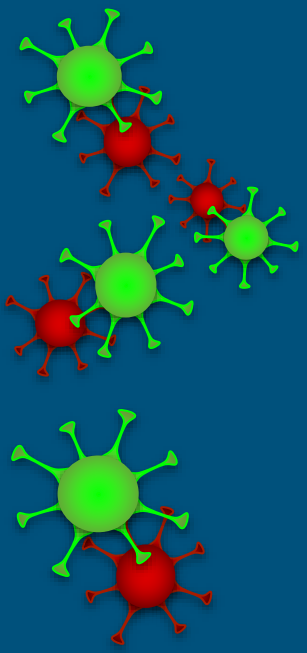
EGU2020-18053



Present Seismotectonic Behavior of the EAF from Improved Seismicity Catalog and Earthquake Source Mechanism Solutions

Sezim Ezgi Guvercin[1] *(sezim.guvercin@gmail.com), Hayrullah Karabulut[2], Ugur Dogan[1], Ziyadin Cakir[3], Semih Ergintav[4], Cengiz Zabci[3], Alpay Ozdemir[1], Seda Ozarpaci[1], Ali Ozgun Konca[2] and Mehmet Kokum[5]

[1]Yildiz Technical University, Dept. of Geomatic Engineering
[2]Bogazici University, KOERI, Dept. of Geophysics
[3]Istanbul Technical University, Dept. of Geological Engineering
[4]Bogazici University, KOERI, Dept. of Geodesy
[5]Firat University, Dept. of Geological Engineering

EAST ANATOLIAN FAULT?

💫 Two lithospheric scale faults, NAF and EAF accommodates the westward motion of Anatolian microplate with slip rates

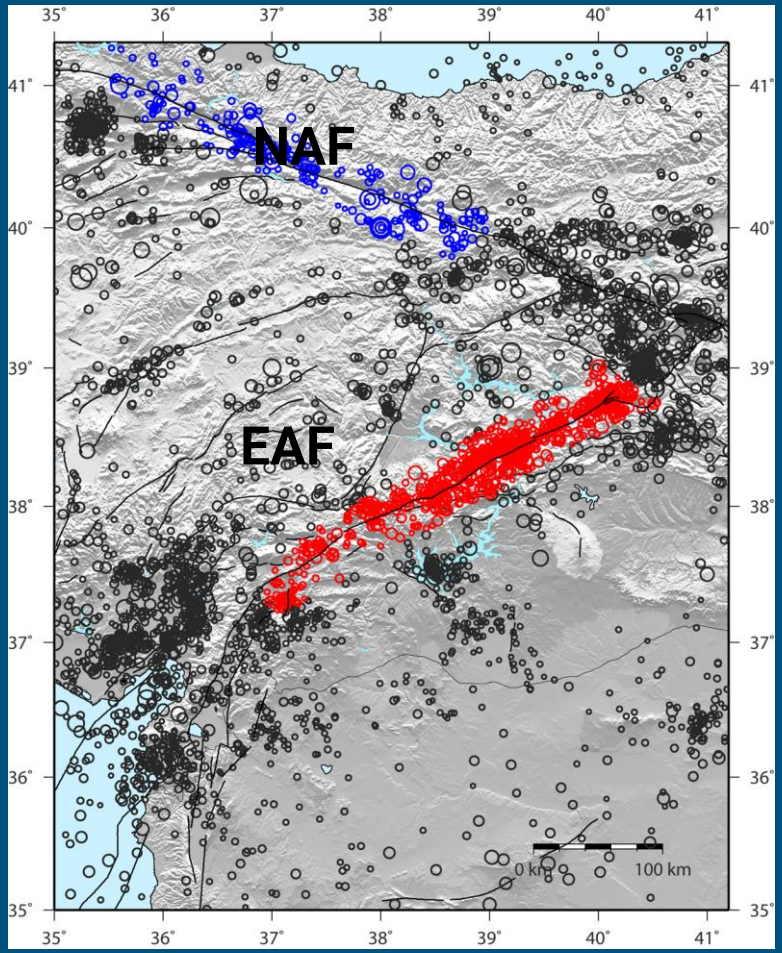
EAF ~10 mm/yr

NAF ~25 mm/yr

EAF slip rate = 10 mm/yr

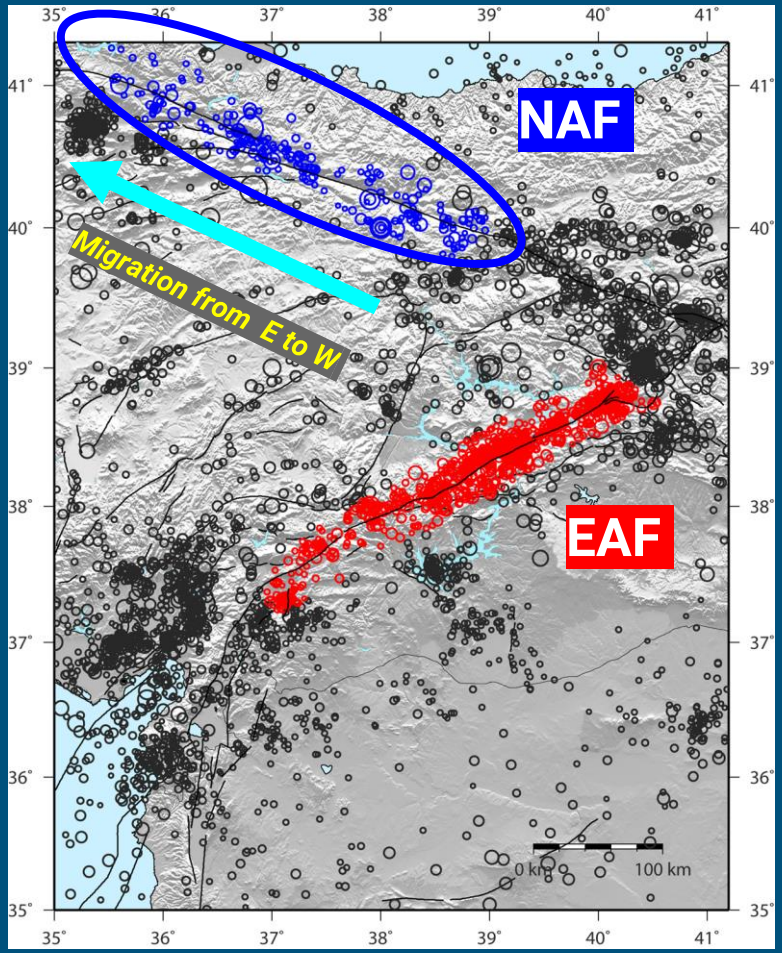
NAF slip rate = 25 mm/yr

EAF is a 400 km long sinistral transform fault.



Seismicity of the East Anatolian Fault!

