14.18: Impact of fault orientation and friction angle on the stress state of an accretionary prism

Graciela Lopez Campos, Institute for Geophysics, The University of Texas at Austin, TX

ABSTRACT

We study large-scale deformation and stress in accretionary wedges with a splay fault that is weaker than the wedge sediments using evolutionary geomechanical models. We model sediments as porous-elastoplastic materials and vary the fault orientation and friction angle. These preliminary models are drained and we model the fault as a pre-existing contact surface. We find that the lower frictional strength of the fault results in a decrease in sediment differential stresses. We demonstrate how the maximum principal stress the sediments can support decreases with decreasing fault strength. We also find that the sediments can support the largest maximum principal stress when a fracture has orientation close to the decollement angle or perpendicular to it. Our results offer a significant improvement over previous, continuous models of subduction zones that predicted Coulomb failure throughout the wedge. They may also provide an alternative explanation to the reduction of principal stresses post-failure usually attributed to fluctuations of pore pressure.

CLICK ON IMAGE FOR LARGER VIEW

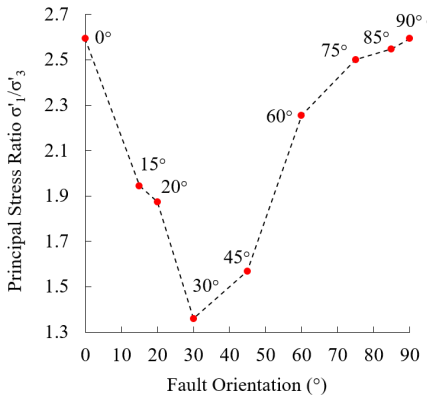


Fig 1: Impact of fault orientation on the sediment principal stress ratio, for sediment friction angle, ϕ'_s= 23.5° and fault friction angle, ϕ'_{fault}= 5°.

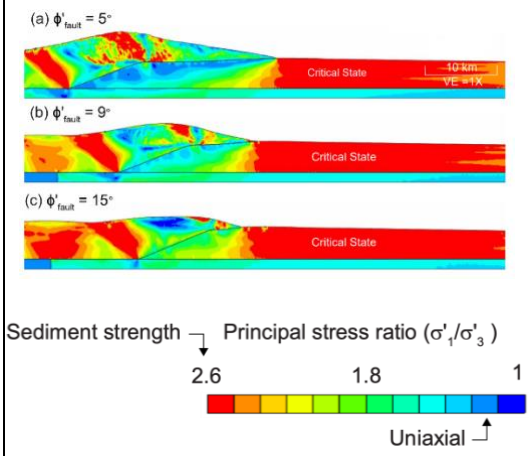
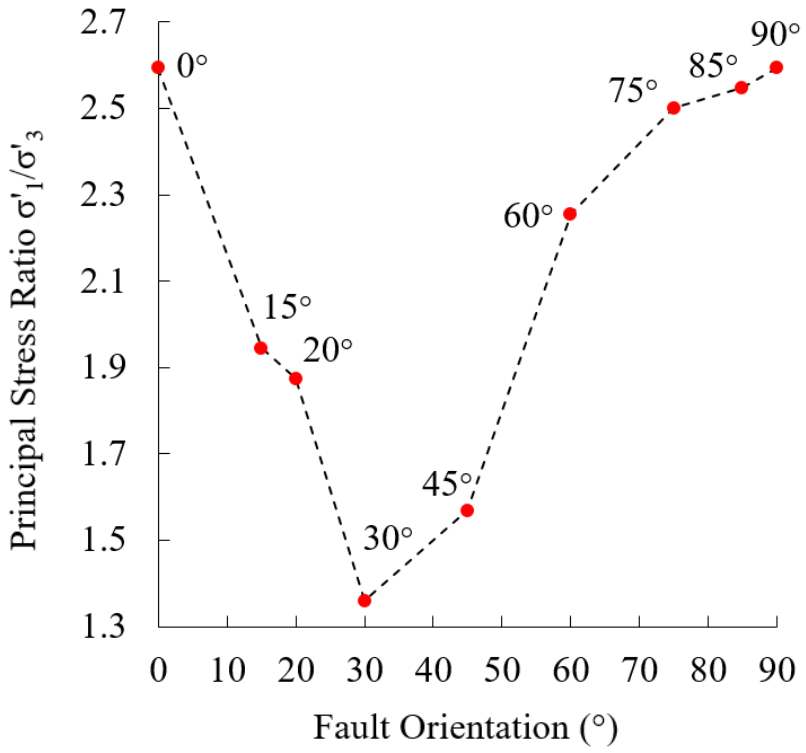


