Long term changes in seismic coupling revealed by seismicity dynamics

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Seismic coupling is generally assumed to be constant in time, and to condition the maximum size that earthquakes can reach locally. Recent observations using GPS displacements of long term (> years) changes in 'interseismic' coupling of the Pacific and North American plates offshore Japan have however proved that coupling can change with time, and also that the inter-seismic phase is not stationary. We here describe a way to estimate changes in coupling using seismicity data rather than GPS displacements, allowing to explore even longer time fluctuations, i.e., lasting over at least 25 years. Several cases of decelerating or accelerating background seismicity occurring on or near the slip interface of the Pacific slab offshore Japan, prior to the 2011 Tohoku-Oki earthquake, are investigated, that suggest that non-stationary coupling is the norm rather than the exception. The cause for these time variations are still unknown, but clearly call for a reappraisal of our understanding of subduction dynamics.