- The NAF experienced migration of large earthquake during the last century from east to west with Mw>7

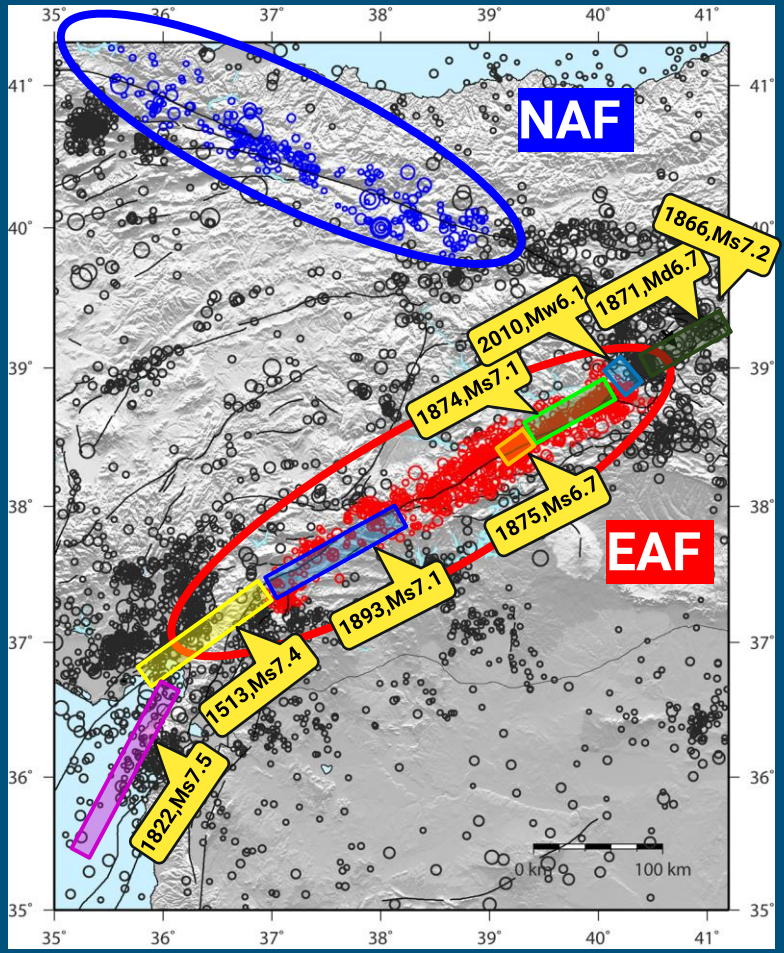


Seismicity of the East Anatolian Fault!

- The EAF experienced migration of earthquakes with Mw>7 between 1513 and 1971 (Duman, 2013).

However,

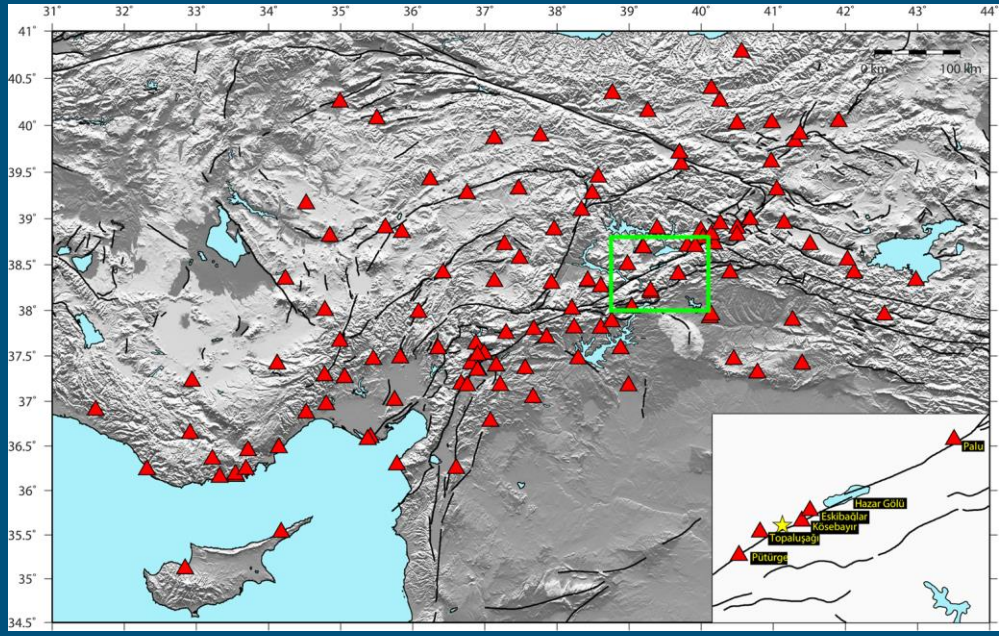
- No earthquakes greater than Mw6.5 occurred on the EAF for 140 years until recently. In addition, recent geodetic studies show that the locking behavior along EAF is heterogeneous with significant creep.



The objective of this study is to understand the segmentation along EAF and understand the relation between plate coupling and seismicity based on 13 years of seismic activity:

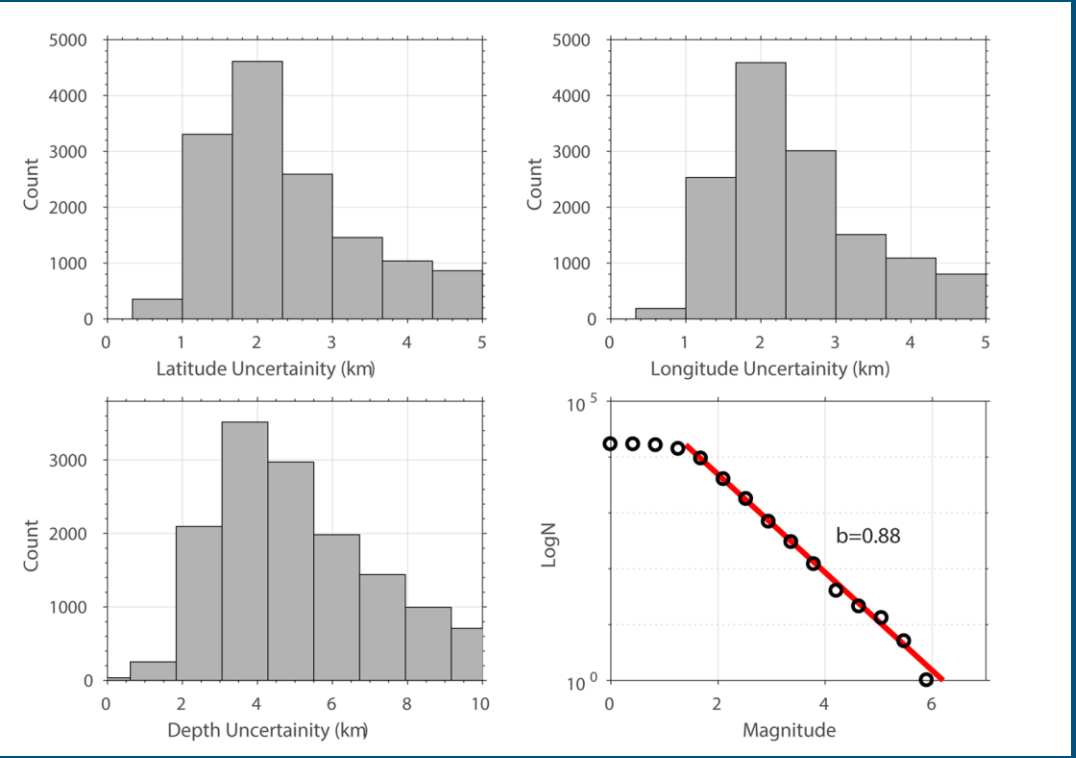
For that purpose,

- We merged the catalogs of AFAD, KOERI and TUBITAK,
- In addition to the two national seismic networks (KOERI and AFAD), we deployed five stations in 2019.(Inset)
- Relocated more than 15000 events
- We employed template search to discover whether there are repeating earthquakes.
- We obtained a preliminary slip model for the Mw6.8 Sivrice earthquake mainshock and early aftershocks.
- Recent geodetic studies also show long term surface creep EAF (Ergintav et al, 2019).
- We present high resolution seismicity of 2019 Mw6.8 earthquake.



