The disturbing influence of small quakes on tremor synchronization

Gaspard Farge*, Emily Brodsky*

Background

Tectonic tremor tracks slow ruptures on major plate boundary faults.

One of the most perplexing aspects about tremor is that some fault segments produce strongly periodic, spatially extensive tremor episodes, while others have more erratic, compact activity.

Tremor activity is known to be ***sensitive to dynamic stresses from nearby earthquakes***.

We measure the the spatial extent of synchronized tremor bursts in several tremor zones and compare it to the local earthquake activity.

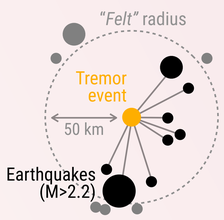
We show that small earthquakes act as local perturbations to stress cycle across the fault, thus limiting how large tremor bursts (slow ruptures) can grow.

Methods

Counting earthquakes

Tremor sources ***"feel"*** M>2.2 earthquakes within 50 km.
Perturbation to tremor sources is measured as:

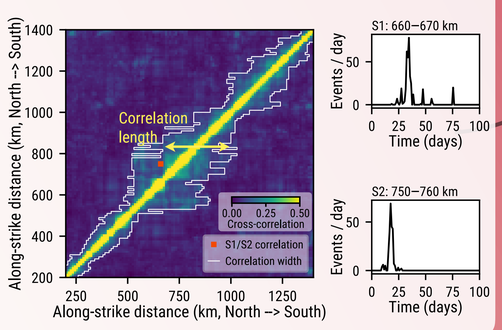
The average number of earthquakes felt by tremor in 10 km segments along strike, per year.



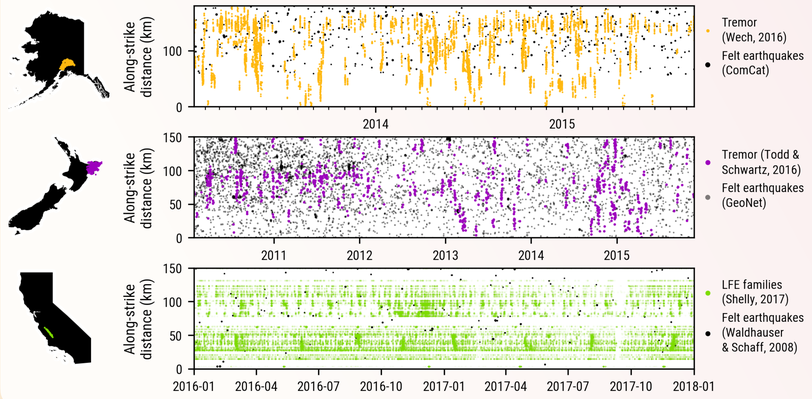
Measuring synchronization

We measure synchronization as the extent of the zone around a short segment which activity correlates well with that segment.

Effectively, this correlation distance measures ***the extent along-strike of tremor bursts*** that activate the considered segment.

