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Decrease of crustal shear wave velocity associated with the 2004, Mw = 6.6 Mid-Niigata earthquake

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We applied interferometric methods to correlation functions of seismic noise to monitor small temporal variations of the seismic velocity in the Earth Crust. The auto-correlation function of seismic noise recorded at a single seismometer located in the vicinity of the source region of the Mw = 6.6 Mid-Niigata earthquake was computed. Analysing the temporal evolution of the auto-correlation function, which is interpreted as the source-receiver co-located elastic wave Green's function, we detect a sudden decrease of relative seismic velocity in the Earth crust of -0.6% that coincides with the occurrence of the earthquake. This drop of seismic velocity is likely to be caused by the change of stress in the source region of the earthquake. Since only a single station is needed and since the technique is easy to implement, we see a high potential for this technique, which we call 'passive image interferometry', as a future real-time monitoring tool for stress changes in the Earth crust. It can be applied to fault zone monitoring, volcano monitoring, and hydrocarbon reservoir monitoring.