Three Earthquakes in the Baltimore Gneiss

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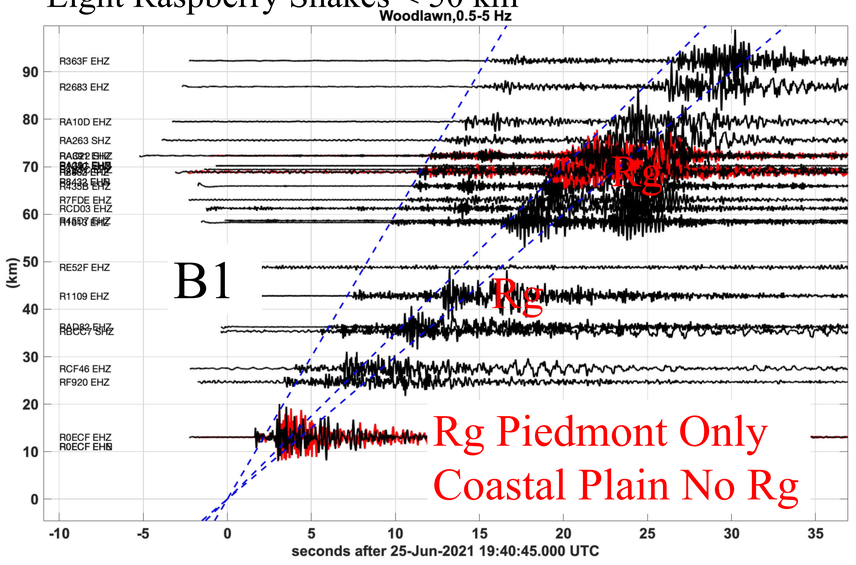
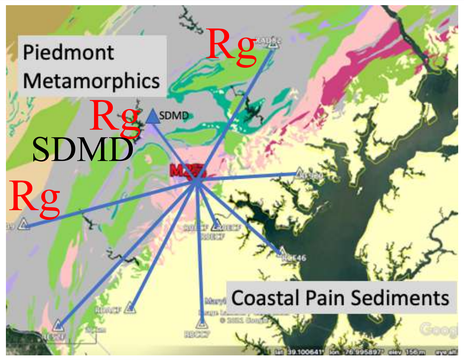
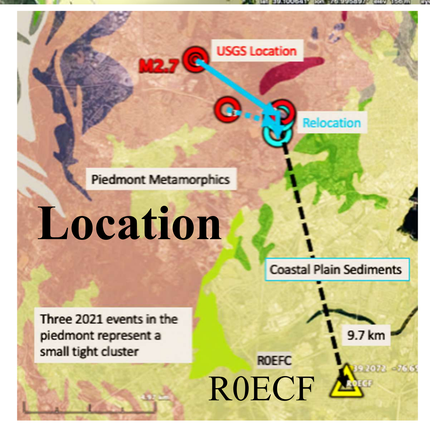
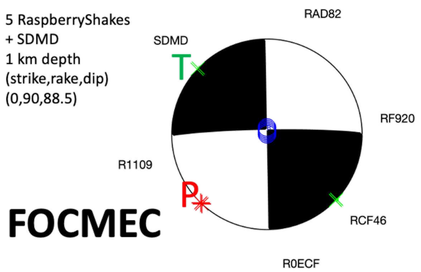
SSA Baltimore 2025

- 3 Events in Piedmont Metamorphics USGS Bulletin:
  - 20210625 19:40:45 2.5km M2.6
  - 20210627 05:53:33 5.0km M1.6
  - 20210815 05:06:04 4.8km M1.7
- Eight Raspberry Shakes < 50 km







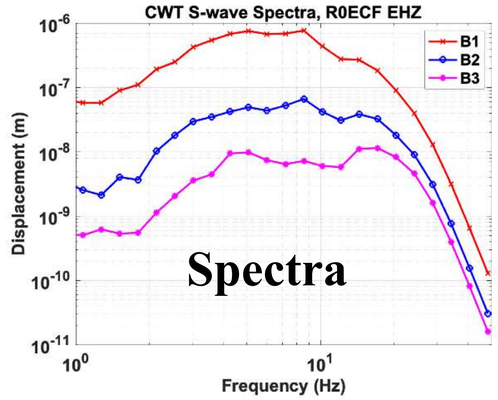


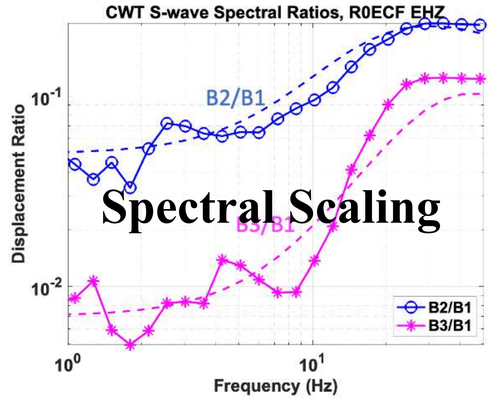
11 Raspberry Shakes P and S
OT 2021/06/25 19:40:44.707, 39.2925, -76.6839, +/- 0.5 km, H = 5.00 +/- 1.9 km, RMS 0.023 sec.
ALL THREE EPICENTERS WITHIN 1 KM

Source Scaling

Moments from Displacement Fourier Spectral Levels, 7 Raspberry Shakes, 9 components

