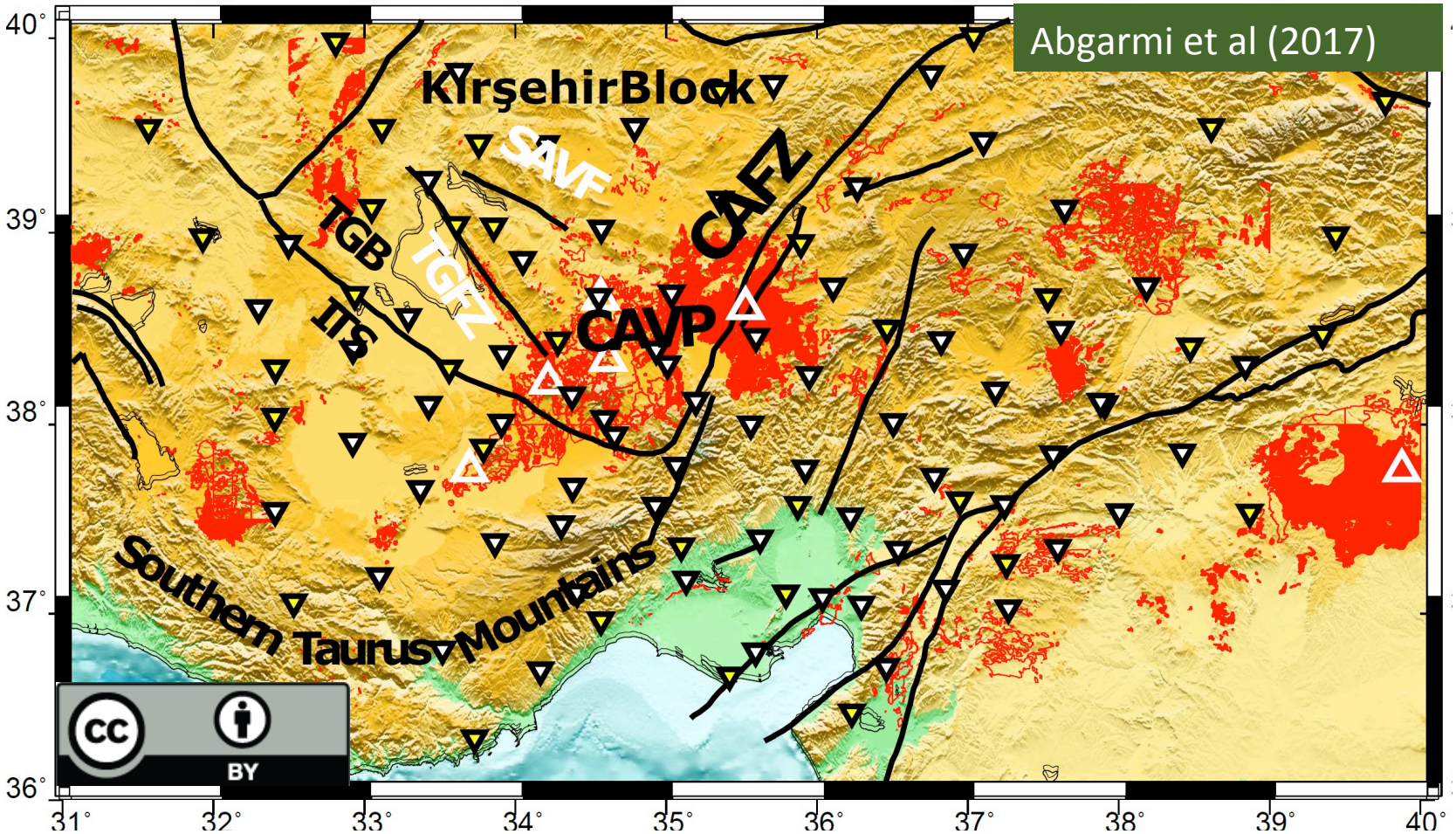
