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Modelling accretionary wedge formation interacting with backarc extension: a parametric study

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In convergent margins, often after the initiation of subduction, the overriding plate enters into an extensional regime, primarily under the influence of basal shear exerted by trenchward mantle flow or by trench suction forces acting on the upper plate leading to the formation of a backarc basin. In accretionary margins, the fragment of continental crust situated between the backarc basin and the subducting plate serves as the "backstop" for the formation of an accretionary wedge. The evolution of such an accretionary wedge and displacement and deformation of the continental crust fragment is strongly controlled by the ongoing backarc extension. The mantle flow which predominantly drives the backarc extension also, in turn, governs the rate of sediment accumulation in the wedge, as well as the distal thermal erosion of the continental plate by extension, derived mantle decompression melting product. In this study, we present a parametric study using a 2D thermomechanical model that explores different modes of backarc extension with varying plate velocity, varying position and size of a weak zone in the overriding plate. We find that the basal shear force towards the trench and interplate tension by slab suction leads to two different modes of backarc extension: (a) where the rollback of the subducting plate leads to extension in the forearc, near-trench region that spreads seaward, and (b) where the basal shear fragments the overriding plate along a zone of inherited weakness permitting independent motion of a forearc crustal fragment. We are unaware of geological examples of the former, pointing to the importance of upper plate inherited strength or coupling with arc volcanism in the formation and localization of back-arc spreading.