

Changes in AE similarity track fault kinematics during laboratory earthquakes

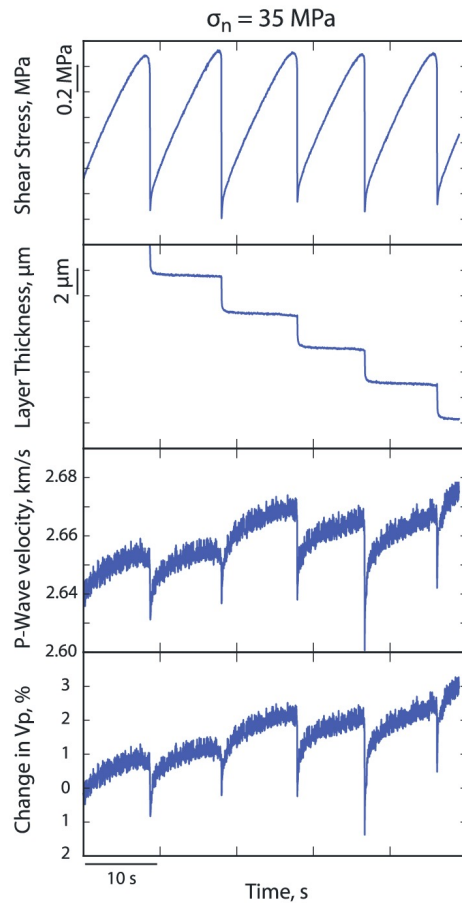
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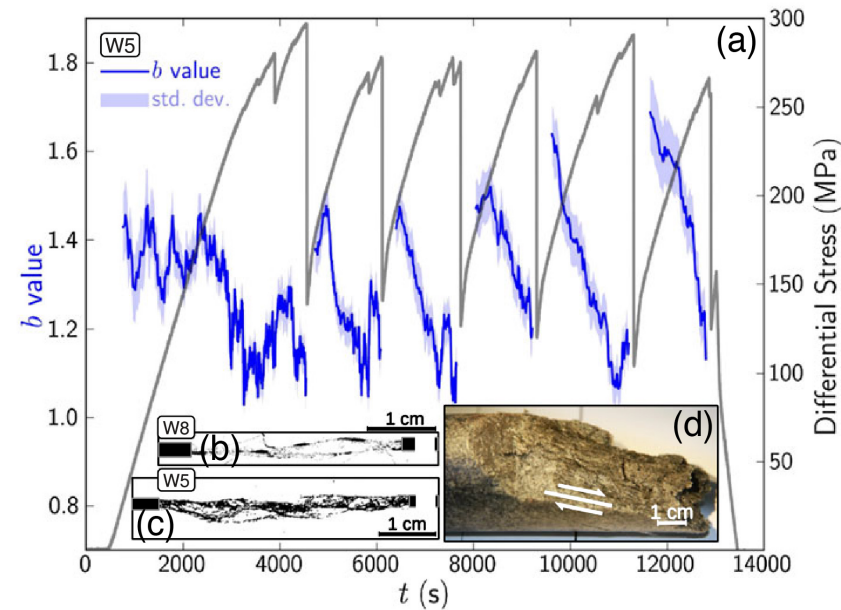
Active acoustic measurement