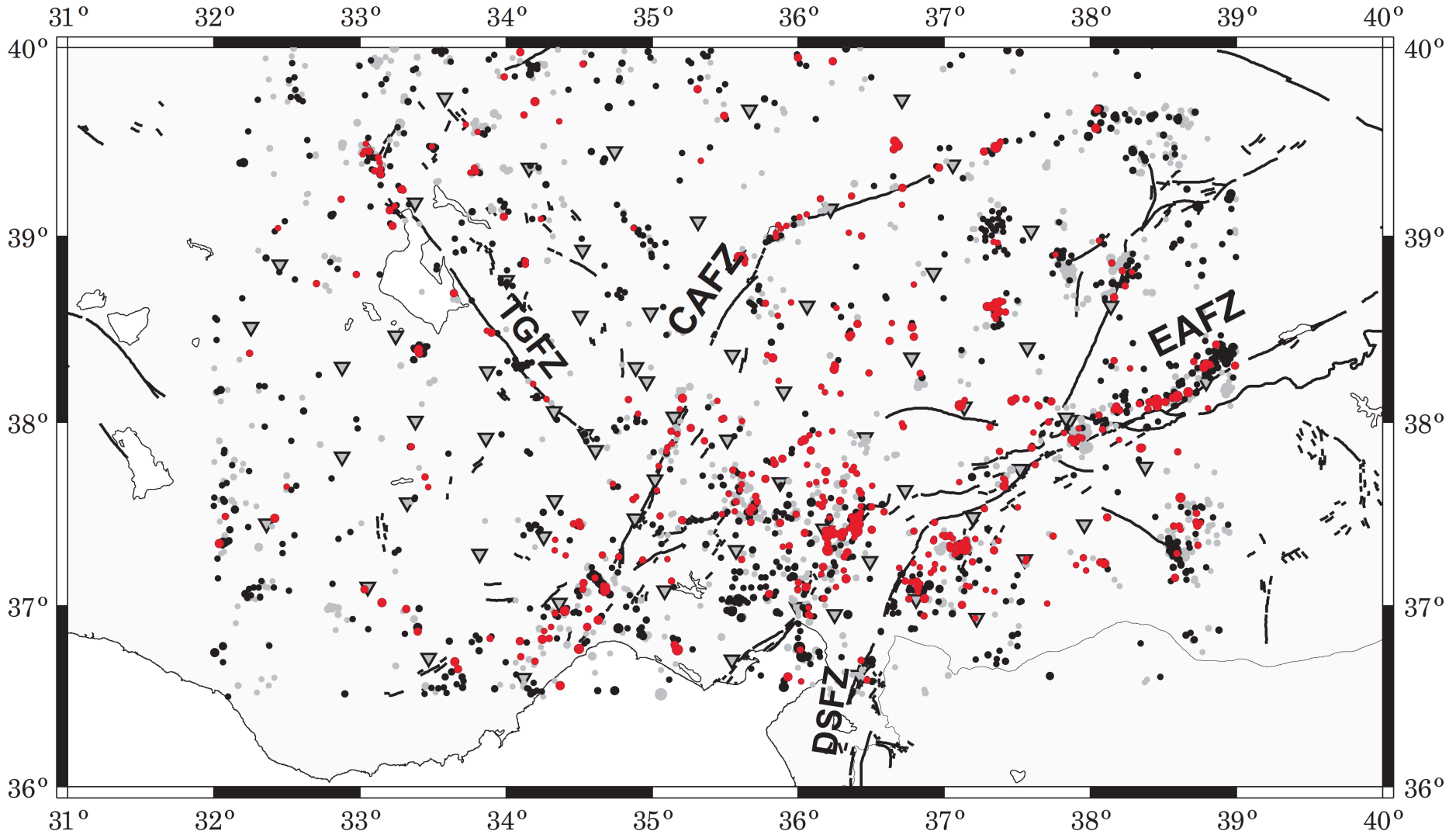

