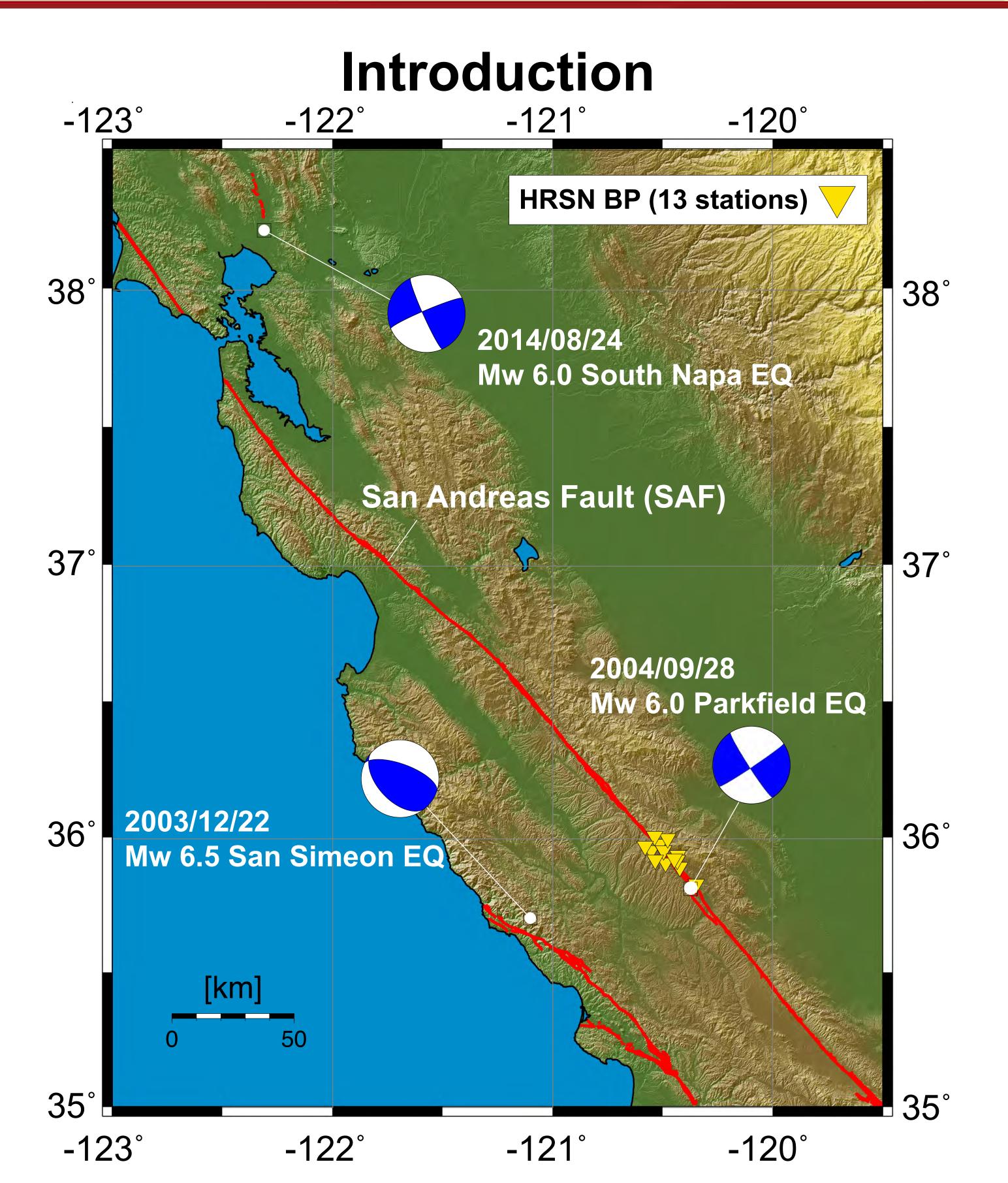
# Monitoring seismic velocity changes in 18 years at Parkfield using ambient seismic noise

