Geophysical Research Abstracts, Vol. 9, 10546, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-10546

A scaling law for morh coulomb rheology

L. Le Pourhiet (1) and Y. Podladchikov(2)

(1) UPMC, (2) UIO (laetitia.lepourhiet@lgs.jussieu.fr)

Non associated plasticity basically states that because plastic dilatation is not proportional to plastic shear strain in rocks, principal stress and principal strain may be non-collinear and lead to a structural (i.e. geometrical) decrease of strength without changing the nominal friction coefficient of the rocks. This non-linear rheology leads to stress-strain curves that are relatively coherent with experiment with a first phase of plastic hardening, a peak of stress and a phase of plastic softening. The amplitude of the peak of strength as well as the residual state of stress depends on friction angle, dilatation angle and orientation of the stress versus the shear band at the onset of shear banding and hence, they do not depend on elastic parameters. For the non dilatant case, the final steady state of our model produces similar solution as Byerlee-Savage Coulomb model or Von Misses model inside the gouge but, following Vermeer approach, we also include the possibility for the wall rock outside the gouge to unload elastically the shear band so that we have been able to quantify 1) the orientation of stresses outside the gouge and hence the most favorable shear band orientation 2) the total stress drop in the surrounding elastic media 3) the amount of shear strain needed to reach the steady state. We found that the shear band that leads to the maximum stress drop have an orientation close to but smaller than Coulomb orientation. For a given shear band thickness (a given lengthscale), we found that the amount of slip needed to reach steady state increase with the ratio of confining pressure and shear modulus (confinement) and decrease with higher poisson ratio and higher nominal friction coefficient.