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3D DEM Modelling of Fault Roughness Evolution

Steffen Abe (1), Janos L. Urai (1), and Karen Mair (2)

(1) RWTH Aachen, Geologie-Endogene Dynamik, Aachen, Germany (s.abe@ged.rwth-aachen.de), (2) Physics of Geological Processes, The University of Oslo, Norway

It is generally observed in field exposures of fault surfaces that they are not perfectly planar but instead have a characteristic roughness. In order to understand the processes which generate this roughness and its implications for the mechanical behaviour we are using numerical simulations to model the evolution of fault surfaces during fault movement.
We are using a 3D discrete element method (DEM) model of the fault where particles can broken away from the fault walls. The models consist of a box-shaped block of material containing an initial fault surface which is given a prescribed starting. A range of roughness types including both sinusoidal and flat surfaces are used. During the simulations, a constant normal stress is applied to the edges of the block, perpendicular to the fault trace and the material on opposing sides of the fault is sheared at a constant rate.
For a range of normal stresses and material properties, we observe how abrasion of the fault walls during shear changes the roughness of the fault surfaces. Initial results suggest that with increasing displacement, the long wavelength sinusoidal roughness is reduced while an amount of small scale roughness is generated. The spectrum of the observed fault roughness parallel to the slip direction, tends towards a power-law relationship with increasing slip.