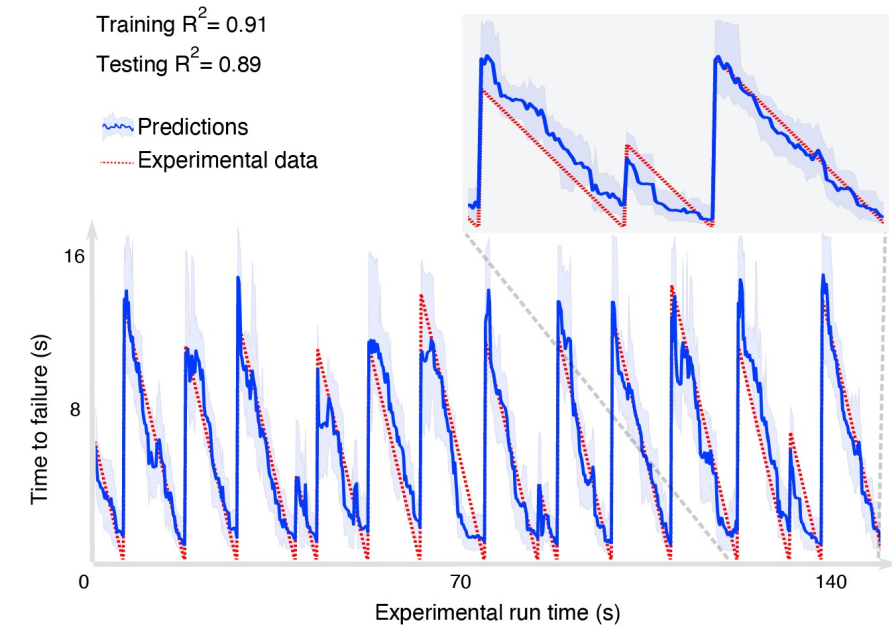
Tinti et al. 2016

Laboratory earthquake prediction

Passive acoustic measurement



Goebel et al. 2013

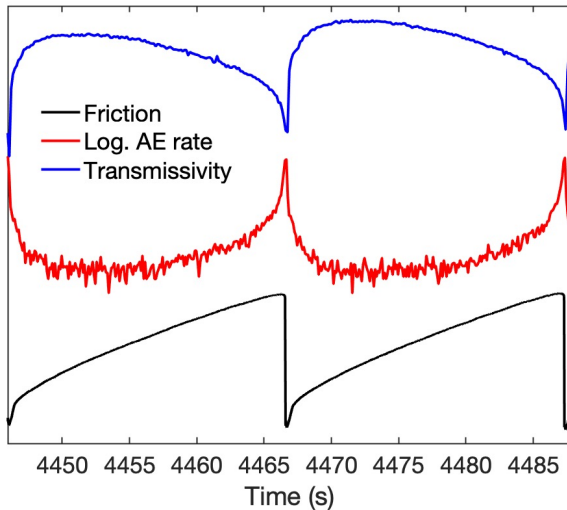
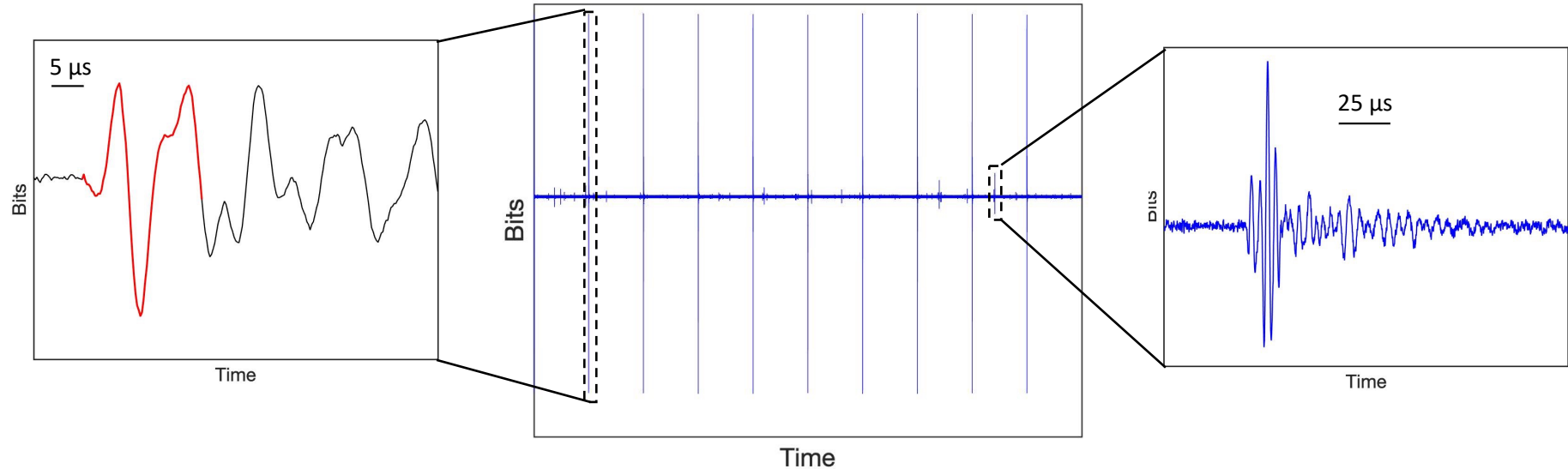
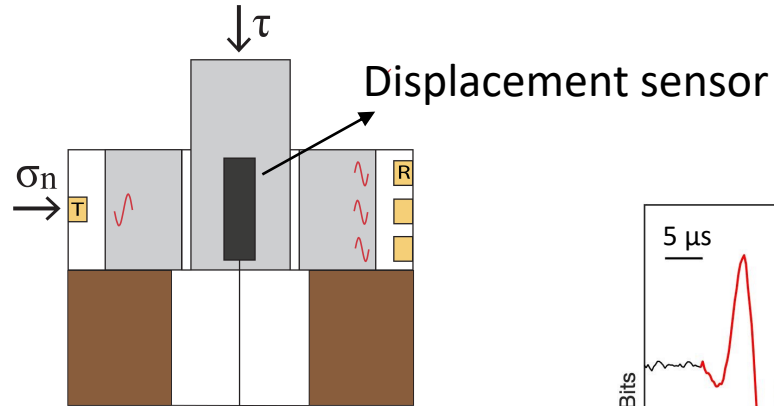


