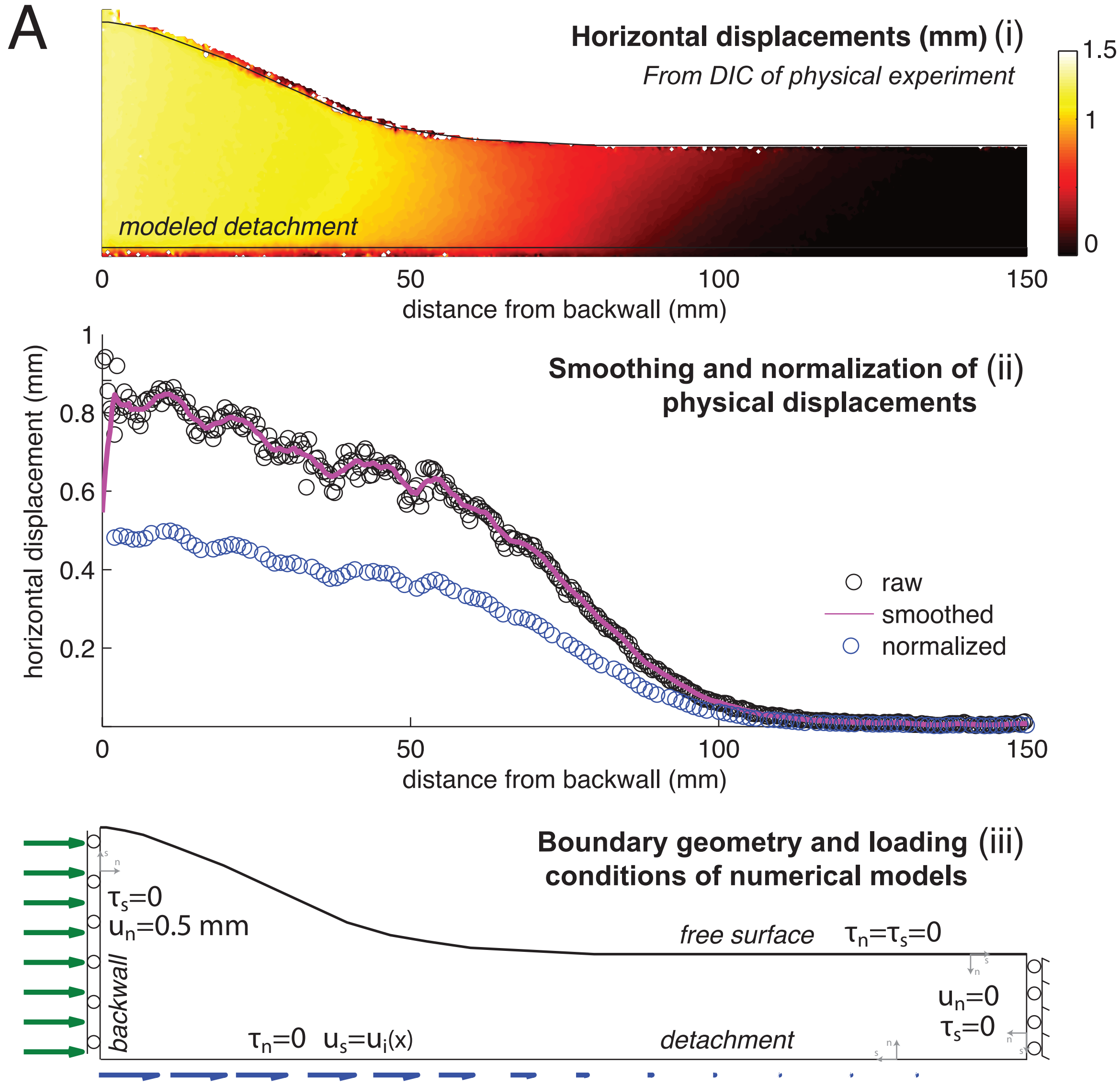
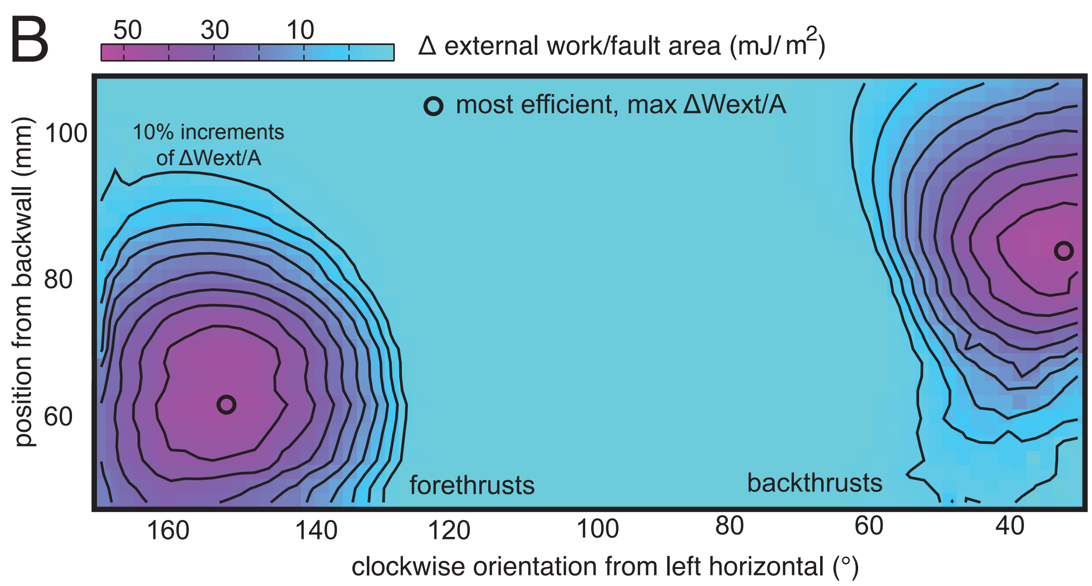
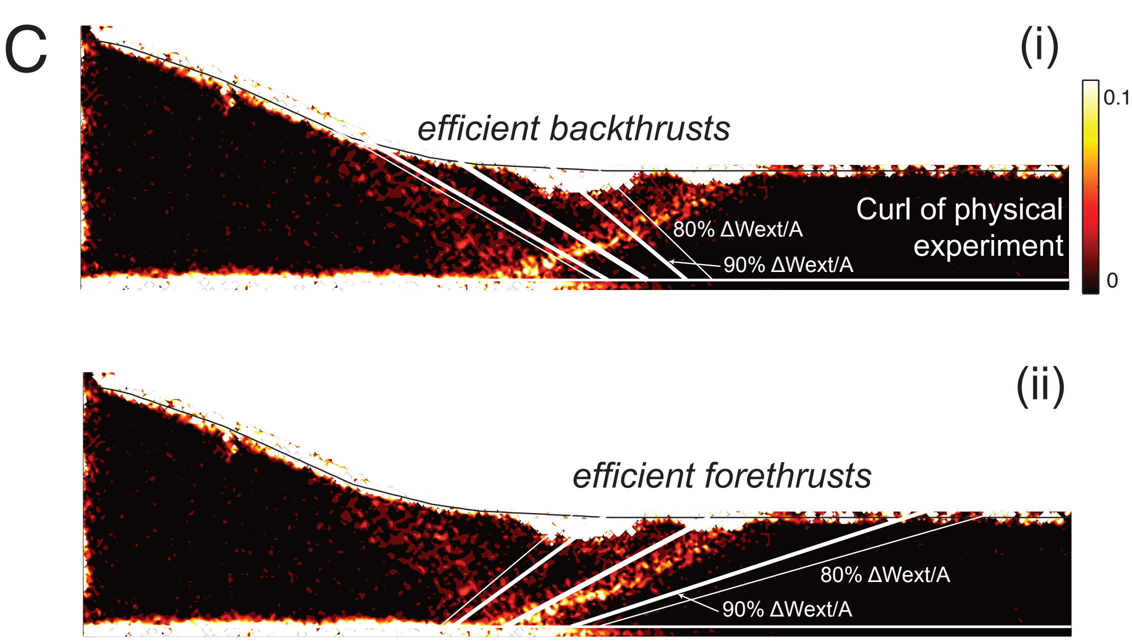
External work optimization analysis of accretion evolution



