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Numerical Simulations of Conditions Leading to Dynamic Pulverization of Rocks

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Recent studies demonstrated the existence of 100-300 m wide belts of pulverized fault zone rocks in the structure of several large continental transforms, including the San Andreas and San Jacinto faults in California, the North Anatolian fault in Turkey and the Arima-Takatsuki fault in Japan. The pulverized rocks differ from other fault damage products by having a powdery texture, with very fine grain size, and deformation at the microscopic scale dominated by Mode I (opening) fractures that display little or no shear displacement (e.g. Dor et al., 2006; Mitchell et al., 2011). Detailed laboratory characterizations have established that the pulverization has a mechanical origin rather than being a weathering product (e.g. Rockwell et al., 2009; Wechsler et al., 2011). Here we attempt to clarify the conditions leading to dynamic pulverization of rocks using 3D discrete element simulations. Simulations are conducted using ESyS-Particle (https://launchpad.net/esys-particle/) a parallel supercomputer implementation (Latham et al., 2004) of the discrete element method optimised for the simulation of earthquakes (Place and More, 1999), the micro-mechanics of brittle failure (Wang et al., 2006), granular media flow (Latham et al., 2006; Hancock and Weatherley, 2010) and rock fragmentation (Mair and Abe, 2011). A parameter-space study is conducted in which synthetic rock samples with different degrees of porosity and strength anisotropy, are subjected to a range of applied boundary strain rates. The results of this study will be presented in the meeting.