EURASIAN PLATE
Black Sea
NAF
Istanbul
ANATOLIAN PLATE
EAAC
EAF
BSZ
29°30'
Aegean Sea
Hellenic Arc
Cyprean Arc
AFRICAN PLATE
Mediterranean Sea
DSF
ARABIAN PLATE
X
45°
42°
39°
36°
33°
21°
24°
27°
30°
33°
36°
39°
42°
45°

- **Robust and stable knowledge of source properties (e.g., moment magnitude estimates)**
- **A better evaluation of seismic hazard potential via reliable seismicity catalogs**



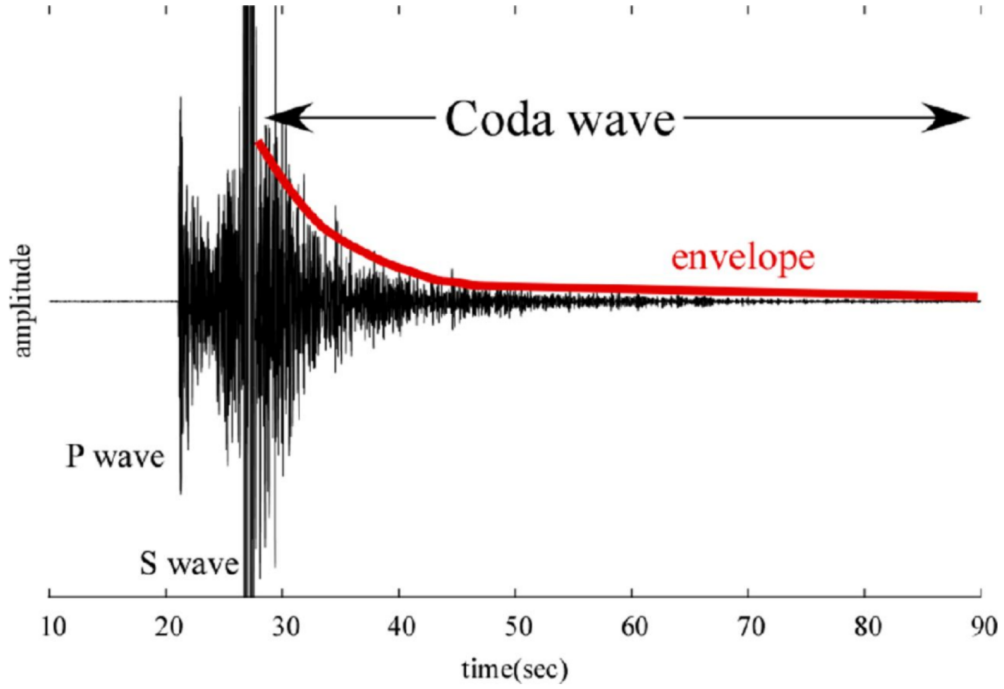
Local seismic activity between 2013-2015 reported by KOERI



Eken (2019)

- **INTRINSIC ATTENUATION:**

- Mineral dislocations, frictional heat.



$$Q_i^{-1} = \frac{b}{2\pi f}$$

b: Absorbtion parameter
v_0**:** The mean S-wave velocity
g: Scattering coefficient
f: frequency

- **SCATTERING ATTENUATION:**

- 3D small-scale heterogenities.

$$Q_{sc}^{-1} = \frac{g^* v_0}{2\pi f}$$

We use Radiative Transfer Theory via Qopen utility

see also: Sens-Schönfelder and Wegler (2006), Eulenfeld and Wegler (2016), Gaebler et al. (2019), and Izgi et al. (2020)