A) Development of numerical model from 2D instantaneous velocity field, calculated from digital image correlation (DIC) of sequential images in physical experiment. **Ai)** Horizontal displacement field calculated from DIC of images of cross section of wedge visible through glass sidewall of experimental device. Black horizontal line shows location of transect from which we sample horizontal displacements (i.e., the modeled detachment of the numerical wedge). **Aii)** Method of developing numerical model from physical displacements observed along transect via smoothing function and normalization technique, which are performed to aid stability and robustness of numerical models. **Aiii)** Loading conditions and boundaries of numerical model. Blue arrows show rightward shear displacements applied to numerical detachment fault (i.e., base of model), which equal values shown as blue dots in (Aii). Green arrows show rightward normal displacements applied to modeled backwall.



B) Results of work optimization search for efficient fault geometries in accretionary system. Colors indicate the gain in efficiency per new fault area (ΔWext/A) for each fault added at various positions from the backwall, and at various orientations. Orientation is measured clockwise from left horizontal plane, so backthrusts have orientations <90°. Black dots show the most efficient backthrust and forethrust identified in search. Black contour lines show 10% increments of ΔWext/A relative to the most efficient backthrust or forethrust.



C) Predicted geometries of efficient backthrusts (i) and forethrusts (ii) relative to curl field calculated from DIC of the physical experiment photos. Thickest lines show geometry of the most efficient structures. Thinner lines show the extent of faults that produce >90% of the local maximum ΔWext/A. Thinnest lines show extent of faults that produce >80% of local maximum. This work optimization analysis predicts almost exactly the position of the observed forethrust, and predicts the position of the backthrust less exactly; however the range of highly efficient backthrusts (>80% of the local maximum Δ Wext/A) overlaps the region of elevated curl that suggests the onset of backthrusting. This analysis closely predicts the dips of the observed backthrust and forethrust.