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Numerical modeling of sedimentation controls on the growth of the fold-and-thrust belts

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The main objective of this study is to understand the coupling between tectonics and surface processes during formation of a thin-skinned fold-and-thrust belt. We focus on the controls of syn-orogenic sedimentation on thrust development during wedge building. We use an Arbitrary Lagrangian Eulerian finite-element model (Sopale) to model the thin-skinned fold-and-thrust belt at upper crustal scales (7 km depth and 200 km length). Sopale takes into account the main features and processes that influence the development of a fold-and-thrust belt including detachment horizons, strain-softening, flexural isostasy, and erosion and sedimentation processes. Initial, more conceptual modeling focuses on wedge development coupled with syn-orogenic sedimentation. Wedge-top sedimentation directly affects the taper angle and clearly modifies the behavior of the wedge; a clear relationship between average thrust-sheet length and the thickness of syn-tectonic sediments is highlighted. Subsequently, a sediment cover that progrades towards the foreland with time is added to reproduce the late syn-orogenic burial of the southern Pyrenean fold-and-thrust belt by conglomerates and demonstrate that wedge top sedimentation can explain the out-of-sequence thrust belt activity in the southern central Pyrenees.