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Growth of a sand wedge : experimental uncertainties, and inversion to deduce fault strength

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The experiments consist in sliding a flat sand layer towards a stable sand wedge. Our objective is to deduce, by an inverse analysis, the evolution of fault strength from the position and life time of the first thrust ramp forming at the front of the wedge. The first, tedious but indispensable step, is to build a statistical model of the experimental uncertainties. We repeated five times the same experiment with fixed lateral walls, and five times with lateral walls accompanying the sliding. In each experiment we measured on several cross-sections the position, dip, and lifetime of the thrust ramp forming at the toe of the wedge, as well as the position, and dip of the second ramp forming further ahead. We first show that the effect of lateral wall friction disappears at a sufficient distance from the walls. We then show that the variations of the observables are similar across experiments and across suitably spaced cross-sections of the same experiment, hence justifying a useful assumption to reduce the number of experiments necessary to build statistics of uncertainties. The observable uncertainties, which are proven independent, follow either gaussian or laplacian distributions. These distributions are then extrapolated to other experiments with differing wedge and basal slopes avoiding the need to repeat them, and providing a probabilistic data set for inversion purposes. The direct problem consists in predicting the observables assuming rigid-plastic behaviour (Coulomb friction with strain weakening). The mechanical theory used to solve this problem is described by Souloumiac et al. (this conference). We are currently calculating the misfit between the real data and the predicted observables according to the type of data uncertainty. Final probability distributions of the friction

parameters will be compared to independent measurements.