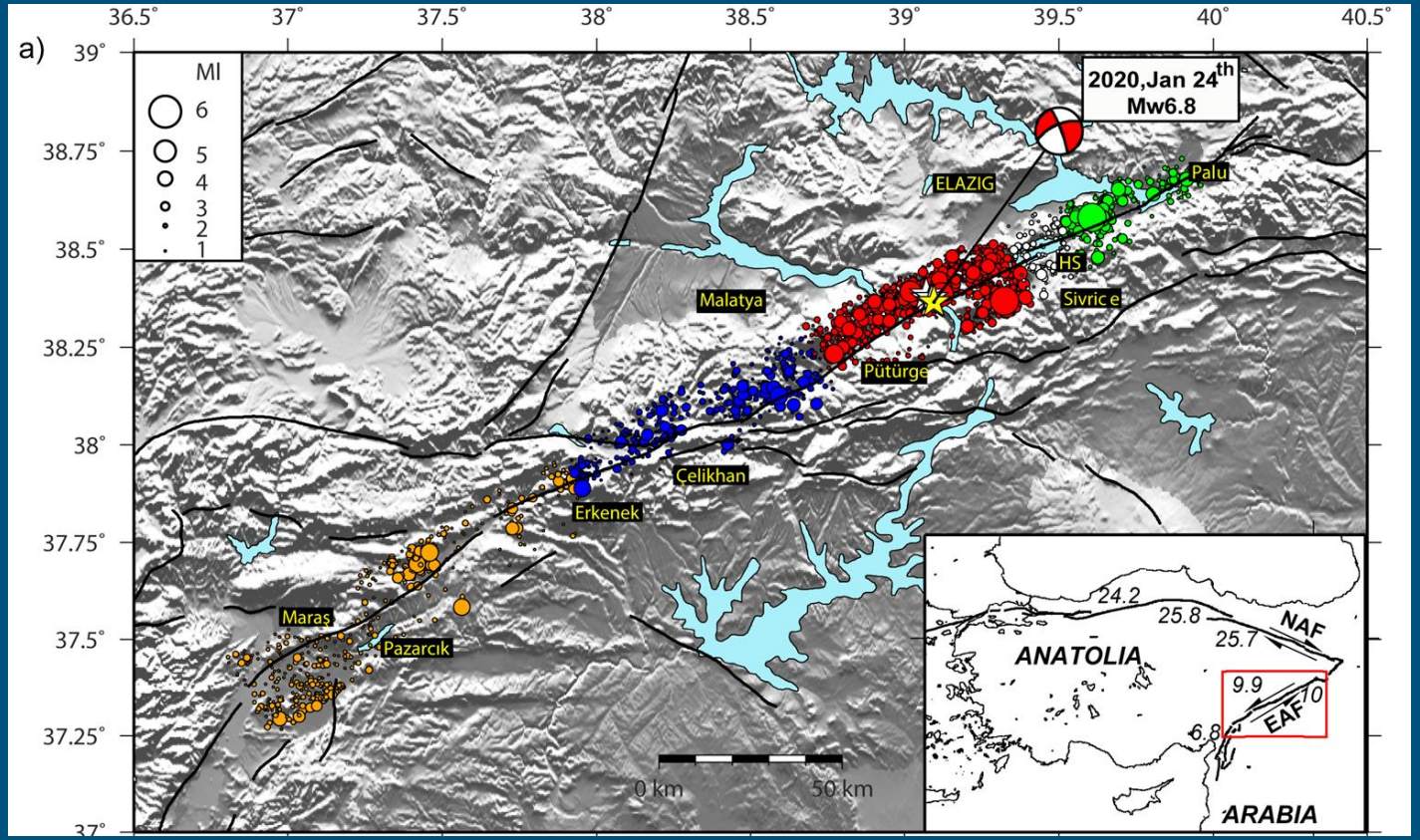
Quality of the final catalog!

- Latitude uncertainty = ~2 km
- Longitude uncertainty = ~2 km
- Depth uncertainty = ~4 km
- B-value = 0.88



Segmentation along EAF from improved seismicity catalog

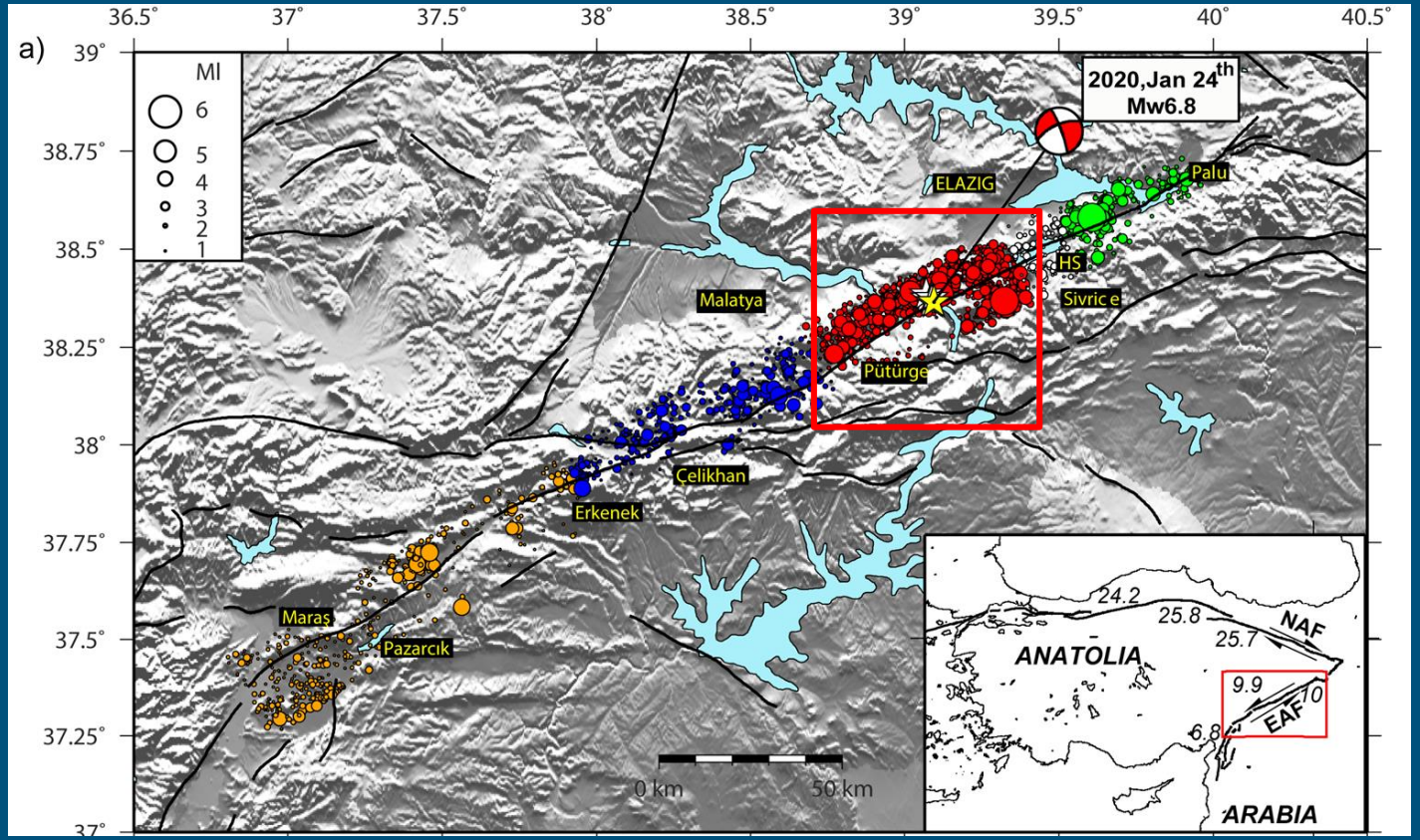
- The variations of seismicity, are consistent the segmentation from geological maps and
- The rupture extent of historical earthquakes with well-recorded surface ruptures (Duman, 2013)