$$E_{obs}(t,r) = \frac{\rho_0 \langle \dot{u}(t,r)^2 \rangle}{C\Delta f}$$

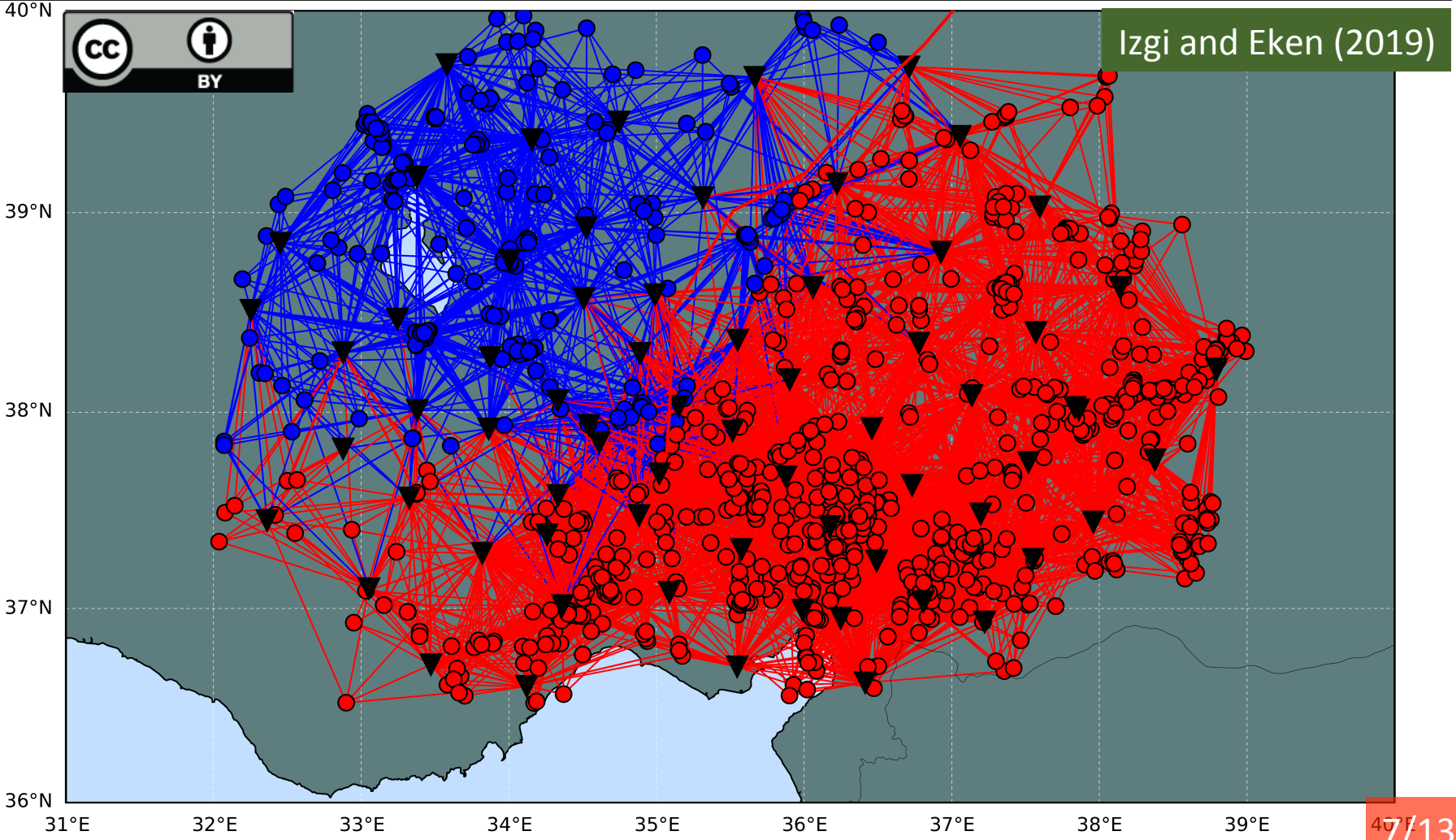
$\dot{u}(t,r)^2$: Mean square velocity
ρ_0 : Mean mass density
Δf: Filter width

$$E_{mod}(t,r) = WR(r)G(r,t,\mathbf{g})e^{-bt}$$

W: spectral source energy ($\mathbf{JHz^{-1}}$)
R(r): site amplification factor **(1)**
g :vector of scattering parameters
$\mathbf{e^{-bt}}$: exponential intrinsic damping with time **(s)**
r: station-event distance **(km)**

The envelope inversion basically enables an improved method for the separation of intrinsic and scattering attenuation of seismic shear waves at various **frequencies (e.g. 0.75, 1.5, 3.0, 6.0, 12.0 Hz).**

