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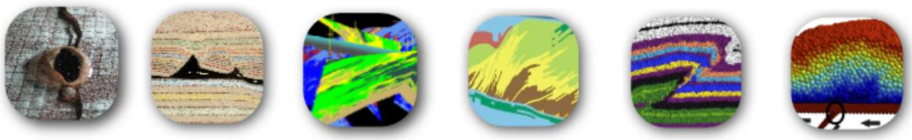

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physical experiments, salt tectonics, Levant basin, Nile cone, gravity driven deformation

Kinematic efficiency of a non-optimally-oriented pre-existing fault system using wet clay experiments

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Introduction

Slip rate of an active fault system is a key parameter to evaluate seismic potential in an earthquake prone area. There exist different methods to calculate fault slip rates, for instance exploiting geodetic data, paleoseismic trenches, or, for blind faults, restoring folds associated with active faults. In some cases, geodetic data are sparse, the active faults are located in area without recent deposits preventing paleoseismic analyses, and do not exist seismic reflection profiles to reconstruct buried folds. In all these cases, we need an indirect method to predict slip rates without using direct data. Two kinds of information are usually available in active areas: geodetic data (e.g. GPS) and basic information on the nature of the faults (e.g. geometry and kinematic). It is known that only a portion of geodetic (regional) strain rate is transferred to a slip on an active fault. To discuss this quantity, it is useful to use the kinematic efficiency ratio, that is the ratio between the regional strain and the slip on a fault (e.g. Hatem et al., 2017). The kinematic efficiency usually increases when a fault system is mature, and it is low at the beginning of fault formation. On the other hand, this efficiency is sensitive to the geometry of faults; for instance, an andersonian fault is more efficient with respect to a non-optimally oriented fault (e.g. inherited fault).
In this study we analyze the evolution of fault efficiency of reverse and strike-slip faults differently oriented with respect to the maximum stress axis. To this aim, we use wet clay analogue models.

Experimental procedures and strategy

We use an 80x60 cm claybox in which a fault is simulated pre-cutting the clay cake before the experiment (Fig. 1). This is made using a method that is able to introduce thin cuts in the clay pack simulating a fault surface (Cooke et al., 2013; Bonini et al., 2015; Bonini et al., 2016; Bonanno et al., 2017). The wet clay is a mixture of kaolin (China Clay) with a water content of 60%. The selected strain rate is 0.005 mm/second. Under these experimental conditions, 1 cm in our models is about 1 km in nature. The clay pack is 5 cm thick and represents 5 km in nature. We perform twelve experiments with different setups (Fig.1).

Experimental results and conclusions

For each experimental configuration we extract data about the evolution of the slip on faults along three traces crossing the experimental box in central and border areas. As expected, the efficiency of the faults is higher when a fault is optimally oriented, i.e. when the maximum stress axis is perpendicular to its strike and dips 30°. In this case the fault efficiency is about 30/40%. In other cases, this value changes proportional to the orientation of faults.

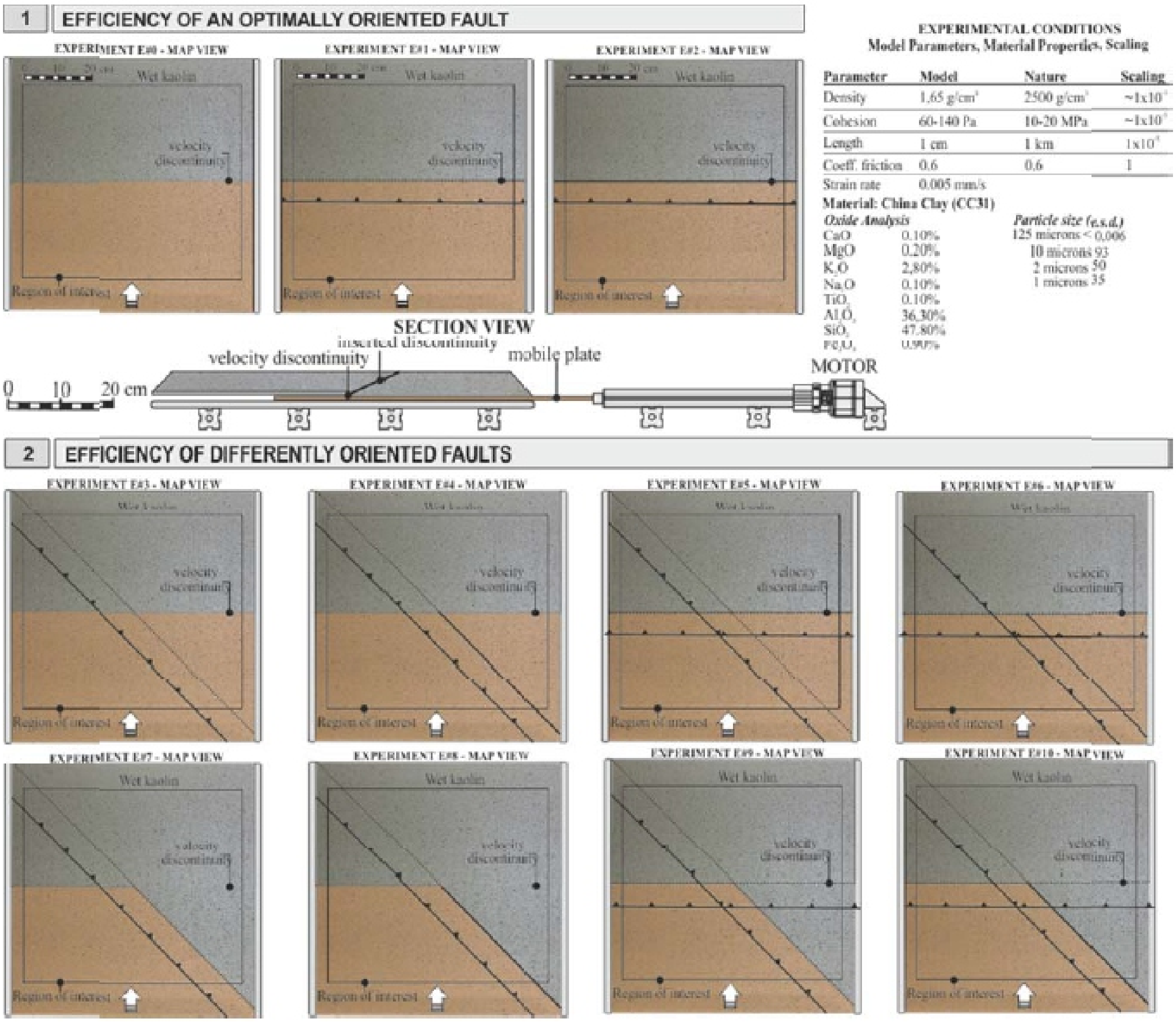

Figure 1. Plan view and cross-sectional view of the experimental apparatus and different views of the initial setups. On the right, upper panel, a table shows the experimental conditions and material parameters.

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Keywords

Fault efficiency, wet clay experiments, keyword.