Segmentation along EAF from improved seismicity catalog

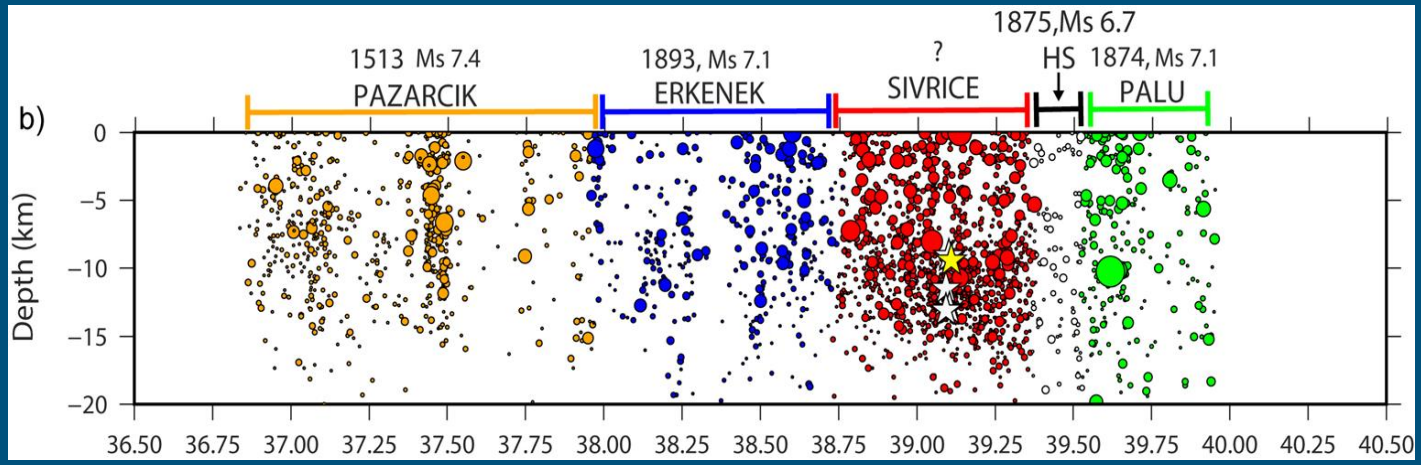
💥 **Results show that the Sivrice-Pütürge segment has relatively high rate of seismicity,**

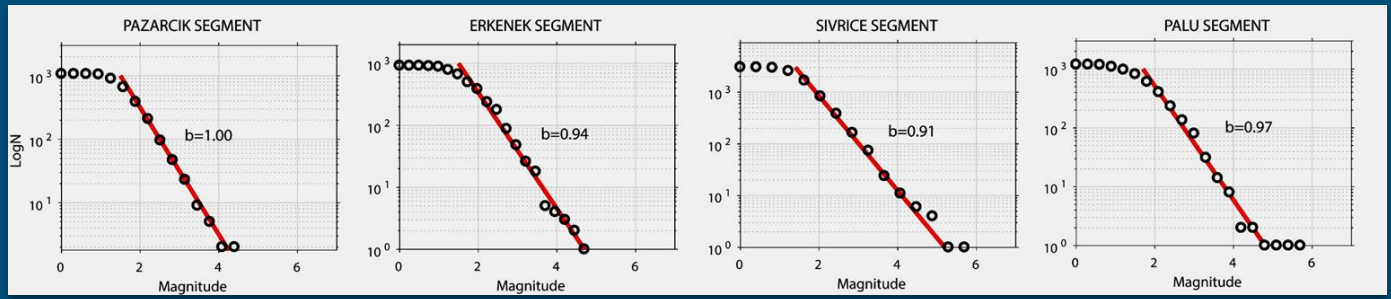
which differentiates from neighboring segments.(See the red box in the figure)



Analysis of Segmentation Along EAF

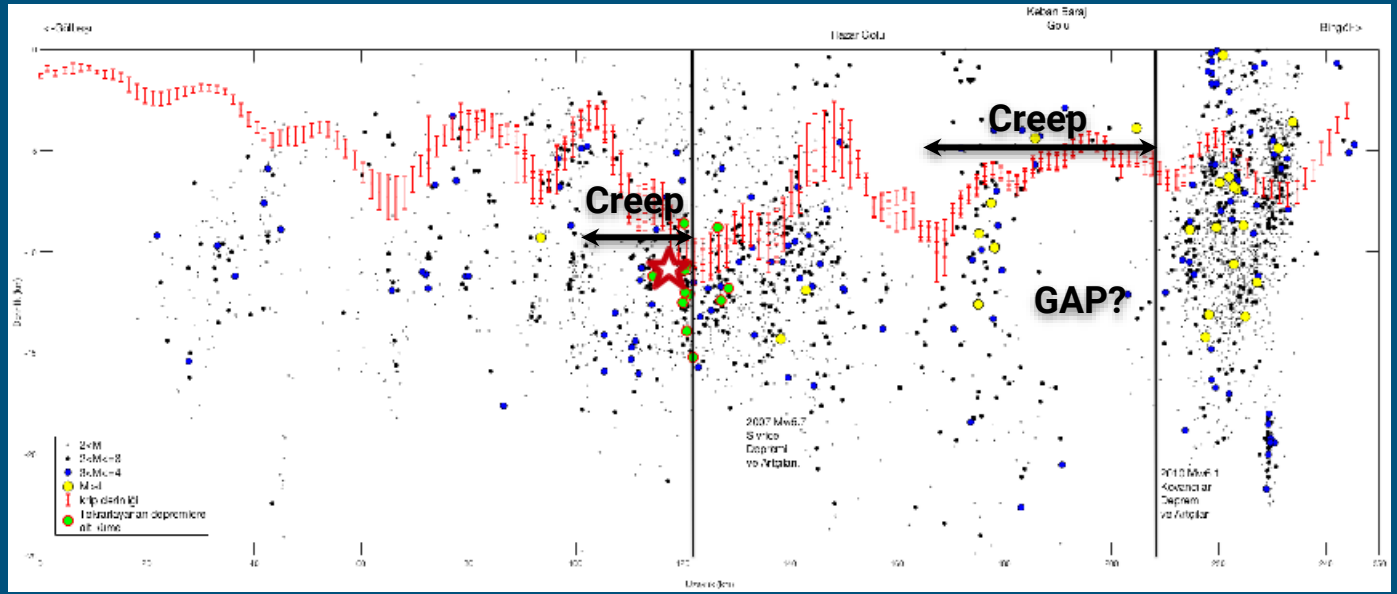
💫 **Although, Sivrice segment has the highest seismicity rate, b-values of sub-faults do not display significant difference.**





Creep rate along EAF and its relation to the segmentation

💫 Varying rates and depths of creep along EAF might be an indicator of the existence of segmentation.

