Geophysical Research Abstracts
Vol. 14, EGU2012-7667-2, 2012
EGU General Assembly 2012

On the precision of sandbox experiments – insight from test-retest variability

T. Santimano, M. Rosenau, M. Morlock, and O. Oncken
GFZ German Research Center for Geosciences, Lithosphere Dynamics, Germany (tsanti@gfz-potsdam.de)

Analogue models using granular materials are widely used to investigate deformation processes in the Earth's brittle upper crust. With the advent of high resolution deformation monitoring techniques (e.g. Particle Image Velocimetry, PIV), analogue modeling has entered the stage of becoming a potentially quantitative tool. As a classic example, fault and topographical evolution in compressional sand wedges with varying parameters are used to guide our understanding of the kinematics of orogenic belts and collision zones. However, in contrast to numerical models the results of analogue models are subject to intrinsic variability which adds complexity in understanding deformation in a natural setting and limits the transfer of labscale observation to nature. In an attempt to yield quantitatively reliable results, experimental data should be statistically analyzed rigorously and treated in a probabilistic way in order to control intrinsic variability and produce more valid conclusions. To demonstrate this approach we show results of a series of simple sandbox experiments where one parameter, the basal friction coefficient, is varied systematically from <0.4 to >0.6. With each change in basal friction, experiments were repeated up to 10 times. In particular, the statistics of the following parameters were analyzed: height, length and slope of the wedge and spacing, lifetime and dip of reverse faults within the wedge. Noticeably, differences in basal friction coefficients as little as 0.1, produces statistically significant different results. Specifically, parameters related to faults, e.g. fault dip show high precision with a coefficient of variation (CV) <0.15 and a strong correlation with basal friction. Parameters related to wedge geometry have a higher intrinsic variation (CV <0.4) and weaker correlation with the basal friction. The reasonably good reproducibility of results demonstrated here corroborates that analogue experiments are valuable tools to investigate deformation processes in a quantitative way. Nevertheless, experiments need to be repeated several times and data treated with a statistical analysis in order to make sound interpretations.