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Global and local avalanches in cohesive and non cohesive granular material: crackling and seismicity

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Commonly, granular materials yield or flow if sufficiently large stress is applied, leading to avalanche-like behavior. For experimentally wedge split cohesive granular material and sheared 2D and 3D grains, we seek to understand the dynamics of these burst of activity from the local to the global scale. Whether the system rearranges locally like in the case of a fracture front propagating in a cohesive material or in the whole system like in the case of sheared granular medium, similar free scale statistics are observed for the intensity of the rearrangements. We present first an experimental setup that allows growing well-controlled tensile cracks in brittle heterogeneous solids of tunable microstructure. Also, force networks and displacement fields are measured both on two and three-dimensional sheared material for cyclically sheared photoelastic and hydrogel particles. Avalanches, their size, location and duration are extracted at the global scale from the rapid variation of the stored energy whereas at the local scale they are measured form the energy drop, displacement and acoustic activity. Statistics of those different quantities are computed and correlated to test their intrinsic entanglement and analyze their universal dynamics.