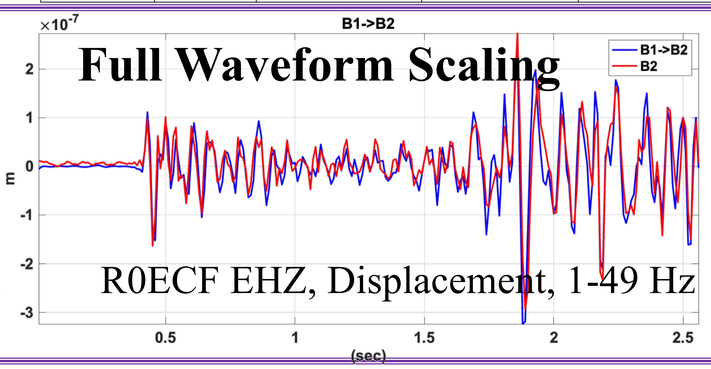
Event	Mw, S wave	Mw ,P wave	Mw Relative	Log10(M) (Nm)	USGS MAG
B1	3.01 (9)	3.11 (9)	0.0	13.78	2.6
B2	2.29 (8)	2.43 (8)	2.38	12.78	1.6
B3	1.94 (5)	2.20 (5)	2.07	12.31	1.7





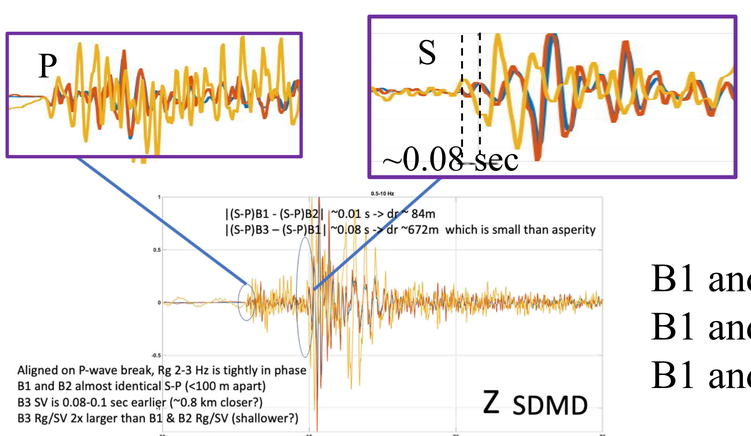
Source Parameters, R0ECF Spectral Scaling

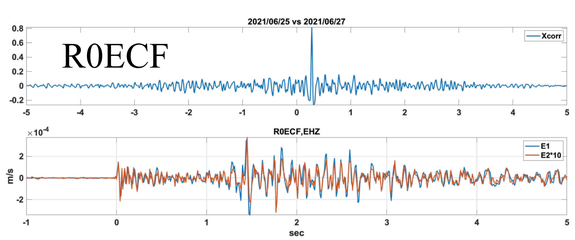
Event	Mw	M (N-m)	Relative	Fc (Hz)	Radius (m)	Stress Drop (Pa)
B1	3.0	6.0e13	1.0	7	285	1.1e6
B2	2.4	3.0e12	0.05	19	105	1.1e6
B3	2.1	4.2e11	0.007	37	54	1.1e6



Transforming B1-> B2 recovers B2 with a max CC = 0.86, 1-49Hz.
The same asperity broke with moment ratio of M2/M1 = 0.05

WAVEFORM COMPARISONS AT SDMD (19 km) AND R0EC (9.7 km)F:
B1-B2 SEPARATED BY < 100 m, B1-B3 SEPARATED BY < 700 m

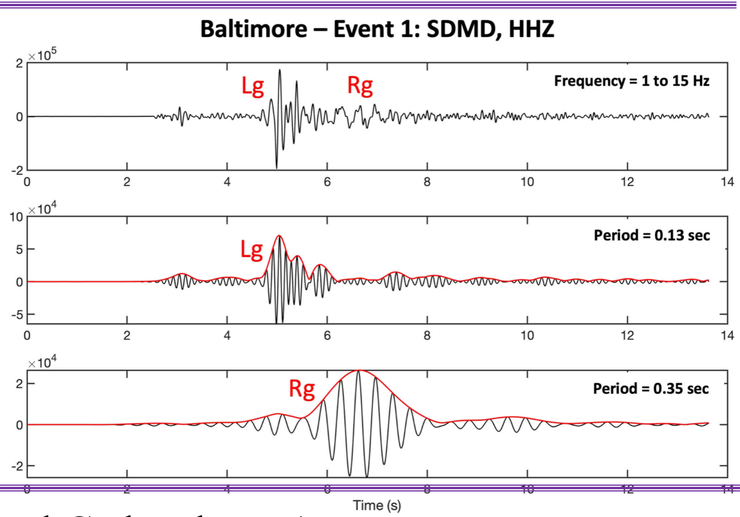




B1 and B2 are 90% coherent 3-45 Hz.
B1 and B2 S-P differ by less than 0.01 sec.
B1 and B3 S-P differ by less than 0.08 sec.

Depth From Rg/Lg

Rg was observed on multiple Piedmont Shakes and SDMD in the Piedmont above the fall line. Rg/Lg ratio based on method of Kafka (1990) favors a shallow depth < 1 km.



Citizen Seismographs Contribute Valuable Data In Sparsely Monitored Suburban Area