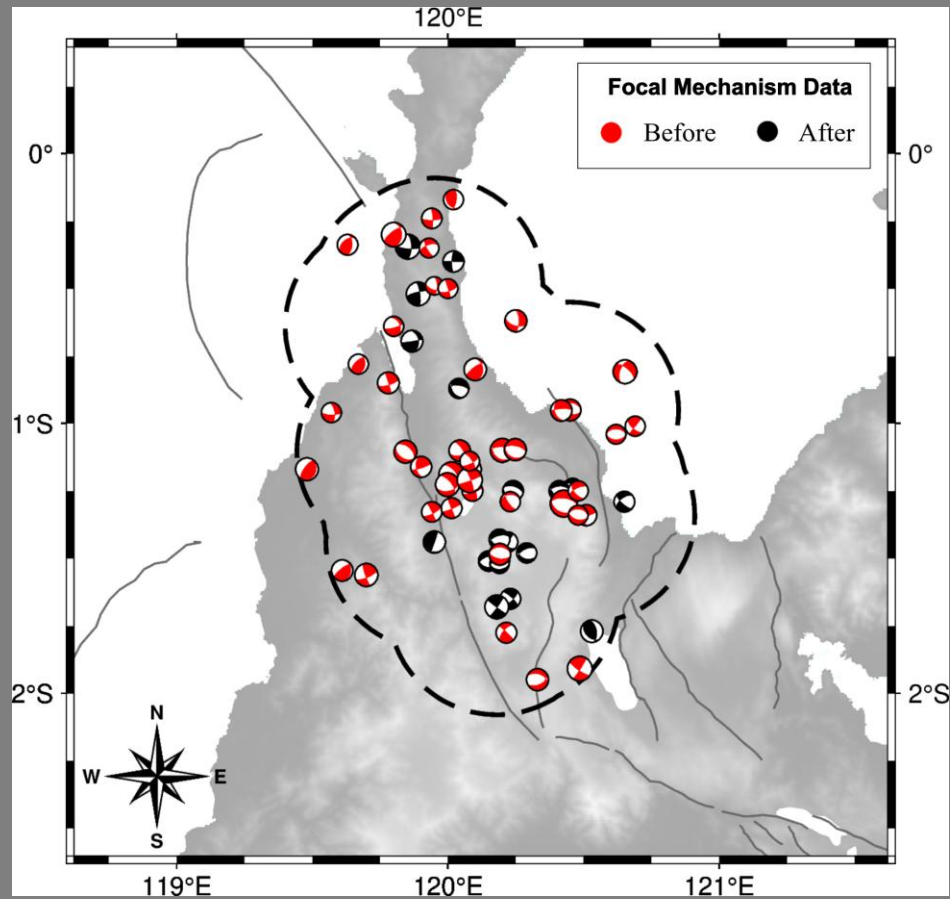
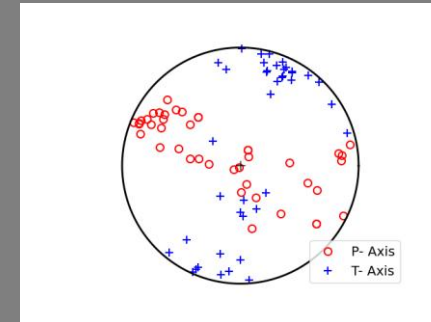