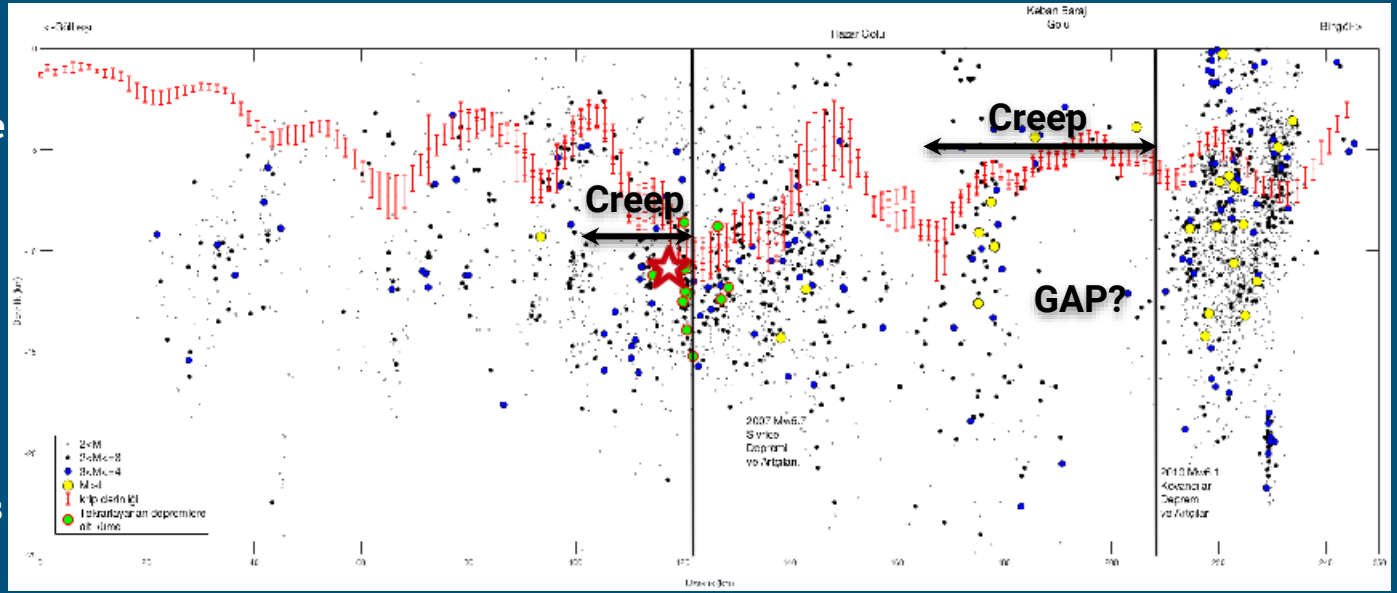


Red bars indicate the depth below which the fault is locked.

Creep rate along EAF and its relation to the segmentation

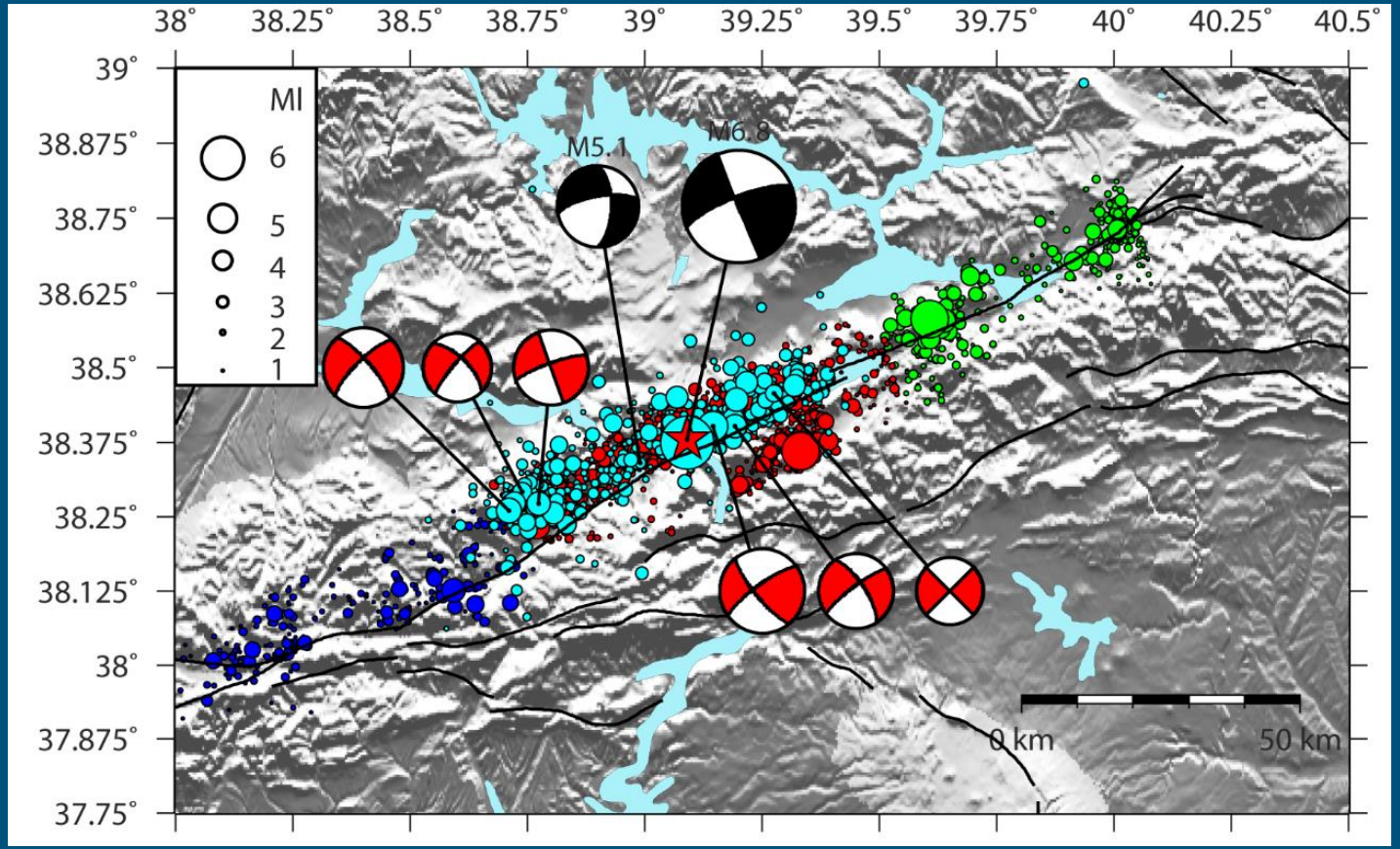
Furthermore,

💫 We employed template search to discover whether there are repeating earthquakes. Comparison of seismicity and creep depth shows that the repeating earthquakes are concentrated in areas where there is deeper creeping sections.



