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Initiation process of a thrust fault revealed by analog experiments

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We conducted 2D (cross-sectional) analog experiments with dry sand using a high resolution digital image correlation (DIC) technique to reveal initiation process of a thrust fault in detail, and identified a number of "weak shear bands" and minor uplift prior to the thrust initiation. The observations suggest that the process can be divided into three stages. Stage 1: characterized by a series of abrupt and short-lived weak shear bands at the location where the thrust will be generated later. Before initiation of the fault, the area to be the hanging wall starts to uplift. Stage 2: defined by the generation of the new thrust and its active displacement. The location of the new thrust seems to be constrained by its associated back-thrust, produced at the foot of the surface slope (by the previous thrust). The activity of the previous thrust turns to zero once the new thrust is generated, but the timing of these two events is not the same. Stage 3: characterized by a constant displacement along the (new) thrust. Similar minor shear bands can be seen in the toe area of the Nankai accretionary prism, SW Japan and we can correlate the along-strike variations in seismic profiles to the model results that show the characteristic features in each thrust development stage.