Drouet et al. 2017

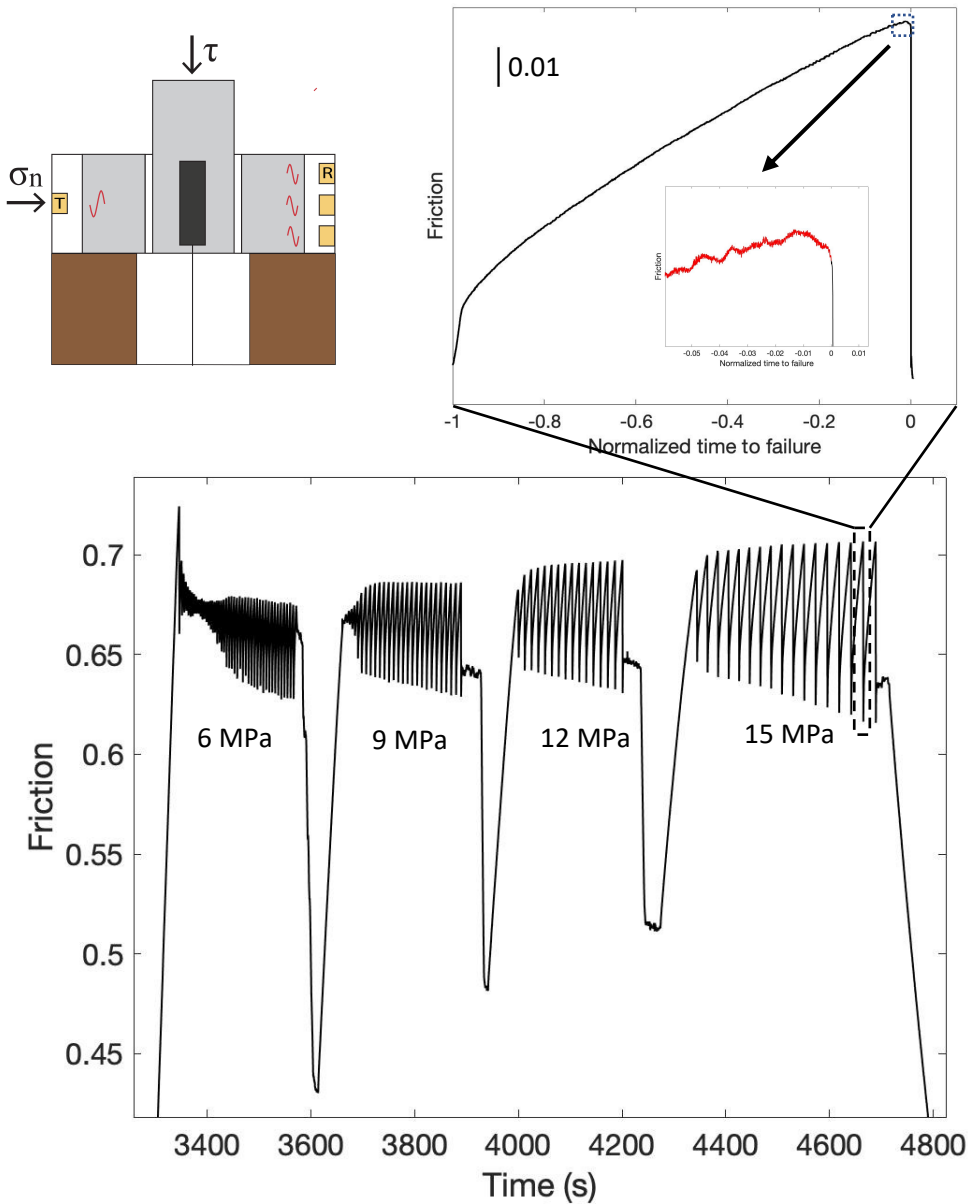
Does AE similarity provide information relevant for (laboratory) earthquake prediction ?

