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Numerical simulations of the formation of a decollement in homogeneous sediments

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The dynamics of accretionary prisms has been extensively studied by analytical, analog and numerical models. Generally, the dynamics of the prism is controlled by a relationship between the internal friction of the prism material and the basal friction on the decollement. However, the formation process of the decollement itself remains debated. In some accretionary prisms, such as in the Japan Trench, the presence of a sedimentary layer of lower friction act as decollement layer. In others, such as in the Nankai Trough (Japan), the decollement is a thin zone of high deformation that developed within a thick and seemingly homogeneous sedimentary layer. In this contribution, we investigate the formation of a basal decollement within homogeneous sediments. We use two-dimensional numerical simulations with boundary conditions similar to the ones of a sandbox experiment. The imposed boundary conditions are such that a portion of the sediment is dragged outside the box below the backstop. We consider a visco-elastoplastic rheology. Results show that the imposed kinematic boundary conditions, where part of the sediments are dragged outside the box, imply two different orientations of the principal stress direction as well as different elastic loading rates above and below the corner of the backstop. These stress regimes lead to the formation of Andersonian and Riedel faults above and below the backstop corner respectively. The Riedel oriented fault tends to follow the bottom of the box in a fashion similar to a decollement. A lower shear modulus favors larger displacement on individual faults and on the decollement in particular. We propose that this model may explain the formation of decollement within homogeneous sediments such as observed in the Nankai Trough.