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Experimental observations of rupture nucleation phase on heterogeneous interface

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With friction experiments, we investigate the rupture dynamics process, in particular the nucleation part, of laboratory earthquakes conducted on a periodically heterogeneous interface between two polycarbonate plates. Thanks to photoelasticity we follow the evolution of rupture front along the fault over time and we estimate the stress-drop with a strain gauge localized at the center of the fault.

We observe that the nucleation process generally does not consist of a monotonic growth observed on homogeneous cases, but of an alternation between slow and fast parts that accelerates until it reaches a point at which fast propagation dominates. Those alternations are correlated with the position of heterogeneities on the interface. Moreover, we observe that nucleation process of ruptures with smaller stress drop last longer than ruptures with a higher stress drop. Finally, we also point out a large variability in the rupture process due to the balance between the friction heterogeneity and the uncontrolled stress heterogeneity.