Definition of AE similarity: average value of the correlation matrix of a population of AEs

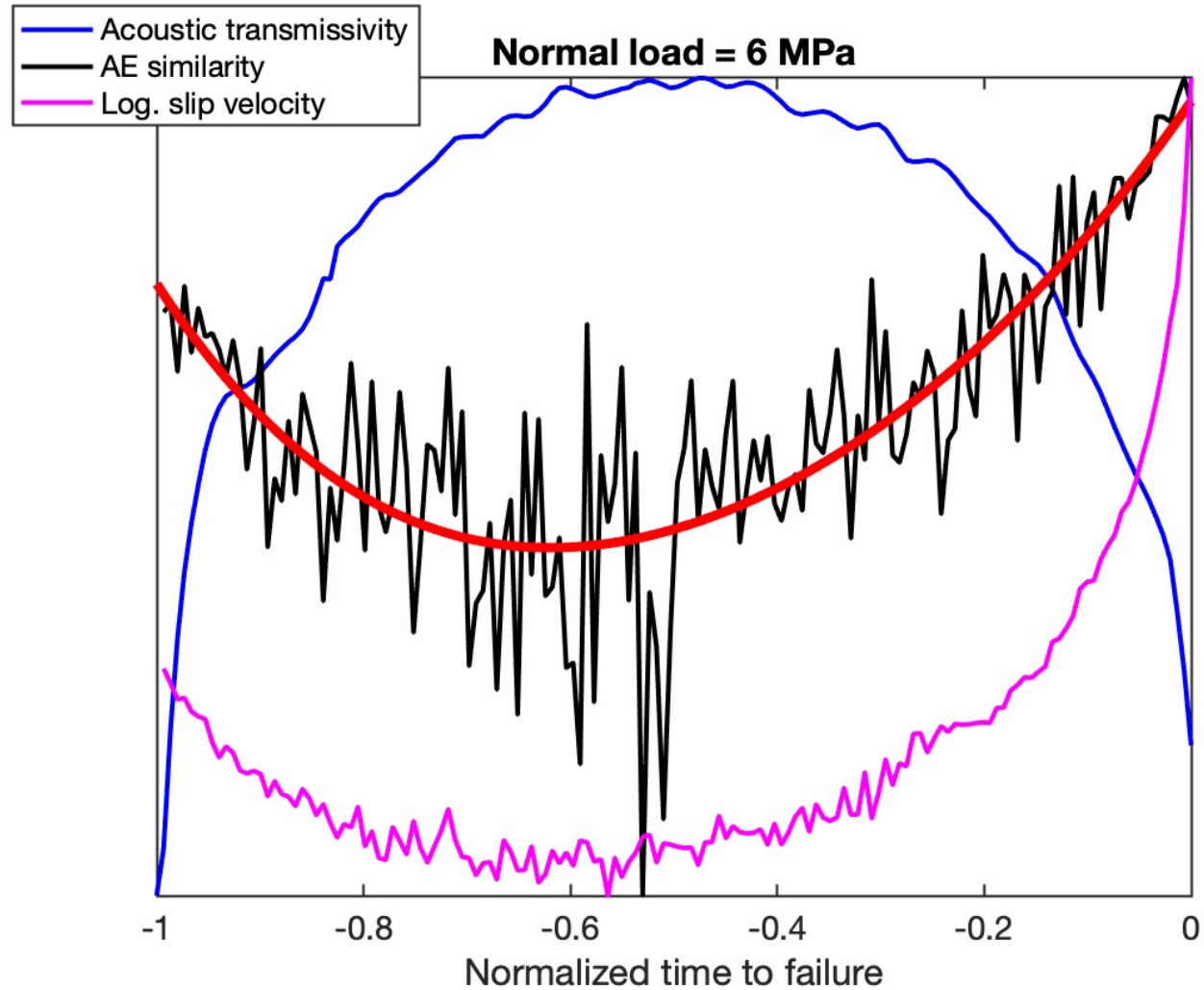
Simultaneous active and passive acoustic recording during the seismic cycle

