The structural architecture of fault zones at depth

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Abstract:
The geometric and mechanical properties of fault zones are believed to affect many aspects of earthquake physics, including the seismic energy budget, aseismic processes, and earthquake triggering potential. Most of our knowledge about these structural properties comes from observations on the surface, but at depth, our understanding is far more incomplete. To improve on these shortcomings, we produced detailed seismicity catalogs with a template matching detection technique for several highly-active sequences in California and Japan, and relocated them with a cluster-based double-difference algorithm. These catalogs illuminate the rich 3D geometric properties of fault zones at depth, providing a better understanding of structural complications like damage zones, fault zone variations with depth, and orthogonal faulting. This information can be used, along with observations of postseismic deformation and intricate spatiotemporal patterns of seismicity, to constrain multiple important aspects of the earthquake rupture process that are unobservable from seismology alone.