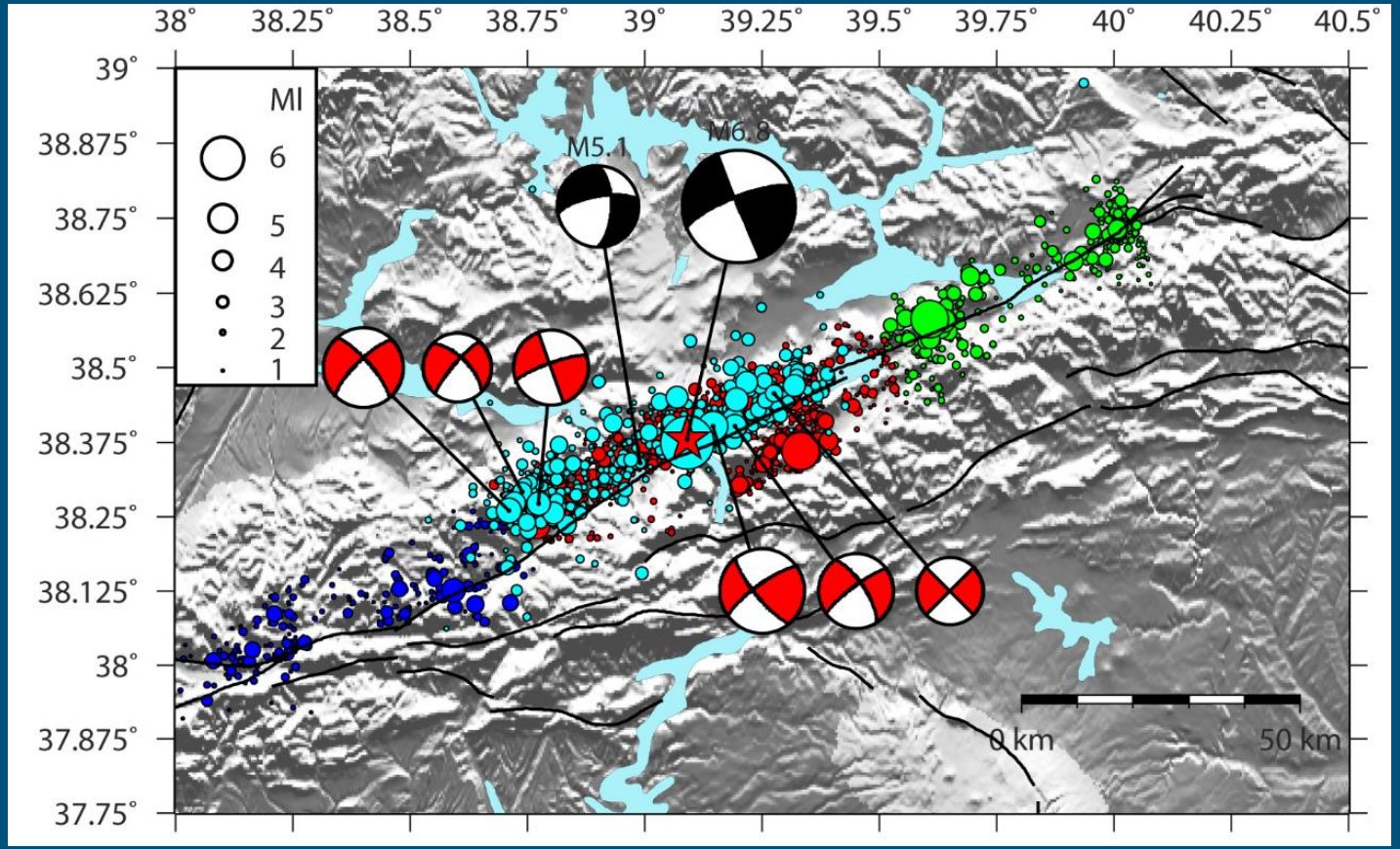
2020, Mw6.8 Sivrice (Elazığ) Earthquake and its relation to the segmentation

💫 2020, Mw6.8 Sivrice earthquake is the latest devastating earthquake which occurred after ~140 year of quiescence.



2020, Mw6.8 Sivrice (Elazığ) Earthquake and its relation to the segmentation

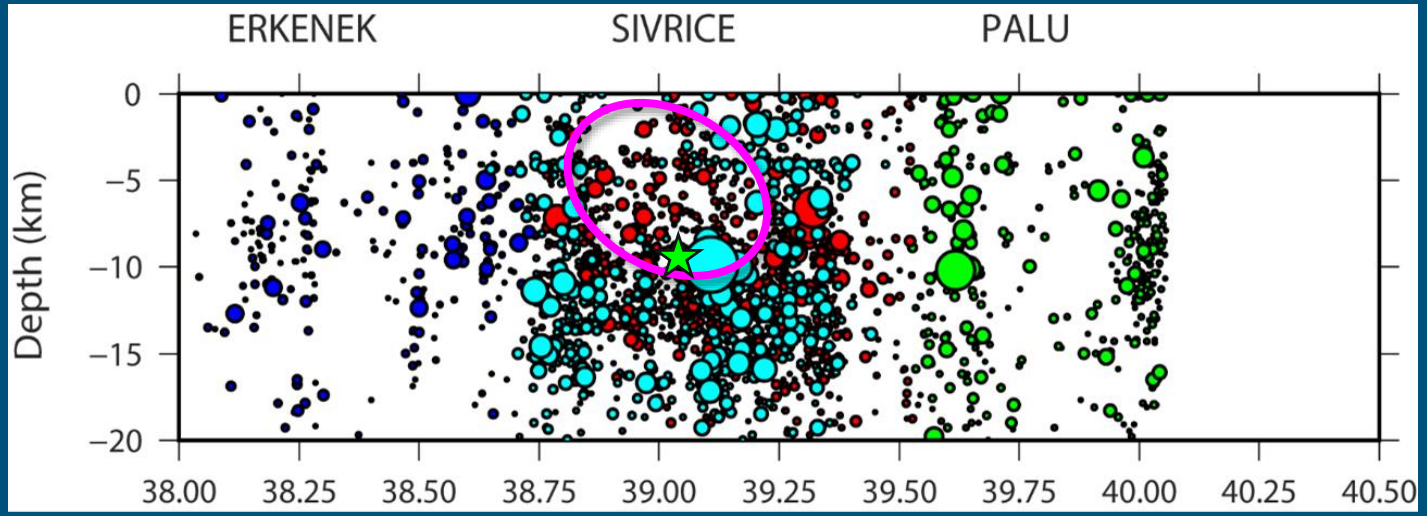
- The focal mechanisms of the foreshock, mainshock and aftershocks were obtained in this study using cut and paste algorithm.