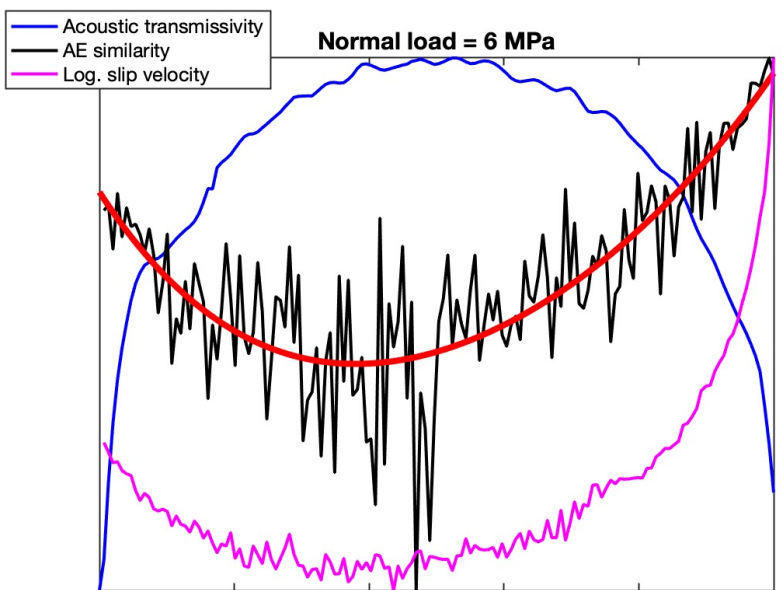


- Normal stress conditions: 6-9-12-15 MPa
- Load point velocity: 10 μ m/s
- 1 transmitter and 8 receivers. Sampling frequency: 10 MHz

