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Near-surface seismic velocity changes in a salt-dominated environment due to shaking and thermal stressing

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We report on results from a seismic station of the Integrated Plate Boundary Observatory Chile (IPOC) showing a superior sensitivity of seismic velocity changes in the surrounding medium to shaking and temperature.
5 years of daily autocorrelations of the IPOC network are analyzed with passive image interferometry. Due to the particular geological conditions we observe a high sensitivity of the medium around the station near Patache (PATCX) resulting in annual periodic velocity variations and temporary velocity reductions induced by ground shaking.
We observe a linear relationship between the amplitude of the velocity reductions and the peak ground acceleration (PGA) of nearby earthquakes at station PATCX. Although velocity reductions are also observed at other stations of the IPOC array for the Mw 7.7 Tocopilla earthquake a clear relationship between the PGA of this earthquake and the induced velocity reductions at the different stations is not visible.
Furthermore, we observe velocity variations with an annual and daily period. We present different arguments that these periodic changes are caused by variations of the atmospheric temperature. In this context we construct a model that starts at observed temperature variations and evaluates thermal stresses induced by the temperature gradients. Using radiative transfer based sensitivity kernels and third order elastic constants we relate the distribution of thermal stress in the subsurface to observable time shifts of coda waves. The model is able to reproduce the major features confirming that stress changes in the subsurface can be detected with noise based monitoring.