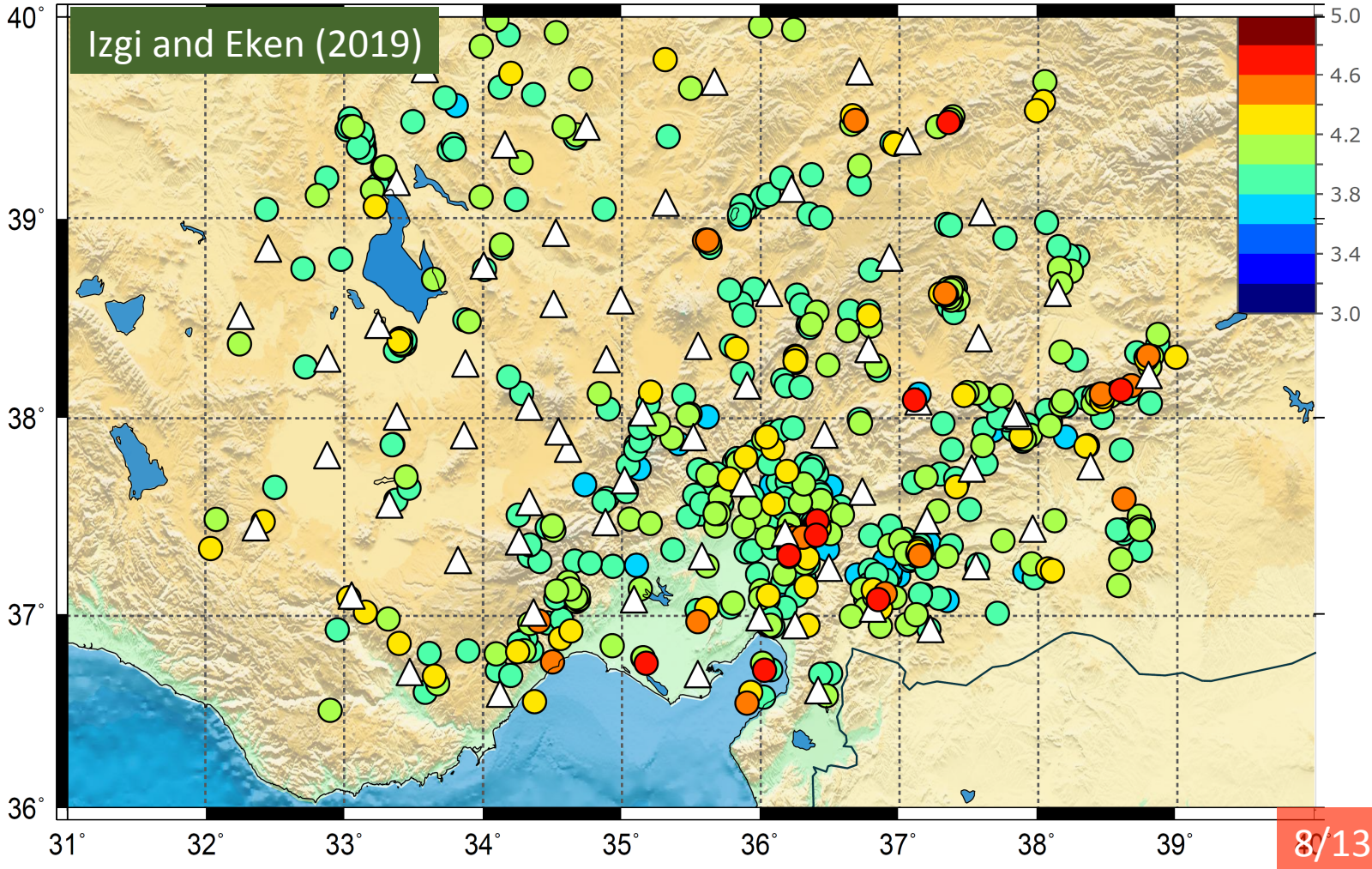
A pascall experiment | *Continental Dynamics/Central Anatolian Tectonics – CDCAT Project:*
70 Broadband stations deployment (2013-2015) (Portner et al., 2018).
A total of **1509** local earthquakes (M_L=<2.0 & M_L>=4.6)

