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Study of the friction variation of shear bands in analogue models of accretionary wedges.

P. Souloumiac (1), B. Mary (1), J. Herbert (2), B. Maillot (1), and M. Cooke (2)

(1) Université de Cergy-Pontoise, Département Géosciences et Environnement, Cergy-Pontoise, France (pauline.souloumiac@u-cergy.fr), (2) UMASS-Geosciences, Amherst, MA, Unites Sates

Numerous works have shown the important influence of the softening of the rock strength on the evolution of accretionary wedges and of fold-and-thrust belts. We aim at comparing numerical results of limit analysis and experimental results using sandboxes in order to relate the softening into shear bands to their observed lifetime.
Numerically, the limit analysis, which consists in a quite simple optimization method, combined with geometrical constructions, demonstrates that a drop in the friction angle of active faults plays an important role on the fault lifetime. Simultaneously, analogical models using a dedicated sand box where the compressive force is monitored throughout the applied shortening, highlights the influence of the softening in dry sand : force drops associated to each fault propagation event are observed. This also means that the induced work required to propagate faults is not negligible. These force drops related to this mechanical work drops can be directly linked to the growth of new thrusts or to the reactivation of existing faults, and consequently to the softening property of sand.
The objective of this work is to compare the observed and the calculated variations of tectonic forces during the creation of new shear bands and to deduce the softening from this comparison. It is thus possible to compare precisely and at the same scale the calculated and the measured mechanical works. Softening is accounted for numerically by a linear drop in the fault friction coefficient with cumulated slip on the shear band. This yields simulations that are in good agreement with the experimental results and therefore gives us precise information on the softening in sand.
Additionally, it is possible to focus on the particular case where the deformation of a wedge occurs without softening. In a numerical model with no softening, the organization of thrusting is indeed very different and the deformation tends to be diffuse. So the next step would be to try to reproduce these results experimentally. A solution may be to use a less frictional material, as glass balls, rather than the sand in our analogical models.