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# Nonlinear elasticity and temporal monitoring of the crust using ambient seismic noise

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Ambient seismic noise provides a powerful tool for monitoring temporal changes in the mechanical properties of the crust. Studies utilizing ambient seismic noise have been conducted in a number of settings, providing data on time-dependent changes in seismic wave speeds during a variety of faulting events. While these observations show that small changes in the mechanical properties of the crust can be reliably measured using noise, it is not a clear how to interpret these changes and how to relate these changes to the stresses and strains of faulting events. Here, we use ambient seismic noise to explore time-dependent changes of seismic wave speeds during various faulting events, including earthquakes and aseismic slow slip events. We relate the changes to observed strains and strain rates, as well as the time-dependent recovery following faulting, and encapsulate our results in a nonlinear elastic model framework. Through this model, we can compare to analogous laboratory measurements on the nonlinear elastic properties of rocks and other materials. Our results show that the crust exhibits a complex, nonlinear elastic behavior, and provides useful constraints for how to interpret monitoring studies of faults and other systems.