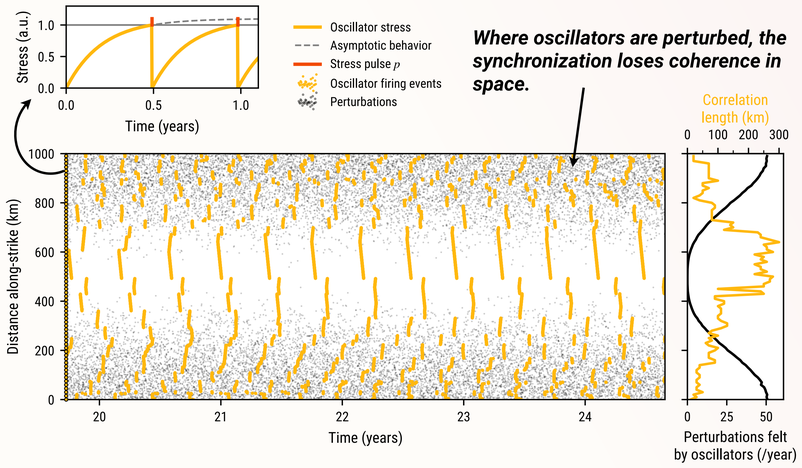


In other zones



Modeling

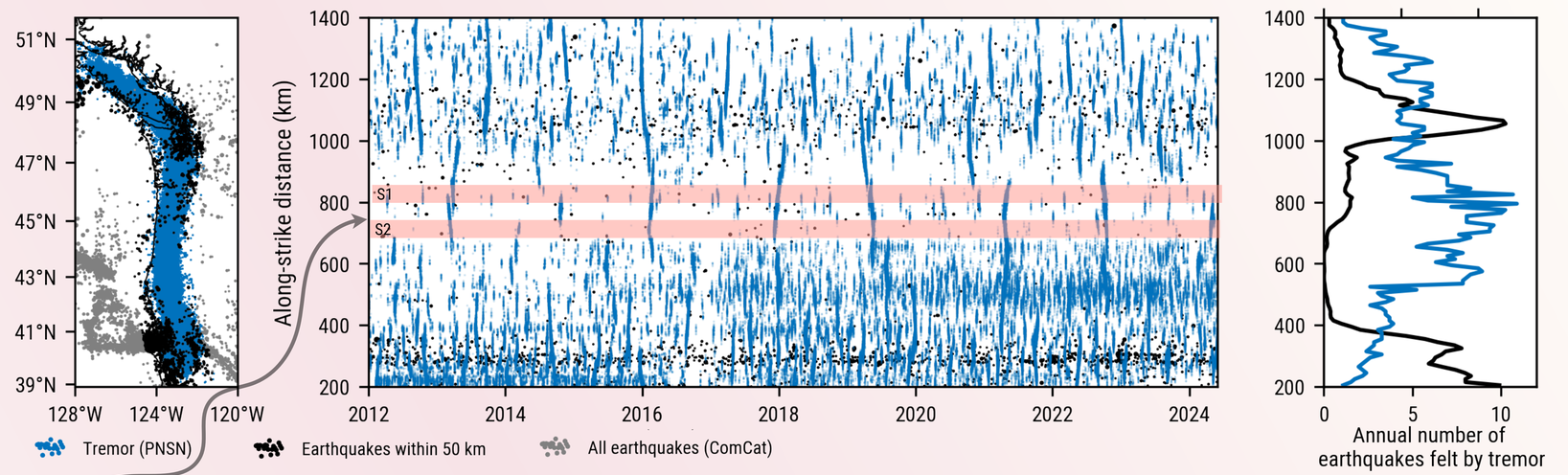
The activity of tremor sources is modeled by the cycle of ***pulse-coupled oscillators*** in a line (1,000 sources). Oscillators interact through pulses and eventually synchronize, producing system-spanning events.