Fig 2: Impact of fault friction angle on the sediment principal stress ratio, for sediment friction angle, ϕ'_s= 23.5° and fault orientation 20°.



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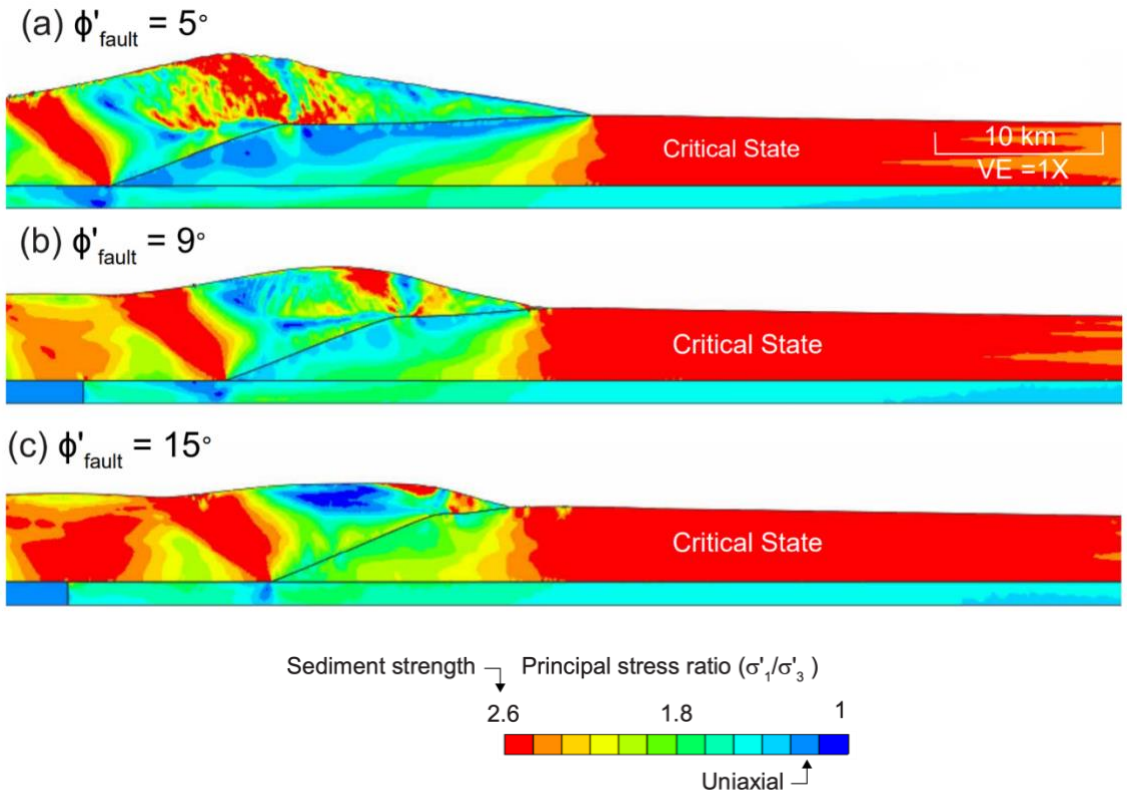

Fig. 2: Impact of fault friction angle on the sediment principal stress ratio, for sediment friction angle, ϕ'_s= 23.5° and fault orientation 20°.

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