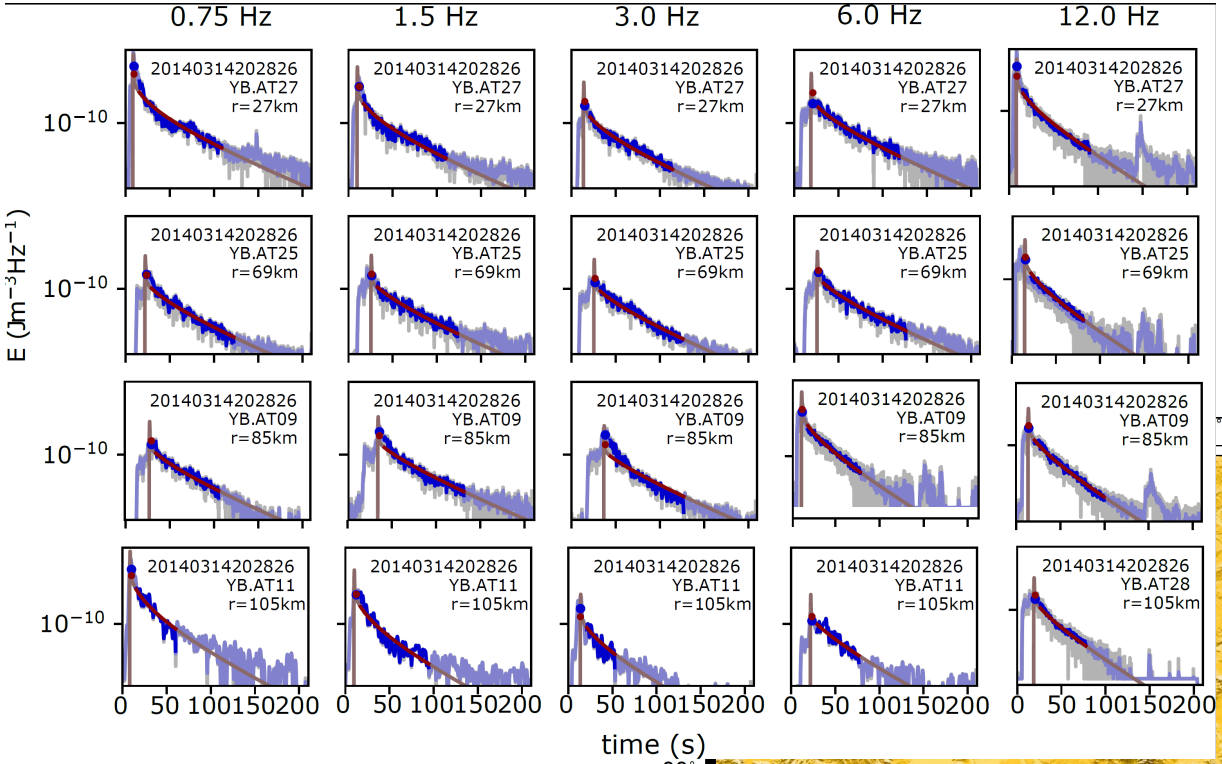


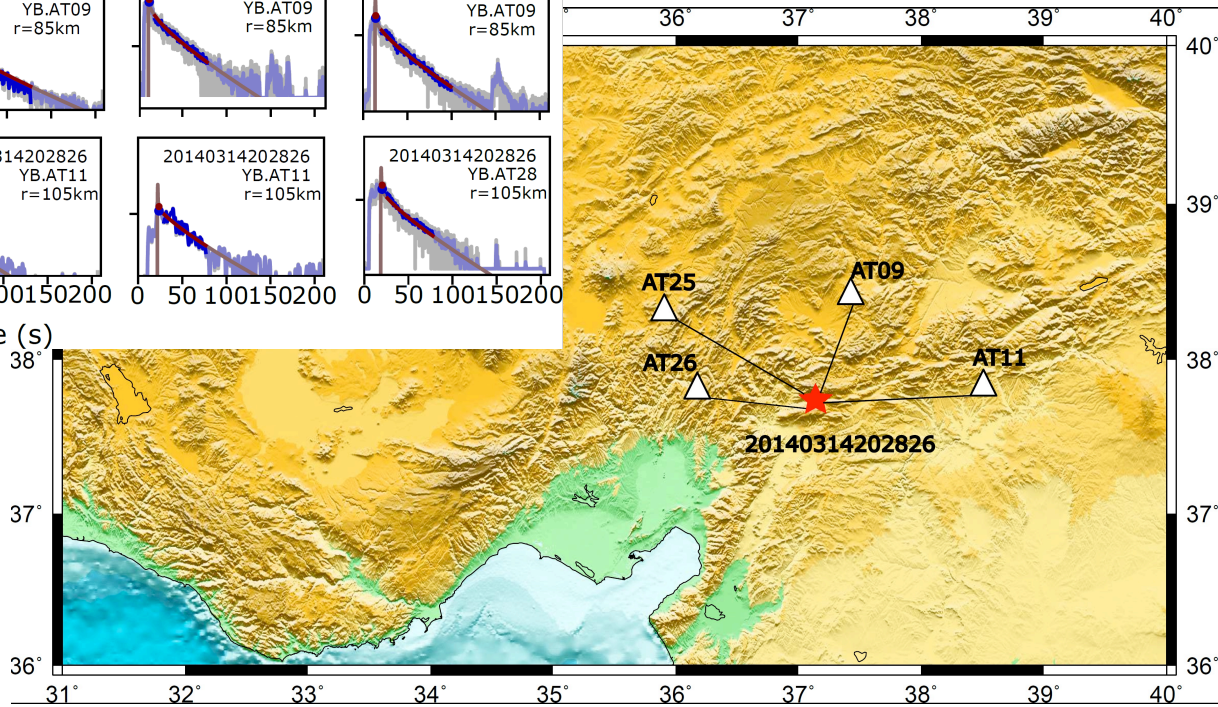
- 3s < **S-wave window** < 7s
- **Coda window ends** 100s after **S-onset**
- Min. 10s coda window
- **SNR** ≥ 2.5