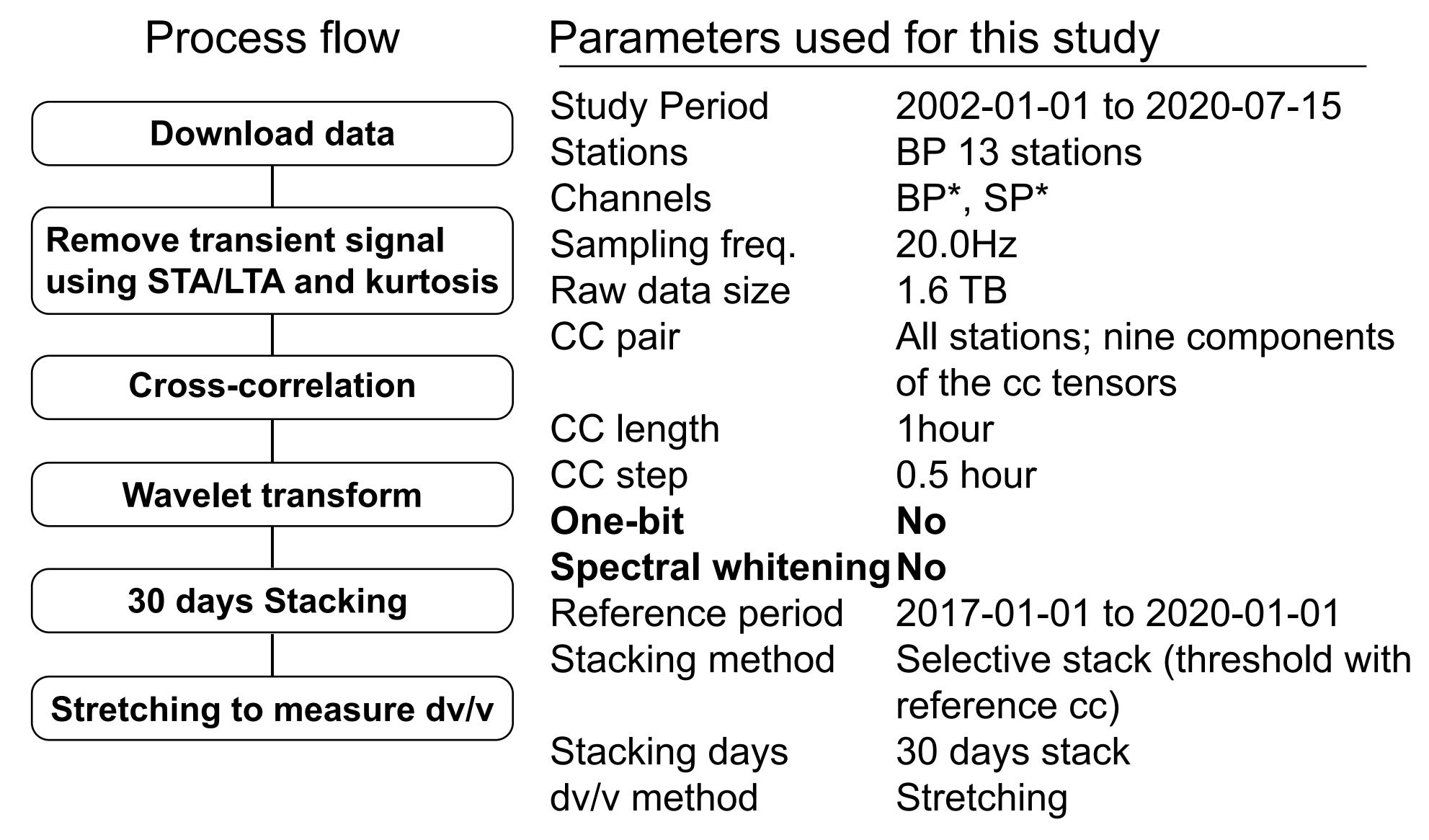
## Kurama Okubo¹; Marine A. Denolle¹

<sup>1</sup>Department of Earth and Planetary Sciences, Harvard University



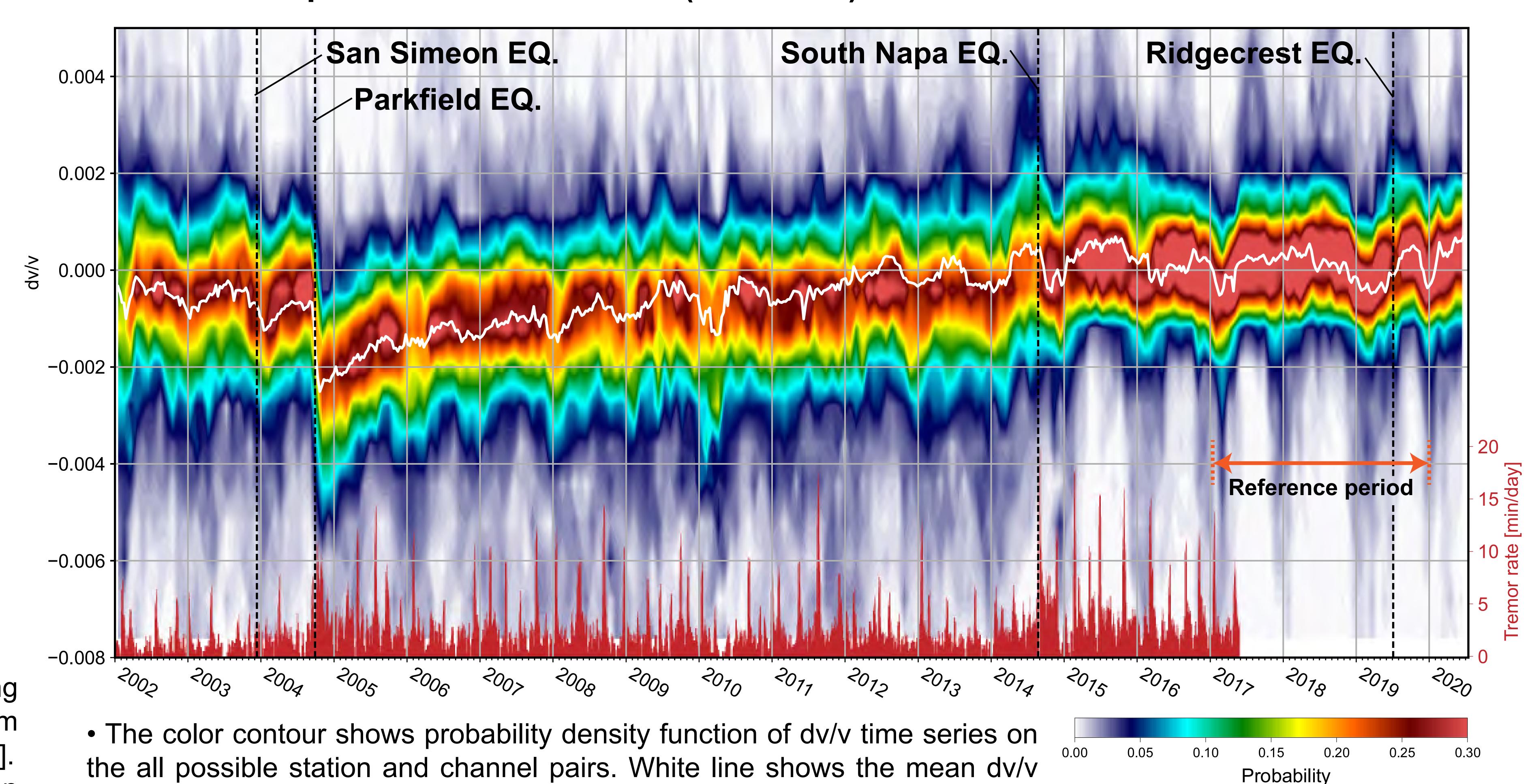
- Previous studies on ambient seismic noise monitoring have shown a coseismic decrease in dv/v and its long-term recovery at Parkfield [Brenguier et al. 2008; Wu et al. 2016].
- This study focuses on the additional connections between both fast and slow earthquakes, tectonic tremor, tidal and thermoelastic strains in 18 years temporal variations of dv/v.

### Data and Methodology



- One-bit and spectral normalization are not applied in order to preserve linear physics of wave propagation.
- To handle large dataset, we use the Julia-based tools, SeisIO.jl and SeisNoise.jl, available on github.

