

## Absolute stress release in the 2011 Tohoku-oki earthquake and pseudo-cyclic behavior of gigantic interplate earthquakes

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The rupture process of the 2011 Tohoku-oki earthquake is characterized by a large maximum slip (50 m), long slip duration (90 s), and a large stress drop (20 MPa). The long slip duration, large stress drop, extensional (normal faulting) aftershocks in a previously compressional stress regime, and low-angle normal slips at approximately the depth of the plate interface suggest that the earthquake released roughly all of the accumulated stress on the plate interface. In order to release roughly all of the accumulated stress, significant weakening of frictional strength on the fault plane must occur due to some mechanisms, such as thermal pressurization of pore fluid on the fault plane. Such dynamic weakening mechanisms of frictional strength are considered to be highly non-linear, and so strongly depends on the parameter conditions just before the earthquake. Then, the periodic occurrence of large interplate earthquakes (megaquake super-cycle) may be questioned. In fact, the most well-known sequence of large interplate earthquakes along the Nankai trough, Japan, shows repeated occurrence of them, but the periodicity is not good; the minimum interval is 90 years and the maximum 264 years [Ando, 1975]. Large variance of the recurrence interval (100 - 800 years) of outsized tsunami deposits along the Pacific coast of Hokkaido, Japan [Sawai, 2009] is also reported. Such pseudo-cyclic behavior of large interplate earthquakes can be understood by constant accumulation of stress due to steady plate motion and accidental release of stress due to dynamic weakening that strongly depends on initial conditions. If so, prediction of M9 events may be fundamentally difficult.

Keywords: 2011 Tohoku-oki earthquake, rupture process, absolute stress, megaquake, super-cycle