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The Effects of Cracks and Fluids on Post-Seismic Healing

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It is now well established that large seismic events change the surrounding velocities, and that these velocities slowly recover over time. Precisely which mechanisms control the recovery process are less well understood. We present the results of laboratory experiments to better characterise what properties of the underlying material control the recovery process. We do this by mixing two waves, one which perturbs the velocity of the sample (as an earthquake does in field data) and one which senses the change in velocity (as in changing noise correlations). This is an inherently nonlinear experiment as we mix two waves and measure the effects of this wave mixing. Within our experiments, we vary the properties of the samples to understand which are most important in controlling the nonlinear response. We focus on two mechanisms. The first is fractures and how changes in fracture properties change the nonlinear response. The second is fluids, in particular the effect of low saturations on the nonlinear response. By changing the fluids and fractures we can turn on and off the nonlinear mechanism, helping us to move toward a better understanding of the underlying mechanisms of these wave-wave interactions.