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Coupled 3D finite element modeling of surface processes and crustal deformation: a new approach based on ABAQUS

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We want to present a new technique to model the complexity of interactions between fluvial transport and geodynamic processes. The capabilities of numerical models of the earth have immensely grown over the past years. On the one hand, several computer models simulating surface processes (erosion and sedimentation) on geological scales have been developed. On the other hand, simulation programs using the finite element method can give us a better understanding of complex mechanical processes within the earth. However, only few software models address the coupling between long-range mass redistribution on the earth's surface and the complexity of crustal deformation. We are trying to fill this gap by a new approach: we have currently developed a new 3D simulation tool combining landscape evolution modeling and mechanical finite element modeling of the lithosphere. It integrates the surface process model CASCADE into the commercial finite element package ABAQUS. It will allow us to model the interaction between river systems and the mechanical deformation of the crust. The technical concept behind this tool will be illustrated, and 3D model examples showing the active coupling between endogenous and exogenous processes will be presented.