- Results are consistent with ~80 degree NW dipping fault angle.

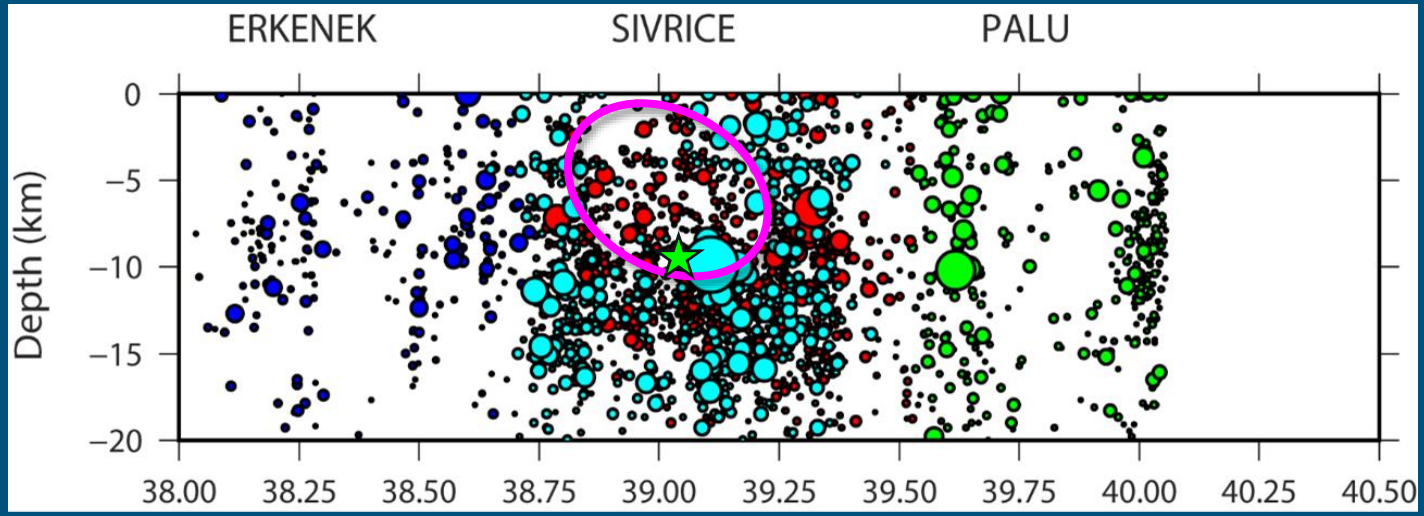
2020, Mw6.8 Sivrice (Elazığ) Earthquake and its relation to the segmentation

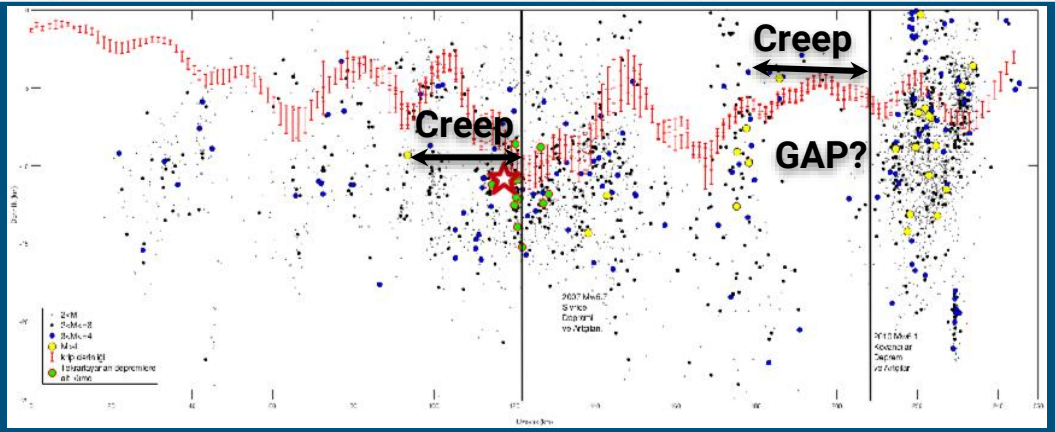
- Another significance of this earthquake is that the extent of its rupture is consistent with the extent of the Sivrice segment which is the seismically most active part of EAF.
- The area of maximum slip (Pink circle) coincides well with the distribution of the aftershocks of 2020, Mw6.8 Sivrice earthquake and also contains the repeating earthquakes.



- Red circles indicate the interseismic activity of Sivrice Segment. Blue circles represents the aftershock distribution of 2020, M6.8, Sivrice Earthquake. Green star shows the location of the repeaters.Pink ellipse is represents the maximum slip are of 2020, M6.8, Sivrice .Earthquake