Stress Orientation Rotation of the 2018 Mw 7.5 Palu Earthquake

Focal Mechanisms Data

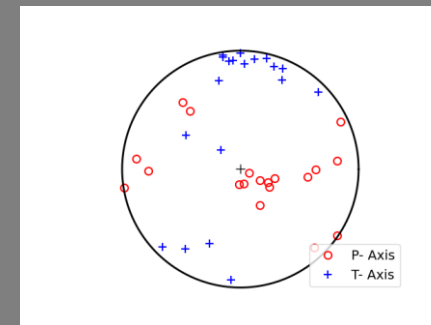


Before 2018 Mw7.5 Palu



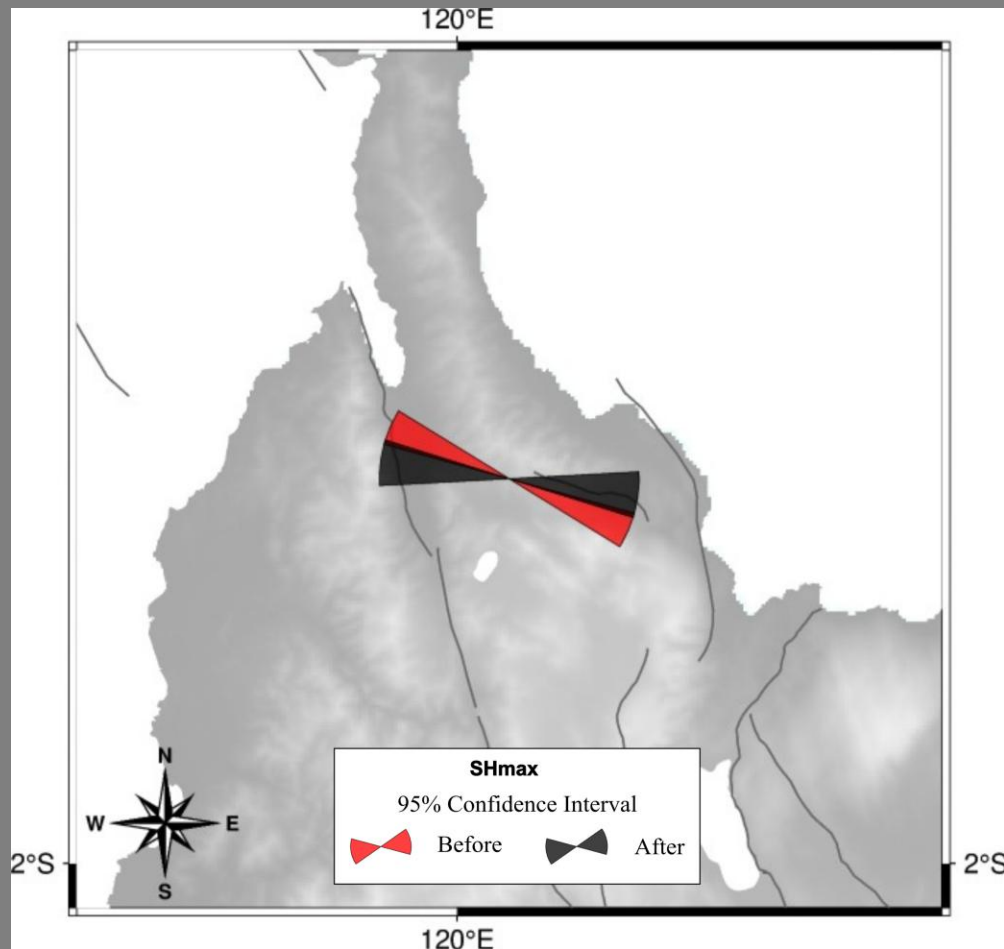
43 events
May 1977 – Sep 2018

After 2018 Mw7.5 Palu

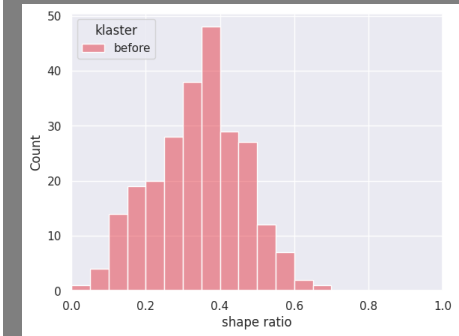
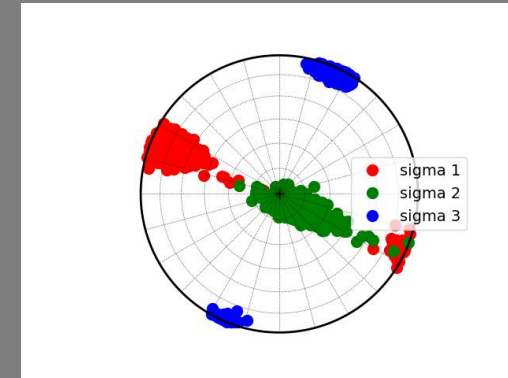


19 events
Sep 2018 – Nov 2021

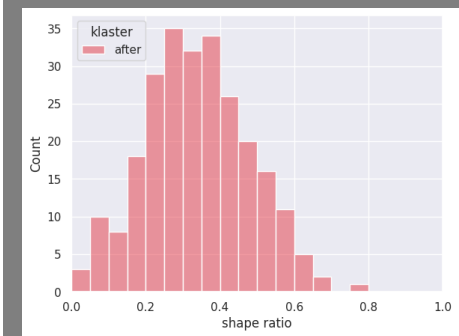
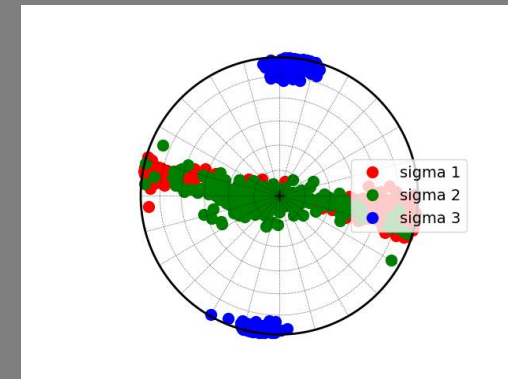
Stress Inversion Result