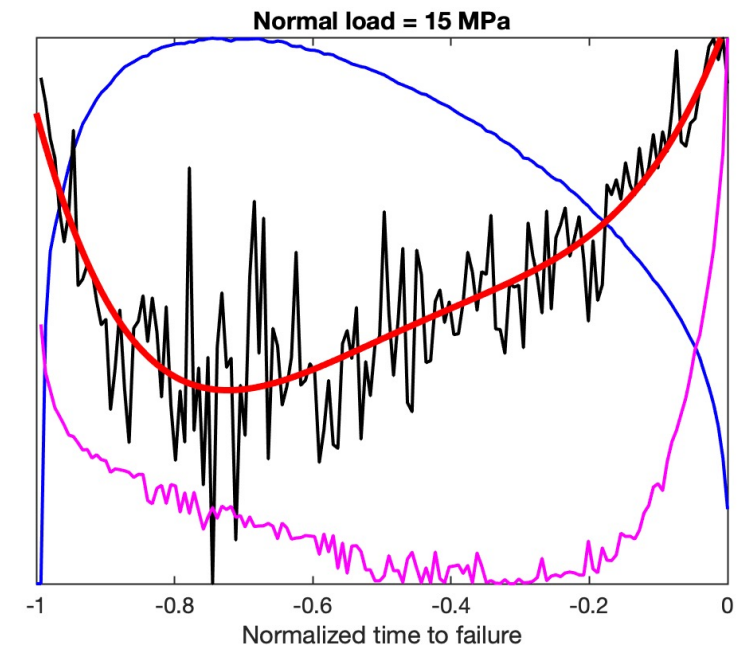
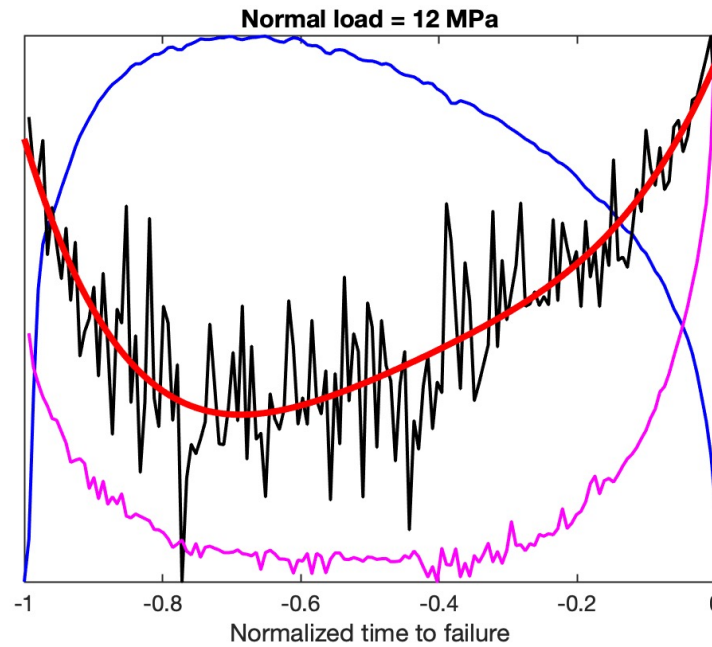
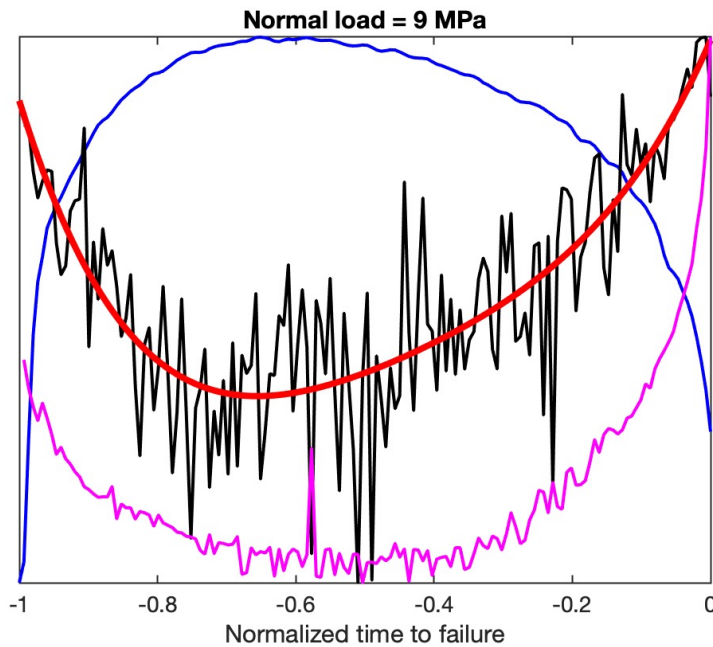