2020, Mw6.8 Sivrice (Elazığ) Earthquake and its relation to the segmentation



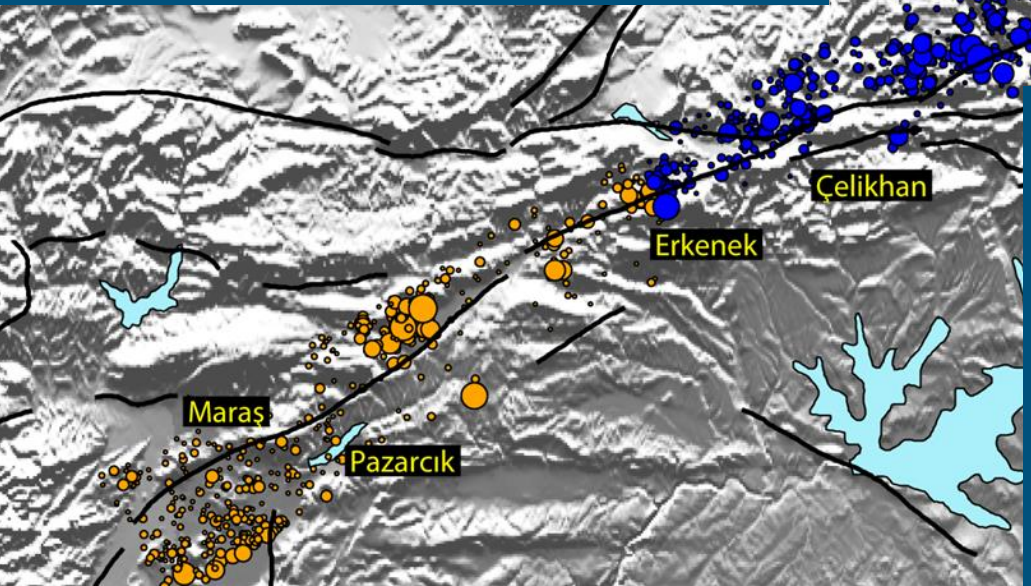


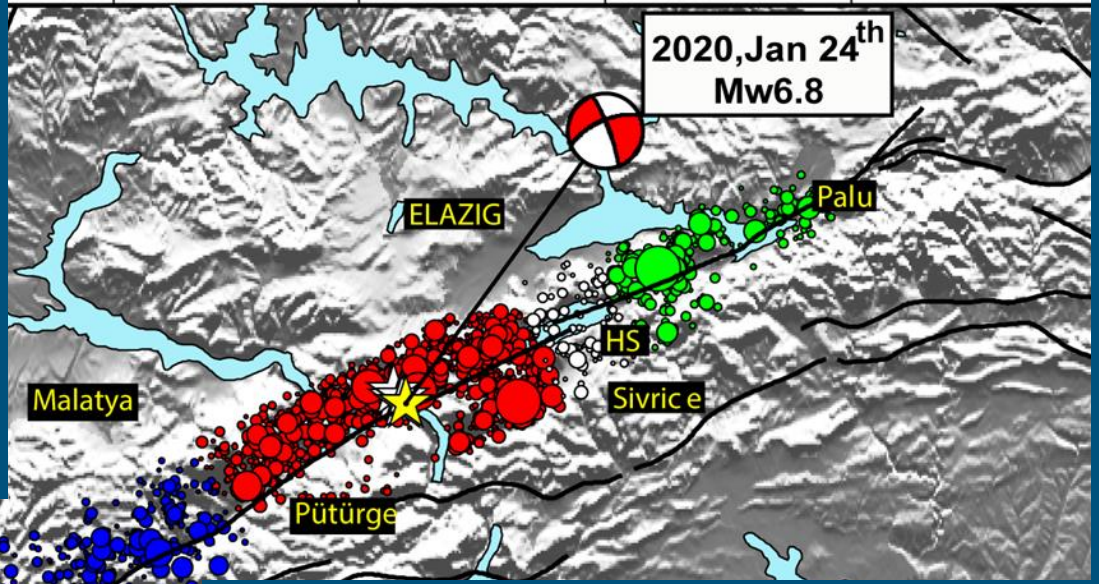
The hypocenter of the 2020, Mw6.8 earthquake in Sivrice, is in the vicinity of the repeaters and at the transition from higher extent of creep to lower amount of creep which might be related to the rupture initiation of the mainshock.

Conclusions

- The improved seismicity catalog is consistent with the rupture extend of historical earthquakes.

- Seismicity rates of the sub-faults are different, however, b-values of the sub-catalogs are similar.





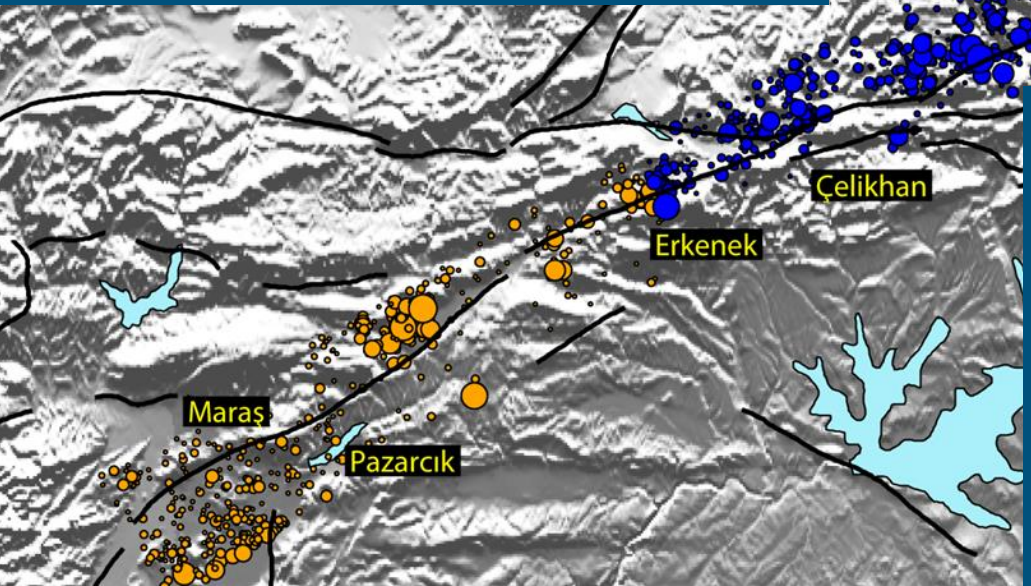
- 2020, M6.8 earthquake ruptured the Sivrice segment which has the highest rate of seismicity.

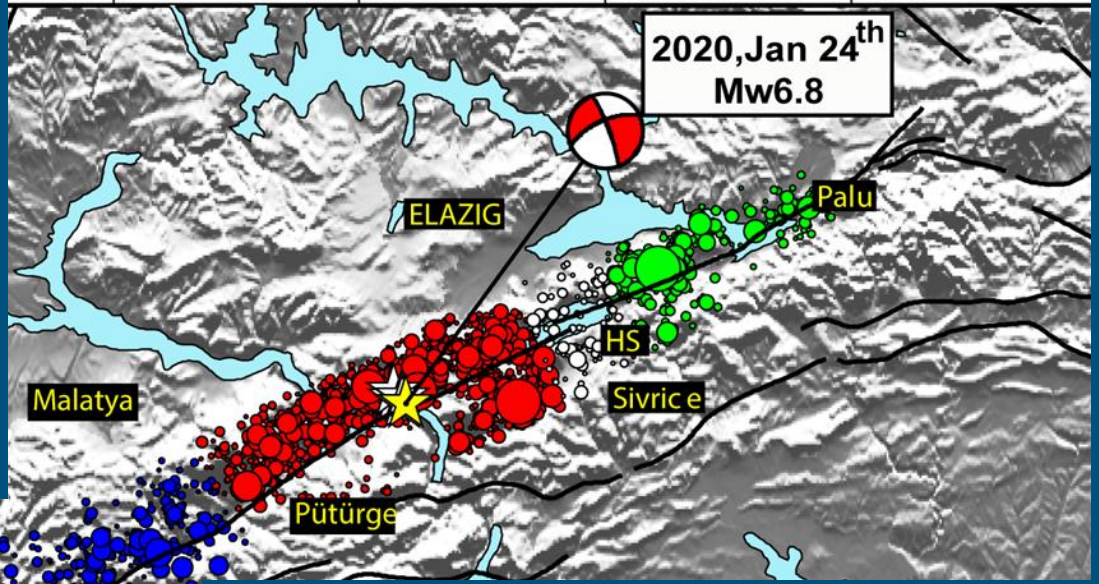
- Hypocenter of the mainshock is in the vicinity of the repeaters which might be related to the rupture initiation.

Conclusions

💫💫 **Focal mechanisms of mainshock and aftershocks indicate that the dip angle of the Sivrice segment is ~80° to N.**

💫💫 **Both the repeaters and the hypocenter of the 2020 earthquake are at a transition from higher extent of creep to lower amount of creep.**





💫💫**The relation between the creep, seismicity and segmentation is still not clear.**

💫💫💫**Future work will focus on understanding the seismotectonics and the relationship between interseismic fault behavior and seismicity.**💫💫💫

References

- Duman, T.Y., Emre, Ö. 2013. The East Anatolian Fault: geometry, segmentation and jog characteristics. Geological Society London, Special Publications, 372.
- Ergintav, Semih, et al. "New evidence for spatiotemporal fluctuations of slip rate on the East Anatolian Fault, Turkey from newly installed creepmeters and seismological data." EGU General Assembly Conference Abstracts. Vol. 20. 2019.

Supported by TUBITAK no: 118Y435 project