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The effect of erosion and sediment deposition on the slip evolution of normal faults after cessation of far-field extension

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Surface processes may influence the slip evolution on isolated faults (e.g. Maniatis et al., EPSL 2009). The interaction can be analyzed by means of three-dimensional models using the commercial finite-element software ABAQUS and the software tool CASQUS (Kurfeß and Heidbach,Computers & Geosciences, 2007). This modeling technique enables full coupling of tectonics and surface processes. Our aim is to determine whether mass redistribution on Earth's surface due to erosion and sedimentation can maintain slip on normal faults after far-field extension has ceased. To investigate this, a model run consists of two phases: a first phase, during which the model is extended and the model surface affected by surface processes, and a second phase with surface processes but without extension of the model. The results show that mass redistribution causes a slip acceleration during the phase of extension and leads to continued fault slip despite the cessation of far-field extension. To obtain more detailed information on how surface processes control the slip behavior of normal faults after the end of extension, parameters controlling erosion and sedimentation, fault geometry and extension rate during the first phase of the model are varied. The results show that the amount and the duration of fault slip depends on all parameters mentioned above. The duration of fault slip after cessation of far-field extension is in the range between tenths of thousands of years and 1-2 Ma.