In Japan, seismic waves slower after rain, large earthquakes

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An earthquake is first detected by the abrupt side-to-side jolt of a passing primary wave. Lagging only slightly behind are shear waves, which radiate out from the earthquake's epicenter and are seen at the surface as a rolling wave of vertical motion. Also known as secondary or S waves, shear waves cause the lifting and twisting motions that are particularly effective at collapsing surface structures. With their capacity to cause damage, making sense of anything that can influence shear wave vertical velocities is important from both theoretical and engineering perspectives.

In Japan the Kiban-Kyoshin network (KiK-net) is made up of 700 seismic detection stations spread across the country. Each station has two separate seismic detectors, one at the surface and one buried in a borehole. Analyzing the KiK-net data for the nearly 112,000 earthquakes that hit Japan between 2000 and 2010, Nakata and Snieder identify a number of relationships that seem to affect shear wave vertical velocities in the near surface.

The authors find that in the months following a major earthquake, shear wave velocities at nearby stations were cut down by 3 percent to 4 percent. Further, the authors find that the shear waves that propagate fastest oscillate in the direction of motion of the underlying tectonic plate. Finally, they find that the shear wave velocity changed with the season. In the southern reaches of Japan the summer months are marked by heavy precipitation. Comparing rainfall records with the data derived from KiK-net's observations, the authors find that shear wave velocities

were significantly reduced following periods of heavy rainfall. They suggest that groundwater infiltration would fill any cracks in the subsurface, increasing pore pressure and reducing seismic wave velocities.

More information: Estimating near-surface shear wave velocities in Japan by applying seismic interferometry to KiK-net data, *Journal of Geophysical Research-Solid Earth*, doi:10.1029/2011JB008595 , 2012

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