AFTER INVERSION

Results from 916 local earthquakes considered for further interpretation







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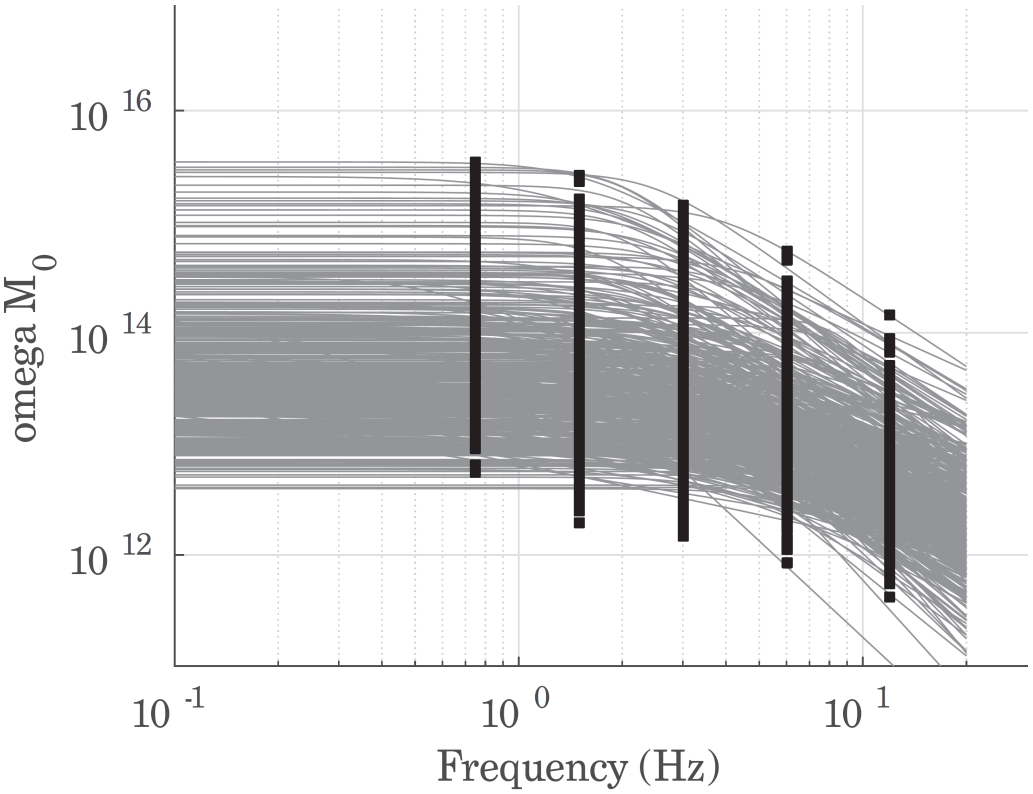
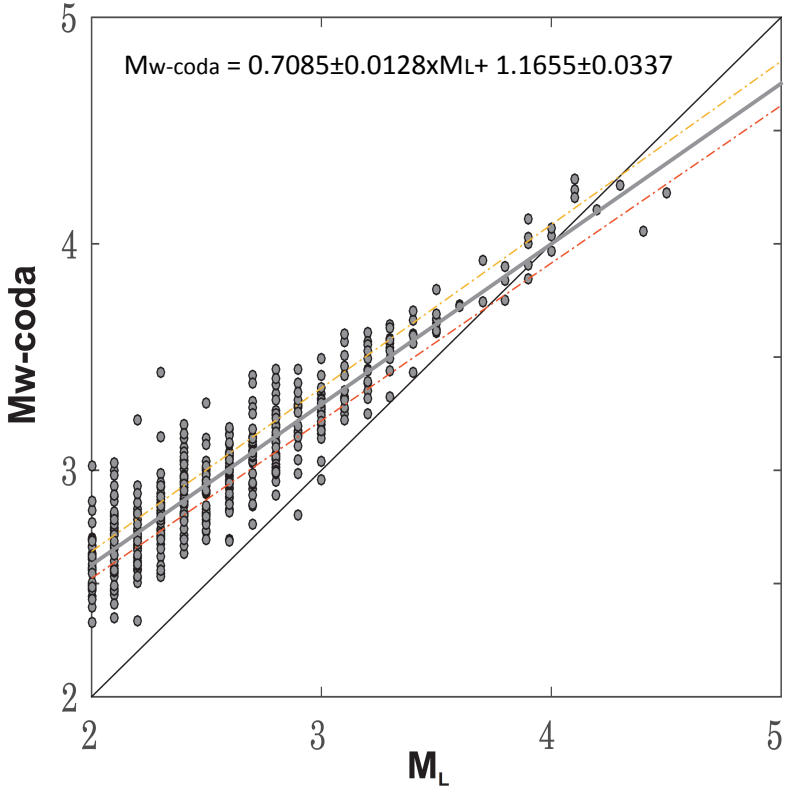
• Constraints on the source properties …