AE similarity vs acoustic transmissivity



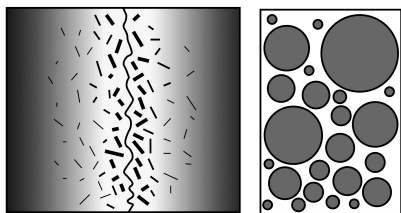


AE similarity vs acoustic transmissivity



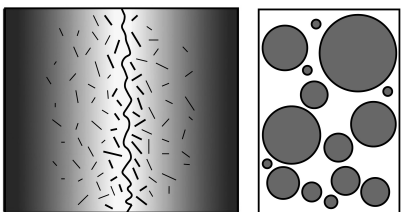
Interpretation and perspectives

A. Interseismic



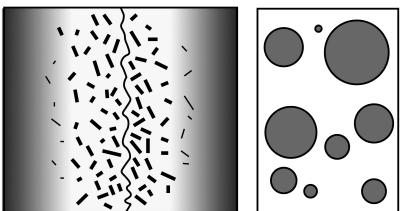
Interseismically, the fault heals as the increasing stresses in the wallrock close fractures

B. Preseismic



Preseismically, the fault slips, thus destroying asperities, while increasing wallrock stresses continue to increase the elastic modulus in a damage zone

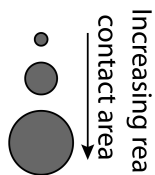
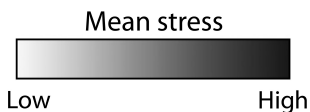
C. Co-seismic



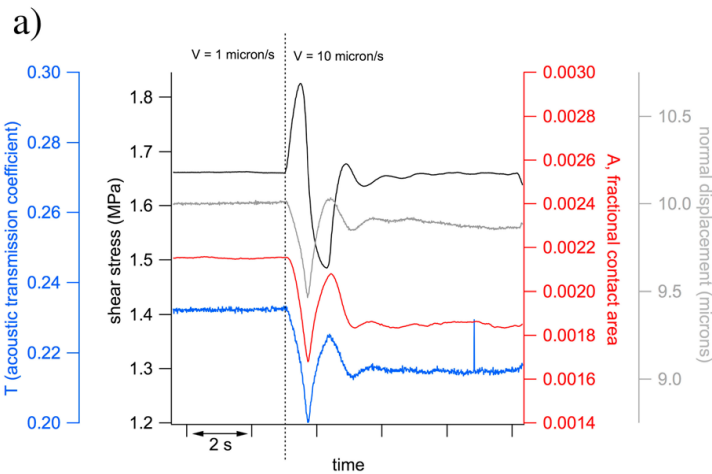
Coseismically, the fault slips and asperities are destroyed rapidly. Simultaneously, the reduced coseismic stresses open existing damage zone fractures and new fractures are created.

Fault core

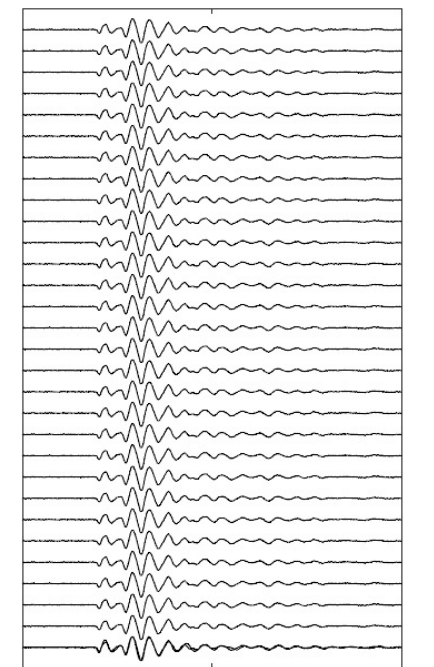
Plan view of fault asperities



Shreedharan et al. 2021



Nagata et al. 2016



Time (μs)

AE similarity is a proxy to
fault contact area



acoustic transmissivity
vs
spectral coherence