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# Temporal Changes of Subsurface Velocities during Strong Shaking

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We apply a deconvolution method to a strong motion dataset recorded at the surface and in boreholes in northeast Honshu, Japan. We try to characterize the nonlinear effects of the subsurface soil during strong shaking and show the change of the subsurface velocity structure during the shaking.

The deconvolved waveforms reflect the subsurface velocity structure, and their horizontal and vertical components correspond to S- and P-wave, respectively, traveling from the borehole to the ground surface. The strong motion records with smaller values of peak acceleration do not include significant non-linear effects, so the deconvolved waveforms of the observed accelerations can be well simulated by the program SHAKE91.

For high acceleration motions during the shaking of two separate earthquakes, large reductions of near-surface velocities are seen. In results for the 2008 Iwate-Miyagi Nairiku earthquake, the large high-frequency ground motions over 4g at one near-source station, caused a non-linear response of the soil, and the reduction of the average shear wave velocity reached 24%. This corresponds to a stiffness change of over 75%. The soil properties and the stiffness coefficient which changed during the shaking did not fully recover after the shaking, leaving a static change.