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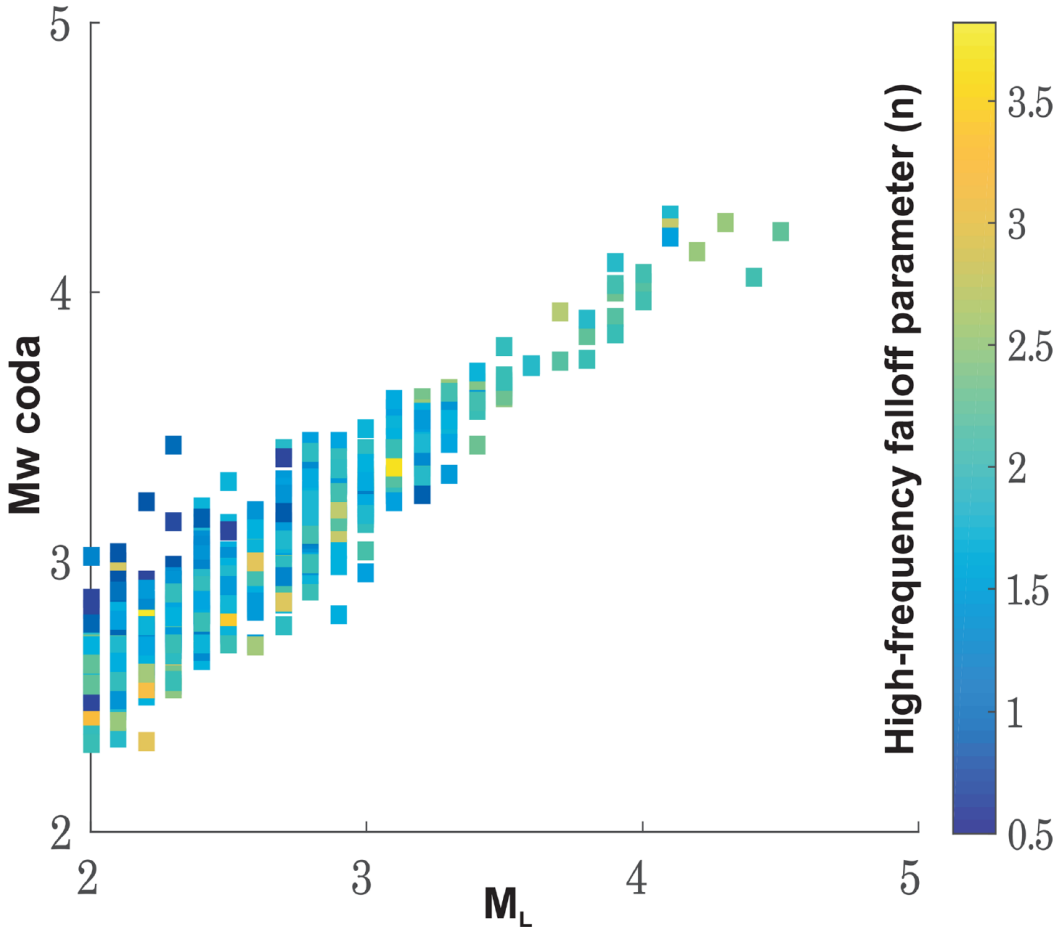
- **Limits of omega-square model ...**



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Our recent findings …

- ✓ Moment magnitude estimates as a direct physical measure of seismic energy for local earthquakes with magnitudes 2.0 ≤ ML ≤ 5.2 recorded at 69 seismic stations in central Anatolia

- ✓ Overall consistency between $M_{w\text{-}coda}$ and M_L

- ✓ Variation of the high-frequency falloff parameter (n > 2 for small earthquakes) → an omega-square model can distort the estimates of corner frequency and even seismic moment, especially in regions where Q is strongly frequency dependent.

Acknowledgements

The ***python code*** (**Qopen**) used for carrying out the inverse modeling is available under the permissive MIT license and is distributed at https://github.com/trichter/qopen.

The facilities of **IRIS** Data Services, and specifically the **IRIS Data Management Center**, for access to seismic waveforms, related metadata, and/or derived products used in this study.

Data for the CD-CAT experiment (**https://doi.org/10.7914/SN/YB_2013**) are available from the IRIS Data Management Center at http://www.iris.edu/hq/.

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