Before 2018 Mw7.5 Palu



After 2018 Mw7.5 Palu



	σ_1 Azimuth	σ_1 Plunge	σ_2 Azimuth	σ_2 Plunge	σ_3 Azimuth	σ_3 Plunge	SHmax
Before	112.5	33.8	125.2	54.1	19.9	7.8	113.5
After	98.7	39.9	275.7	48.2	6.6	7.2	97.2
Δ	-13.7	6.2	150.5	-5.9	-13.3	-0.6	-16.4

Stress Drop Ratio $\left(\frac{\Delta\tau}{\tau}\right)$ Calculation

To calculate the stress drop ratio, we use equation (4) in Hardebeck 2001

$$\Delta\theta = \tan^{-1} \left(\frac{1 - \frac{\Delta\tau}{\tau} \sin 2\theta - \sqrt{\left(\frac{\Delta\tau}{\tau}\right)^2 + 1 - 2 \frac{\Delta\tau}{\tau} \sin 2\theta}}{\frac{\Delta\tau}{\tau} \cos 2\theta} \right) \longrightarrow \frac{\Delta\tau}{\tau} = - \frac{\sin(2\Delta\theta)}{\cos(2\theta + 2\Delta\theta)}$$

Calculation of θ and $\Delta\theta$

21,874

HARDEBECK AND HAUSSON: CRUSTAL STRESS FIELD IN CALIFORNIA

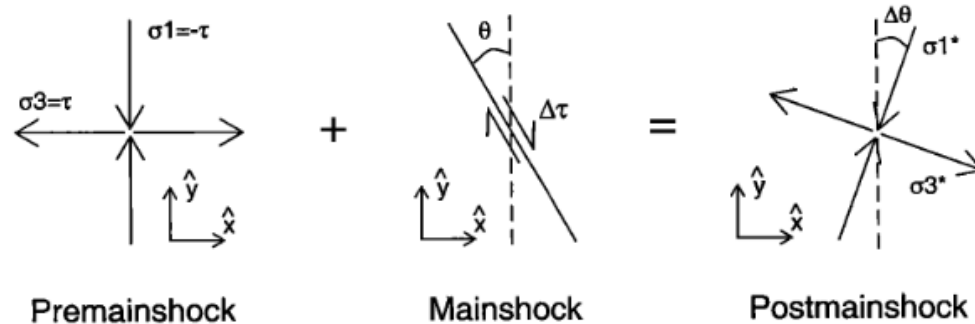


Figure 8. Assumed geometry of a stress rotation due to slip on a fault. The postmainshock stress state is equal to the premainshock stress state plus the stress change due to the earthquake. The problem is assumed to be two-dimensional, so it can be represented entirely in the σ_1 - σ_3 plane. θ is the angle from the fault trend to the σ_1 axis, clockwise positive. $\Delta\theta$ is the rotation of the σ_1 axis, clockwise positive. The mainshock stress drop, $\Delta\tau$, is taken to be positive for the sense of slip shown and negative for the opposite sense of slip.

