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Morphotectonic evolution of passive margins undergoing active surface processes: large-scale experiments using numerical models.

Romain Beucher and Ritske S. Huismans
University of Bergen, Mathematics and Earth Sciences, Bergen, Norway (romain.beucher@geo.uib.no)

Extension of the continental lithosphere can lead to the formation of a wide range of rifted margins styles with contrasting tectonic and geomorphological characteristics. It is now understood that many of these characteristics depend on the manner extension is distributed depending on (among others factors) rheology, structural inheritance, thermal structure and surface processes. The relative importance and the possible interactions of these controlling factors is still largely unknown. Here we investigate the feedbacks between tectonics and the transfers of material at the surface resulting from erosion, transport, and sedimentation. We use large-scale (1200 x 600 km) and high-resolution ($\sim$1km) numerical experiments coupling a 2D upper-mantle-scale thermo-mechanical model with a plan-form 2D surface processes model (SPM). We test the sensitivity of the coupled models to varying crust-lithosphere rheology and erosional efficiency ranging from no-erosion to very efficient erosion. We discuss how fast, when and how the topography of the continents evolves and how it can be compared to actual passive margins escarpment morphologies. We show that although tectonics is the main factor controlling the rift geometry, transfers of masses at the surface affect the timing of faulting and the initiation of sea-floor spreading. We discuss how such models may help to understand the evolution of high-elevated passive margins around the world.