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Coseismic dislocation modeling by physical experiments

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Detecting coseismic surface deformation provides useful information about geometry and kinematic of the seismogenic fault activated during an earthquake. Recent advances in inversion of geodetic data (e.g. GPS, SAR) allowed to better constrain coseismic slip at depth using fault dislocation modeling. Our study presents an analogue modeling technique to reproduce the coseismic deformation using wet kaolin. Rheological data for this analogue material support its use to simulate coseismic brittle- elastoplastic deformation of the Earth's crust acting during the earthquake cycle. We focused our experiments on continental dip-slip faults and our approach is based on the uniform slip model concept. We built two sets of analogue models: the first setup is thought to verify if our analogue modeling technique reproduces surface deformation similar to those obtained using numerical elastic dislocation models; in the second setup some mechanical weak levels have been inserted inside the analogue material to simulate preexisting discontinuities. We use high-resolution strain analysis based on digital image correlation (particle image velocimetry-PIV) and laser scanning to monitor the experiment surface deformations. The results of the first set of experiments highlighted a good correlation with those obtained by elastic dislocation numerical models. The second set demonstrates the important role carried out by mechanical discontinuities of the rocks hosting seismogenic source on the coseismic deformation detectable at the surface.