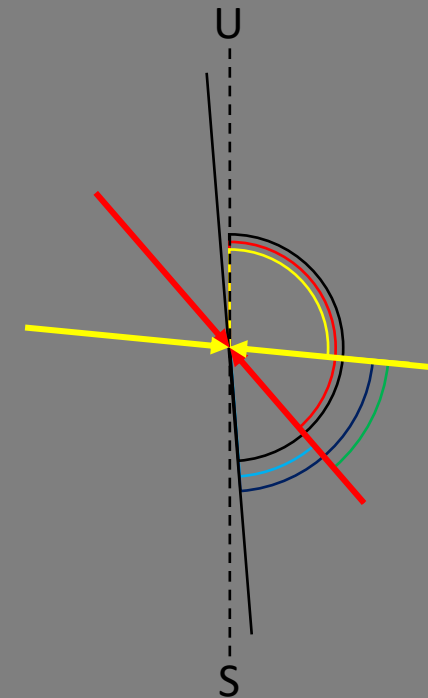
Nodal plane 2018 Mw 7.5 Palu

348.57° - 15 87.77° - 146

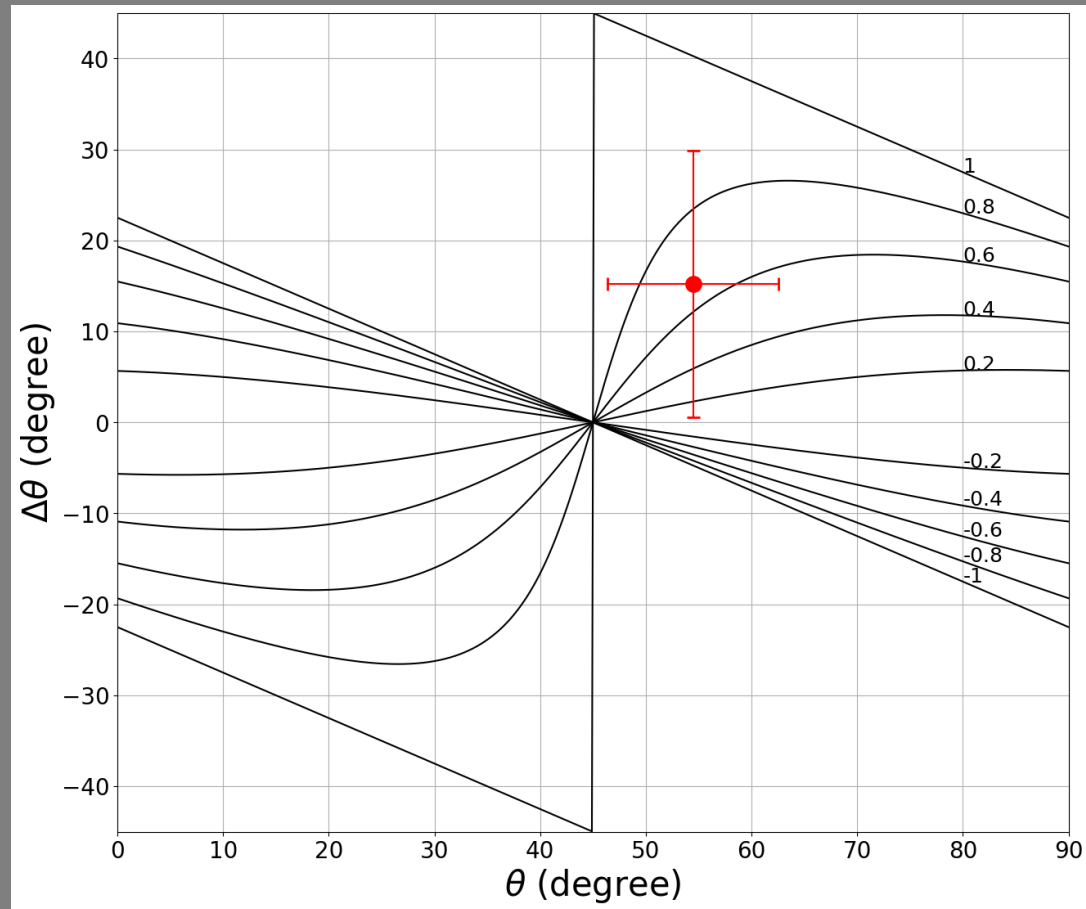
$$\begin{aligned}\theta &= 168 - 113.51 = 54.48 \\ \theta_a &= 168 - 97.16 = 70.84 \\ \Delta\theta &= 70.84 - 54.48 = 16.36\end{aligned}$$

Fault | **Before** | **After** | $\theta + \Delta\theta$ | θ | $\Delta\theta$

Hardebeck & Hauksson 2001 say that θ and $\Delta\theta$ are calculated on the $\sigma_1 - \sigma_3$ plane. Since the mechanism of the 2018 Mw7.5 Palu earthquake is strike-slip, the $\sigma_1 - \sigma_3$ plane is horizontal, so the angle used is SHmax with respect to the strike of fault.



Model Stress Drop 2018 Mw 7.5 Palu by SHmax



$$\begin{aligned}\theta_b &= 54.5 \pm 8.1 \text{ (46.4 - 62.6)} \\ \Delta\theta &= 15.2 \pm 14.7 \text{ (0.5 - 30.0)} \\ \frac{\Delta\tau}{\tau} &= 0.67 \pm 0.46 \text{ (0.03 - 0.95)}\end{aligned}$$