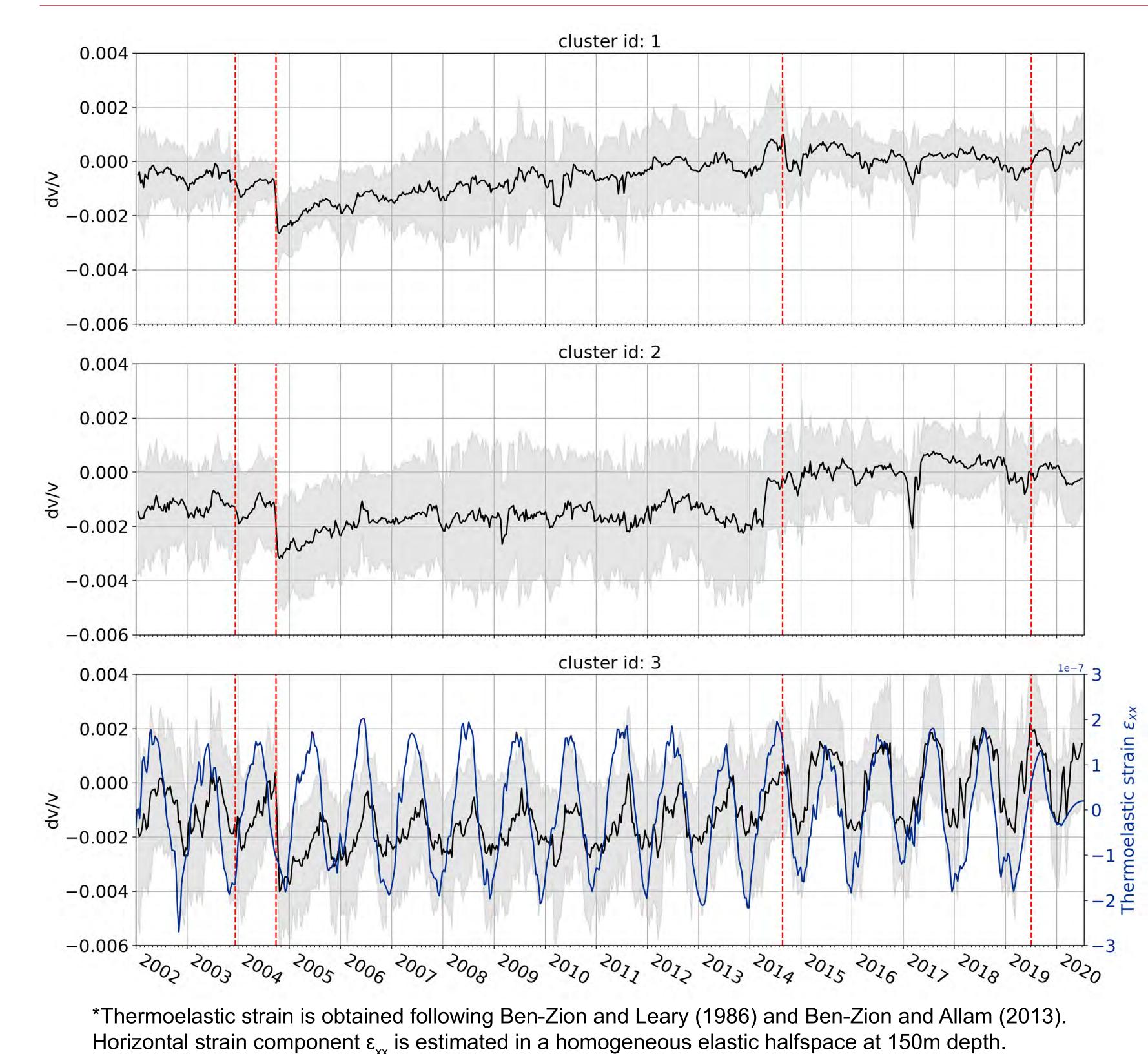
#### Temporal variations of dv/v (1.0-1.1 Hz) from 2002-01-01 to 2020-07-15



• The color contour shows probability density function of dv/v time series on the all possible station and channel pairs. White line shows the mean dv/v after removing outliers. Tremor rate on SAF is obtained from independent catalog [Delbridge et al., 2020].

\* The catalog of tremor rate is currently available from 2001.08 to 2017.05.

#### K-shape clustering of dv/v time series



Reference:

• We conducted K-shape clustering [Paparrizos and Gravano, 2015] on the set of dv/v time histories associated with all possible station and channel pairs.

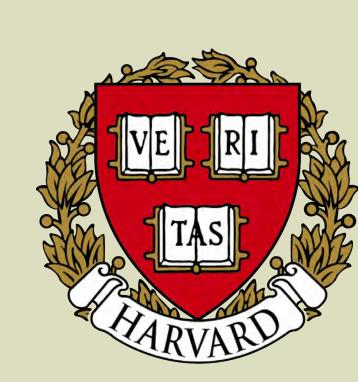
• Cluster 3 (bottom) shows seasonal variation, whose cycle is harmonized with the thermoelastic strain at depth estimated from the variation of surface temperature.

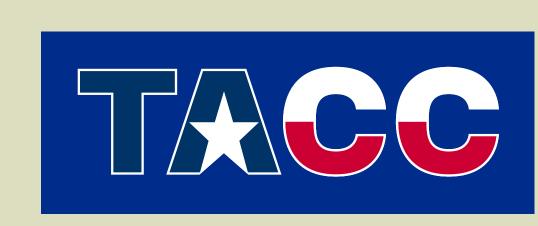
#### Conclusion

- The dv/v time history in 18 years shows that the long-term post-earthquake healing of the 2004 Parkfield earthquake continues today.
- Although we removed tremor signals from waveform before cross-correlation, the dv/v shows consistent fluctuation after the 2014 South Napa EQ, corresponding to the increase of non-volcanic tremor rate.
- A subset of dv/v shows seasonal variation corresponding to thermoelastic strain at depth, showing the potential to estimate the evolution of in-situ strain around faults using dv/v time history.









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