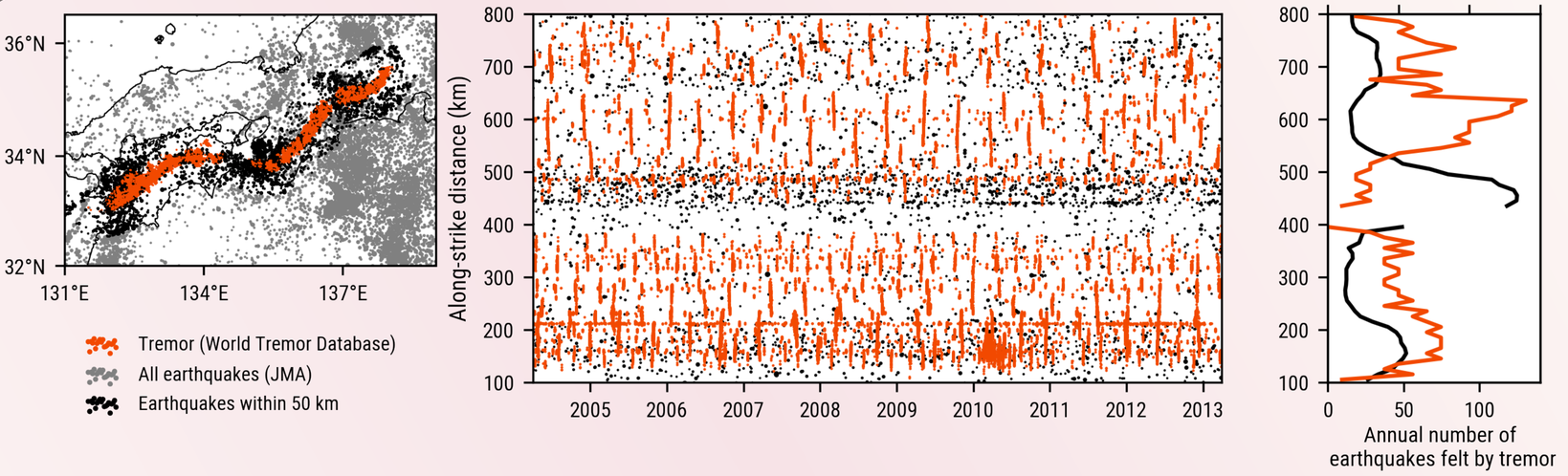


The activity of small earthquakes limits the extent of tremor synchronization

Where background ***earthquake rate is high,*** *tremor activity is* ***less synchronized*** *in space.*

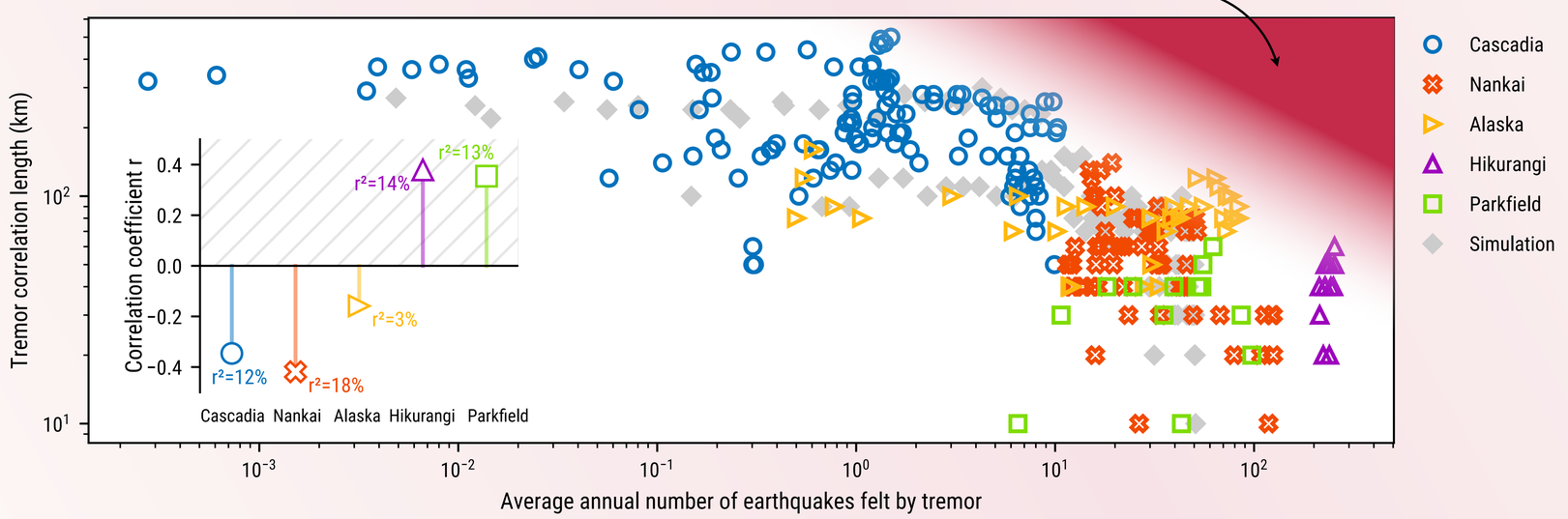
Where it is ***low****, the fault is* ***synchronized on hundreds of kilometers.***





This trend also appears when comparing tremor zones across the world.

More frequent perturbations from small earthquakes seems to inhibit fault synchronization on large scales in tremor zones.



* UC Santa Cruz
gafarge@ucsc.edu