Geophysical Research Abstracts, Vol. 9, 03072, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-03072

DEM Simulation of dynamic Rupture Patterns on a rough Fault

S. Abe (1) and C. Bean (1)

(1) Seismology and Computational Rock Physics Laboratory, UCD School of Geological Sciences, University College Dublin (stefan.abe@ucd.ie)

A discrete element (DEM) simulation is used to investigate the properties of dynamics rupture of a rough fault. The model fault has both intrinsic small scale roughness and heterogeneity at large spatial scales. The small scale roughness is due to the intrinsic properties of the DEM where the fault model is constructed from a large number of spherical particles. The large scale heterogeneity is introduced by varying the amount of small scale roughness along the fault.
The model, consisting of two elastic blocks separated by the fault, is started from a stress-free state. A constant shear velocity ist then applied to the outer edges of the model parallel to the fault plane and the model evolves into stick-slip dynamics.
A number of the resulting slip events have been investigated in detail. The results show that the properties of dynamic fault rupture in the model are quite similar to real seismic events in a number of aspects. We observe slip pulses which are comparable in shape and duration with those obtained from inversion of seismic data. The stress drops and rupture velocities in the model are also similar to field observations. The spatial distribution of total slip generated by the model events is best fitted by a fractal distribution. Comparisons between the pre-slip stress distribution and the displacement distribution generated by the event shows that the extent of the rupture is strongly determined by the distribution of areas with a low stress deficit before the event. Most of the area ruptured during the event is characterised by a low slip deficit, i.e. close to failure, before the event. The rupture is generally stopped by barriers consisting of areas which were far from failure before the event. However, such barriers don't always stop the rupture.