Geophysical Research Abstracts, Vol. 8, 04176, 2006
SRef-ID: 1607-7962/gra/EGU06-A-04176

Heat dissipation during frictional sliding on simulated faults

K. Mair (1) and F. Renard (1,2)

(1) Physics of Geological Processes, University of Oslo, Norway, (2) LGIT-CNRS-OSUG, Universite Joseph Fourier, Grenoble, France, (karen.mair@fys.uio.no)

Heat generated during frictional sliding is an important component of the energy budget of earthquakes. Frictional heating is a potential weakening mechanism in the earth's crust. For these reasons it is highly relevant to investigate heat dissipation during faulting. We present results from laboratory experiments where we measured heat emission during frictional sliding of simulated faults using novel thermal imaging techniques. A 3x3 cm cleaved crystal of halite (NaCl) held under constant normal load was dragged across a coarse sandpaper surface at constant slip rate. Since halite is transparent to infra-red, the heat emission at the sliding surface could be monitored using a fast high resolution infra-red camera. We also recorded surface evolution optically and monitored frictional resistance to sliding with accumulated slip through time. We characterized the thermal signature of a given experiment as the average heat signal of the interface. During sliding, the hard sand grains of the substrate created grooves in the weak salt by plastic deformation. These developing striations could be directly correlated to heat spots that were produced at the tip of each groove and persisted as a tail. When a layer of halite 'gouge' was added to the interface, friction level, and the microstructural deformation of the halite was substantially reduced, however the heat produced at the interface remained relatively constant. Moreover, some regions of the surface remained relatively cold, even after a significant amount of slip, indicating that energy dissipation was highly heterogeneous over the entire fault. Our approach offers the possibility to link microscopic thermal processes with macroscopic friction and better understand how energy partitions into different deformation mechanisms during frictional sliding on faults.